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Trade that Benefits the Environment and Development

OPENING MARKETS FOR ENVIRONMENTAL GOODS AND SERVICES

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Foreword

In the latter half of the 1990s, the OECD's Joint Working Party on Trade and Environment (JWPTE) carried out a series of analytical studies, based on the OECD/Eurostat manual that had recently been drawn up to support statistical surveys on national environment industries. A seminal volume published in 2001, *Environmental Goods and Services: The Benefits of Further Trade Liberalisation*, assembled these studies and included, in an annex, an illustrative list of "environmental goods", with their Harmonized System codes. This list has since become a reference point for analytical studies, as well as a key point of departure for input into the ensuing WTO negotiations. Indeed, WTO ministers at the 2001 Doha Ministerial Conference mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services". However, since the relevant paragraph 31(iii) of the Doha Ministerial Declaration stops short of defining "environmental goods" or "environmental services", the scope of the Doha mandate has been left to negotiators, who have therefore turned to work undertaken by international organisations, including the OECD, for supporting analysis.

Most of the working papers produced over the last four years for the JWPTE and included in these two volumes have been shared with WTO members in information sessions, symposiums and the special (negotiating) sessions of the WTO Committee on Trade and Environment (CTE-SS). The present volume deals with some of the more generic issues that confront negotiators: issues of scope and definition of environmental goods, the mechanics of liberalisation at both the national and multinational levels and the important synergies between trade in environmental services and trade in environmental goods. The second volume will explore in greater depth three categories of "environmental goods": environmentally preferable products, renewable energy and energy-efficient products. Its three chapters will consider the scope and definition of each product category, examine tariff and non-tariff barriers to trade, and explain the environmental effects of liberalising such goods.

By assembling the analytical work recently completed in the OECD's JWPTE (and in the case of Chapter 4 of this volume, the Working Party of the Trade Committee), it is hoped that these studies will continue to serve as input in understanding the challenges in WTO and regional trade negotiations on initiatives involving "environmental goods and services".

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Table of Contents

Acronyms

APEC	Asia-Pacific Economic Co-operation
ASEAN	Association of Southeast Asian Nations
CACM	Central American Common Market
CAFTA-DR	Central American-Dominican Republic Free Trade Agreement
CEEC	Central and Eastern European Countries
CEFTA	Central European Free Trade Agreement
COMESA	Common Market of Eastern and Southern Africa
CTE	Committee on Trade and Environment
CTS	Council on Trade in Services
EAC	East African Co-operation
EG&S	environmental goods and services
GDP	gross domestic product
GNP	gross national product
FDI	foreign direct investment
JWPTE	Joint Working Party on Trade and Environment
MEA	multilateral environmental agreement
MERCOSUR	Southern Common Market
MFN	most-favoured nation
NAFTA	North American Free Trade Agreement
NGO	non-governmental organisation
NTB	non-tariff barrier
PPP	purchasing power parity
PPP	public-private partnership
PPM	processes and production methods
Quad	United States, European Union, Japan and Canada
RTA	regional trade agreement
SAPTA	South Asian Preferential Trade Arrangement
SMEs	small and medium-sized enterprises
TBT	technical barriers to trade
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WCO	World Customs Organization
WTO	World Trade Organization

Executive Summary

This is the first of two volumes that draw together a series of working papers produced over the last three years for the OECD's Joint Working Party on Trade and Environment (JWPTE) and the Working Party of the Trade Committee. Its aim is to help to understand the challenges in WTO and regional trade negotiations relating to initiatives on "environmental goods and services". It has as its impetus the declaration of WTO ministers at the 2001 Doha Ministerial Conference, which mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services". This volume deals with some of the generic issues that confront negotiators: issues related to the scope and definition of environmental goods; the mechanics of liberalisation at both the national and multinational levels; and the important synergies between trade in environmental services and trade in environmental goods. Its companion volume focuses on environmentally preferable products, renewable energy and energy-efficient products.

Seventeen country studies on liberalisation of trade in environmental goods and services are analysed to set the stage

In 2003, the OECD's JWPTE commissioned seven country studies to examine the benefits realised by recent OECD members and observers from the liberalisation of trade in environmental goods and services. At about the same time, similar country studies were undertaken by UNCTAD (six studies) and the UNDP (four studies). This chapter examines the 17 country studies commissioned by the three international organisations. The countries featured are Brazil, Chile, China, Cuba, the Czech Republic, the Dominican Republic, Guatemala, Honduras, Israel, Kenya, Korea, Mexico, Nicaragua, Pakistan, Panama, Thailand and Vietnam. Chapter 1 thus sets the stage for discussions of the development dimension of environmental goods and services (EG&S) by providing background on how EG&S markets have been evolving in recent years in developing and emerging economies.

The first section identifies the key determinants of demand for EG&S. Generally, countries with complementary determinants of demand have experienced stronger growth in their EG&S markets than countries with contradictory determinants of demand. Results suggest that demand for EG&S is driven by the interplay of determinants, rather than by any single determinant.

The nature of the market for EG&S in each of the 17 countries is also reviewed. Consumption of EG&S has grown over the last decade and is expected to expand significantly in the next five to ten years. While it is not surprising that Japan, the United States and the European Union continue to be major exporters of environmental goods (as defined by the OECD and APEC lists, which are discussed in Chapter 2), the direction of the trade flows has varied according to importing region: the Latin American countries

seem to favour US suppliers, while Asian counties source their EG&S predominantly from Japan, and increasingly from China. Anecdotal evidence suggests that imports are being used to remedy environmental problems that locally produced EG&S cannot resolve. Many developing countries are exploiting niche markets and developing their own export capacity.

The chapter also examines in greater detail demand determinants in four key areas: water supply and wastewater treatment, solid-waste management, hazardous-waste management and air pollution control. In most of the 17 countries the public sector remains largely responsible, either directly or indirectly, for providing these services. At the same time, new policies and regulations are being introduced to increase the participation of the private sector, and many publicly controlled services are being outsourced to private (domestic and foreign) companies. Many countries' environmental laws and standards, often introduced in the 1990s, need strengthening, suggesting new opportunities for EG&S markets in the future.

The development and content of the lists of environmental goods established by APEC and the OECD are compared

As noted above, the Doha Ministerial Declaration calls for negotiations on "environmental goods", but stops short of defining them. It was not surprising therefore that discussions in the WTO Committee on Trade and Environment in Special Session (CTE-SS), entrusted with these negotiations, began by examining the substantial amount of work already undertaken by the OECD and APEC (Asia-Pacific Economic Co-operation forum). Chapter 2 compares and contrasts both the developmental history and the specific content of the two lists. It is important to understand that the objectives of the two exercises differed, as did the procedures for generating the lists. They are therefore not strictly comparable.

The OECD list was the result of an exercise intended to illustrate, primarily for analytical purposes, the scope of the "environment industry". It flowed directly from joint OECD and Eurostat work on a manual for national statisticians to assist them in measuring their national environmental industries. On the basis of the general categories of goods and services, the JWPTE added examples of specific goods. This OECD list could therefore be broad, because adding products to the list had no particular policy consequences. Moreover, the OECD's larger list was created deductively: starting from general categories based on the classifications in the environment industry manual, it added specific examples in order to produce an estimate of average tariffs on a previously undefined class of goods.

The APEC approach, on the other hand, started with nominations, not unlike the request-offer procedures traditionally used in trade negotiations. This yielded a list of goods which was then arranged according to an agreed classification system. Further, since the aim of the APEC list was to obtain more favourable tariff treatment for environmental goods, APEC member economies limited themselves to specific goods that could be readily distinguished by customs agents and treated differently for tariff purposes. For this reason, issues related to "like products", products defined by particular processes or production methods, and products defined by their life-cycle impacts were not addressed, with the result that some goods were omitted from the list that were included on the OECD list. This constraint of practicality could be relaxed in the OECD's analysis because its aim was merely to illustrate what might be included.

Both the OECD and the APEC lists have helped frame the current WTO negotiations on environmental goods. This detailed comparison of the two lists facilitates understanding of how and for what purposes they were devised. It makes clear why many, if not most, WTO members regard the lists as helpful but not definitive.

A variety of practical issues that negotiators must address when nominating goods as environmental are discussed

Chapter 3 examines a series of practical considerations that must be addressed when nominating products as "environmental goods" on the basis of the Harmonized Commodity Description and Coding System (HS) tariff nomenclature. Two issues which negotiators need to address concern whether to include goods with multiple uses, some of which are not "environmental", and goods that are sold as entire plants or systems. The first part of the chapter explores possible ways of accommodating these categories of goods while remaining true to the principles of the WTO and the World Customs Organization (WCO). While procedures for dealing with such goods often create additional transaction costs, precedents in previous WTO sectoral agreements and initiatives could be followed. Goods can and are being differentiated on the basis of end use, generally either through assurances provided by importers or agreed indications on the covered products. Entire plants and systems can be and are being imported under single tariff descriptors.

A third set of issues concern goods of interest because of the processes or production methods by which they were manufactured, extracted or harvested. By identifying certain processes or methods as environmentally superior, it has been suggested by some observers that such criteria should be another basis for identifying goods as "environmental". Goods of interest because of the processes or methods used to produce them, but which are difficult to accurately and easily distinguish at borders, create other problems. There may be a few products, however, for which separate descriptors, and therefore separate tariff treatment, can be developed. These would include products distinguishable by some observable or measurable difference in their chemical or physical characteristics. By contrast, resource-efficient goods are easily distinguished by measurable technical criteria. For this category of goods, the main difficulties arise because of the need for international harmonisation of the relevant norms (*e.g.* annual energy consumption per litre of a refrigerator's capacity), and for keeping them up to date over time.

The chapter then takes up some institutional implications of considering different categories of goods as "environmental goods". Unless WTO members decide to restrict any agreement to goods already described at the 6-digit HS level, they will need to decide on how to deal with "ex-heading" goods. One approach would be to revise the HS coding system, but this is unlikely to happen in the near future. Another would be for countries proposing "ex-heading" goods to be diligent in identifying the HS sub-heading under which they would classify them. Otherwise there may be protracted *ex post* negotiations on classification matters.

Last, but not of least importance, is the issue of whether WTO members would treat an agreement on environmental goods as a one-off exercise, or whether the product coverage should be reviewed as technologies and environmental requirements change. This has given rise to the concept of a "living list". Such a review mechanism would be virtually imperative for an agreement that included goods defined by their relative

environmental performance, since the very concept involves obsolescence: environmentally "better" products and technologies will inevitably become available over time.

A sector-specific checklist for environmental services is developed to draw attention to issues of importance and to help manage request-offer negotiations

Chapter 4 concentrates on environmental services, another aspect of paragraph 31 (iii) of the Doha Ministerial Declaration. It forms part of an ongoing joint OECD-UNCTAD project on trade in services to produce a set of sector-specific checklists for managing request-offer negotiations under the General Agreement on Trade in Services (GATS). Its aim is to assist WTO members, and particularly developing countries, gain greater insight into issues of importance in the environmental services sector and how they might be approached in the current services negotiations.

The environmental services sector is difficult to identify as a coherent whole. Environmental services have traditionally been understood in terms of infrastructure that provides water and waste treatment services, often by the public sector. More recently, however, new regulatory requirements and other factors have created a need to move beyond these infrastructure-dependent services, generating demand for "non-infrastructure" environmental services and environment-related support services.

In most countries, infrastructure-dependent environmental services have historically been provided by municipalities for reasons of public policy or because they have some of the characteristics of a natural monopoly. Nevertheless, trade in these services has increased in recent years, following changes that have resulted in a stronger presence of the private sector. Particularly in developing countries that lack sufficient domestic capacity, decisions to involve the private sector usually lead to foreign participation. A variety of alternatives to total privatisation have been developed, ranging from government procurement to different kinds of public-private partnerships.

Trade in environmental "non-infrastructure" (*e.g.* air pollution control) and support services (*e.g.* environmental consulting) has also been growing. These services represent new approaches to resource use and generally reflect higher environmental awareness and standards in societies.

Considering the many serious environmental problems to be tackled, countries cannot afford weak environmental services sectors. Liberalising trade and investment in environmental services can provide better access to these services, and can potentially lead to significant economic and environmental benefits. In the case of environmental services requiring infrastructure, liberalisation can help to increase investment in, and improve the performance of, that infrastructure, and make such services more widely available, to the benefit of the environment and public health. For environmental and related services that are not heavily dependent on infrastructure, gains can be made through increased competition, which can lead to lower costs, innovation and improved services. Enhanced domestic capacity can in turn lead to development of export capacity and broader economic benefits.

Nonetheless, liberalising trade in environmental services, particularly infrastructure services, is no easy task. It must be carefully thought through and supported by a strong regulatory framework. To achieve public policy objectives, new regulatory tools may be

required, including those related to pricing, universal access and service standards. While these fall largely outside the scope of the GATS, they are important accompanying measures for successful liberalisation.

Risks of market failure for achieving social objectives appear to be less significant for environmental non-infrastructure and support services. This is because, unlike infrastructure-dependent environmental services, for which business-to-consumer relations are crucial, these services are largely used by business or institutional clients. On the other hand, some regulatory spheres, such as service standards, remain very important for these services.

The current GATS negotiations offer WTO members an opportunity to achieve further liberalisation in an orderly and flexible manner. Flexibility is needed to carefully plan liberalisation, identify segments and modes of supply so that they are compatible with national and development goals, and enact appropriate regulations.

Governments also need information about the full range of measures that prevent access to environmental markets of trading partners. This is particularly true for environmental services, because of the variety of services and the large number of measures that may affect market access. Finally, the chapter provides a checklist of questions on trade-restricting measures that WTO members can ask each other, and be prepared to answer, when framing requests and assessing offers.

An exploration of the synergy between environmental goods and services aims to demonstrate concretely the relation between them

Chapter 5 explores the connections between trade in environmental services and trade in environmental goods. As the OECD has long argued, many of the goods that it and other organisations have identified as essential for environmental protection and remediation are also important, in fact, because they are used in the provision of environmental services. When discussing the benefits of liberalising trade in environmental goods and services it is salutary to keep this synergy in mind.

This chapter seeks to show, as concretely as possible, why environmental goods are essential inputs for environmental services. It describes the different environmental services, highlights the main environmental goods that are vital for carrying them out, and shows how trade in particular services stimulates demand for certain goods.

The final section demonstrates, through actual examples, why liberalisation of environmental services functions best when trade in the environmental goods they depend on is also freer. The examples focus on business-to-business trade in different environmental services, such as between chemical companies or steel plants, which have decided to turn over the management of their wastewater treatment to companies that specialise in that activity. The reasons why businesses choose to do so are many: to focus on their core areas of expertise, to reduce their debt burden, to ensure that the technologies and techniques used to manage their waste streams are the best available. In virtually all the cases examined, some goods used in the provision of the service were imported, but many were procured locally. Indeed, tentative evidence suggests that as the market for environmental services expands in particular countries or regions, so do the number and scope of local suppliers of associated goods.

Chapter 1

Environmental Goods and Services A Synthesis of Country Studies

by

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This chapter presents a synthesis of 17 country studies on environmental goods and services (EG&S) commissioned by the OECD, UNCTAD and the UNDP. The countries examined are Brazil, Chile, China, Cuba, the Czech Republic, the Dominican Republic, Guatemala, Honduras, Israel, Kenya, Korea, Mexico, Nicaragua, Pakistan, Panama, Thailand and Vietnam. Its aim is to identify determinants of demand for EG&S; to show common themes and experiences in the EG&S markets of different countries; and to draw attention to key trade, environment and development policy linkages. It also seeks to contribute to the exchange of expertise and experience in the area of trade and environment so that liberalisation of trade in EG&S can benefit all countries, developing and developed alike.

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Introduction

The development of agricultural and industrial capacity, allied with the phenomenon of urban and suburban sprawl, puts pressure on the environment. The challenge for any society is to remedy the problem in ways that are both economically efficient and environmentally effective.

The liberalisation of trade in environmental goods and services (EG&S), which are broadly defined as those that measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as manage waste, noise and ecosystems,[1] can help meet this challenge. For importing countries, fewer and lower barriers to trade in EG&S can translate into greater access to the most efficient, diverse and least expensive goods and services on the global market. For exporters, liberalisation can create new market opportunities and spur development of globally competitive industries dedicated to environmental improvements (*e.g.* via technology development or diffusion).

In recognition of the importance of liberalising trade in EG&S, WTO ministers, meeting in Doha, Qatar, in November 2001, mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services".[2] They recognised also the importance of technical assistance and capacity building in the field of trade and environment and encouraged the sharing of expertise and experience with members wishing to perform environmental reviews at the national level. At the same time, the ministers specifically "instructed the [WTO] Committee on Trade and Environment (CTE) to give particular attention to the effect of environmental measures on market access, especially in relation to developing countries, in particular the least developed among them, and those situations in which the elimination or reduction of trade restrictions and distortions would benefit trade, the environment and development".[3]

Shortly afterwards, at the 2002 Johannesburg World Summit on Sustainable Development, heads of state and government, national delegates and leaders from non-governmental organisations (NGOs), businesses and other major groups, advocated supporting voluntary WTO-compatible market-based initiatives for the creation and expansion of domestic and international markets for environmentally friendly goods and services.[4]

In 2003, the OECD commissioned seven country studies on EG&S markets, and trade and other policies affecting those markets. These studies, on Brazil, Chile, the Czech Republic, Israel, Kenya, Korea and Mexico, attempted to:

- Identify the factors driving developments in the market for environmental EG&S.

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1. The definition of EG&S in the OECD/ Eurostat *Environmental Goods and Services Industry: Manual for Data Collection and Analysis* (OECD/Eurostat, 1999) includes goods derived from biological resources such as water, wood, biological material, medicinal plants, artisanal products, edible fruits, non-timber forest products as well as agricultural products. It also includes services provided by ecosystems such as carbon sequestration, as well as human activities, such as wastewater activities, solid-waste management, hazardous-waste management, and noise and vibration abatement. The use of this definition is without prejudice to the WTO negotiations on environmental goods and services.
2. Paragraph 31(iii) of the Doha Ministerial Declaration, WT/MIN(01)/DEC/1 of 20 November 2001.
3. Paragraph 32(i) of the Doha Ministerial Declaration, WT/MIN(01)/DEC/1 of 20 November 2001.
4. United Nations, *Report on the World Summit on Sustainable Development*, 2002, paragraph 99.

- Review the EG&S market size and structure.
- Analyse the institutional, regulatory and policy issues affecting the full realisation of benefits, both from liberalisation and from expansion of the market for EG&S.
- Identify relevant issues regarding specific sub-sectors within the EG&S sector.
- Note whether there has been any national strategy to enhance the market for EG&S and whether trade liberalisation has played a significant role in boosting the market.

Since the Doha Ministerial, UNCTAD and UNDP have also examined the factors that have driven changes in the international market for EG&S. The six UNCTAD country studies attempted to outline challenges and opportunities for Central American and Caribbean countries in liberalising trade in EG&S.[5] Four UNDP country studies aimed to provide a more substantive link between trade in EG&S and human development in China and Hong Kong, Pakistan, Thailand and Vietnam.[6]

This chapter presents a synthesis of all 17 country studies (Table 1.1). In each case, local experts were involved in drafting the study, and staff members of the international organisation were involved in the editing. Given that many different contributors can claim to have contributed to the final texts, and that the three international organisations emphasised slightly different issues, there is a surprising similarity across the studies. All use a broad definition of EG&S which is comprehensive enough to include biological products and services provided by ecosystems as well as human activities.[7] Each study provides information on both technical and substantive issues relating to the EG&S sector in a particular country and each examines the implications of liberalising trade in EG&S.

The general aim of this chapter is to identify determinants of demand for EG&S; to show common themes and experiences in countries' EG&S markets; and to draw attention to key trade, environmental and development policy linkages associated with EG&S liberalisation. It also seeks to contribute to the exchange of expertise and experience in the area of trade and environment and to help ensure that liberalisation of trade in EG&S works for all countries.[8]

The first section of the chapter outlines determinants of demand, such as: the state of the economy; population and population growth; the state of the environment; and pressure from stakeholders, civil society and consumers in each of the countries reviewed. It also documents changes in national (environmental and trade) policy, strengthened institutional mechanisms, commitments to international (regional and multilateral) environmental agreements (MEAs), and the implementation of complementary measures that may have driven demand for better environmental quality and increased use of EG&S.

5. Cuba, the Dominican Republic, Guatemala, Honduras, Nicaragua and Panama.

6. The UNDP and UNCTAD case studies have not been endorsed or reviewed by OECD member countries.

7. The definitions used in the case studies are without prejudice to the WTO negotiations on environmental goods and services.

8. Unless otherwise stated, the data have been taken directly from the country studies and have not been checked for accuracy.

Table 1.1. Country studies on EG&S commissioned by the OECD, UNCTAD and the UNDP

Country	Organisation	Principal authors	Title
Brazil	OECD	Oswaldo dos Santos Lucon and Fernando Rei	Liberalising Trade in Environmental Goods and Services in Brazil
Chile	OECD	Annie Dufey, Edmundo Claro and Nicola Borregaard	Liberalising Trade in Environmental Goods and Services in Chile
China	UNDP	Peter Hills	Trade in Environmental Services and Human Development, Country Case Study — China and Hong Kong Special Administrative Region
Cuba	UNCTAD	Cristobal Felix Diaz Morejon	Cuba: Análisis de los Servicios Ambientales [Cuba: study on environmental goods and services]
Czech Republic	OECD	Vladimir Dobes and Vladislav Bizek	Liberalising Trade in Environmental Goods and Services in the Czech Republic
Dominican Republic	UNCTAD	Catherin Cattafesta	República Dominicana: Servicios relacionados con el medio ambiente [Dominican Republic: environment-related services]
Guatemala	UNCTAD	Evelio Alvarado, Humberto Mazzei and Rubén Morales	Guatemala: Informe nacional sobre los Servicios Ambientales [Guatemala: national study on environmental services]
Honduras	UNCTAD	Jenny Suazo and Néstor Trejo	Honduras: Los servicios ambientales en Honduras con vistas a la formulacón de posiciones nacionales de negociación post-Doha [Honduras: environmental services in Honduras from the perspective of formulating national negotiating positions post-Doha]
Israel	OECD	Joshua Golovaty	Liberalising Trade in Environmental Goods and Services in Israel
Kenya	OECD	Moses M. Ikiara and John M. Mutua	Liberalising Trade in Environmental Goods and Services in Kenya
Korea	OECD	Jintaek Whang and Jae-Hyup Lee	Liberalising Trade in Environmental Goods and Services in Korea
Mexico	OECD	Carlos Muñoz Villarreal	Liberalising Trade in Environmental Goods and Services in Mexico
Nicaragua	UNCTAD	Margarita Núñez-Ferrera	Nicaragua: Situación de servicios ambientales [Nicaragua: situation with respect to environmental services]
		José Guillermo López López	Situación de bienes ambientales (BA) en Nicaragua según listas OCDE y APEC [Situation with respect to environmental goods (EG) in Nicaragua according to the OECD and APEC lists]
		José Guillermo López López	Nicaragua: Acceso a mercados exteriores del bien ambiental etanol [Nicaragua: access to foreign markets of the environmental good ethanol]
Pakistan	UNDP	Syed Ayub Qutub	Trade in Environmental Services and Human Development, Country Case Study — Pakistan
Panama	UNCTAD	Artístides Hernández	Panamá: Estado de los servicios ambientales en el marco de la apertura económica [Panama: study of environmental services within the context of economic opening]
Thailand	UNDP	Sitanon Jesdapipat	Trade in Environmental Services and Human Development, Country Case Study — Thailand
Vietnam	UNDP	Nguyen Thanh Giang	Trade in Environmental Services and Human Development, Country Case Study — Vietnam

The following section considers the market for EG&S in each of the countries examined. The analysis differentiates domestic and export markets and provides some information on the extent to which the demand for EG&S has been met by locally produced goods and services or by imports. The section also specifically considers the

extent to which trade has actually helped to address local environmental problems and the extent to which local environmental problems have led to the development of new industries.

Authors of the country studies were asked to focus on key environmental media or issues. As most chose to examine water supply and wastewater treatment, solid-waste management, hazardous-waste management and air pollution control — issues on which a certain amount of information was available — the subsequent section considers these issues in greater detail.

Determinants of demand

Economic performance

The 17 countries studied vary considerably in their economic makeup, performance and outlook (Table 1.2). Israel and Korea are categorised by the World Bank as high-income economies without substantial indebtedness. Kenya, Nicaragua, Pakistan and Vietnam are low-income economies with moderate to serious indebtedness, and the rest are middle-income economies with moderate-to-low indebtedness. Such factors greatly affect the sums that governments can spend on EG&S. Many of the countries without adequate financial means are looking to the private sector (and overseas) for assistance.

Table 1.2. Economic performance of examined countries in 2003

Country	Trade in goods (% of GDP)	Value added in services (% of GDP)	FDI, net inflows (% of GDP)	Aid (% of GNI)	GDP per capita, PPP basis (USD)
Brazil	25	75	2.0	0.1	7 838
Chile	56	57	4.1	0.1	10 274
China	60	33	3.8	0.1	5 003
Cuba	..	..	..	..	..
Czech Republic	111	57	2.8	0.3	18 154
Dominican Rep.	81	58	1.9	0.5	7 108
Guatemala	38	58	0.5	1.0	4 109
Honduras	66	56	2.9	5.9	2 709
Israel	62	..	3.5	0.4	23 132
Kenya	43	65	0.6	3.4	1 041
Korea	62	62	0.5	-0.1	19 148
Mexico	55	70	1.7	0.0	9 146
Nicaragua	61	56	4.9	20.7	3 221
Pakistan	30	53	0.6	1.3	2 018
Panama	30	76	6.2	0.3	6 416
Thailand	109	46	1.4	-0.7	7 007
Vietnam	115	38	3.7	4.5	2 304

Source: World Bank, *World Development Indicators Database*, www.worldbank.org/data/wdi2005/index.html and www.worldbank.org/data/wdi2005/wditext/Cover.htm, accessed 17 October 2005.

Currently, total trade in goods (the sum of merchandise exports and imports) represents 30-60% of gross domestic product (GDP) in most of the countries surveyed. However, the Czech Republic, Thailand and Vietnam trade goods in excess of their GDP. Comparable figures on trade in services were not included in most of the studies and are not readily available.

Net inflows of foreign direct investment (FDI) account for between 2% and 6% of GDP in most of the countries reviewed. Several among the low-income countries (Guatemala, Kenya and Pakistan) have significantly lower net inflows. Aid, as a percentage of gross national income (GNI), is less than 1% in most cases, but nearly 6% in Honduras and over 20% in Nicaragua.

Most of the countries studied have witnessed variable GDP growth over the last ten years (Table 1.3). China is the notable exception as it has experienced momentous and almost uninterrupted growth for almost two decades. The 1997 economic crisis in Southeast Asia severely affected the growth of the Thai and Korean economies, but these countries have since had a significant economic recovery. GDP per capita at purchasing power parity (PPP), which is a useful concept for comparing living standards and examining productivity levels over time, shows that Israel, Korea and the Czech Republic generate more wealth per person than Brazil, Chile, Mexico and Thailand, which in turn generate more than all the others.

Table 1.3. GDP and GDP growth of examined countries in 1993, 1998 and 2003

Country	1993		1998		2003	
	Current GDP (USD billions)	Annual % growth	Current GDP (USD billions)	Annual % growth	Current GDP (USD billions)	Annual % growth
Brazil	438	4.9	788	0.1	506	0.5
Chile	44	7.0	73	3.9	72	3.3
China	432	13.5	946	7.8	1417	9.3
Cuba	..	..	..	1.2	..	..
Czech Republic	34	0.1	61	-1.1	90	3.7
Dominican Rep.	10	3.0	16	7.4	17	-0.4
Guatemala	11	3.9	19	5.0	25	2.1
Honduras	3	6.2	5	2.9	7	3.5
Israel	66	5.6	104	3.3	110	1.3
Kenya	5	0.4	11	1.6	14	1.8
Korea	362	6.1	345	-6.9	608	3.1
Mexico	403	1.9	421	4.9	639	1.4
Nicaragua	2	-0.4	4	3.7	4	2.3
Pakistan	51	1.8	62	2.6	82	5.0
Panama	7	5.5	11	7.4	13	2.0
Thailand	125	8.3	112	-10.5	143	6.9
Vietnam	13	8.1	27	5.8	39	7.2

Source: World Bank, *World Development Indicators Database*, www.worldbank.org/data/wdi2005/index.html, accessed 17 October 2005.

Countries with high incomes, low indebtedness, large FDI inflows, some aid or strong GDP growth should have seen demand for EG&S increase over time. In countries with more than one of these attributes, growth in demand should be even stronger. In countries that have seen their standard of living increase there is anecdotal evidence of an environmental Kuznets curve (EKC) at work.[9] That is to say, as per capita income rises, so does the demand for environmental quality.

Population and population growth

The size of the population of the 17 countries examined varies considerably (Table 1.4). China is the world's most populous country, with over 1 billion inhabitants. Panama, the least populous country in the study, has about 1/450th of that number, with only 2.9 million inhabitants. The size of the population is obviously an important determinant of the total volume of EG&S consumed.

Table 1.4. Population, population growth and life expectancy of the examined countries

Country	Population in 1993		Population in 1998		Population in 2003		Urban population		Life expectancy at birth (years)
	Millions	Annual % growth	Millions	Annual % growth	Millions	Annual % growth	% of total in 1993	% of total in 2003	
Brazil	155	1.5	166	1.3	177	1.20	77	83	69
Chile	14	1.7	15	1.4	16	1.18	84	87	76
China	1178	1.1	1242	1.0	1288	0.62	30	39	71
Cuba	11	0.4	11	0.6	11	0.66	74	76	77
Czech Rep.	10	0.1	10	-0.1	10	0.01	75	74	75
Dominican Rep.	7	1.7	8	1.7	9	1.45	56	59	67
Guatemala	9	2.6	11	2.6	12	2.59	42	46	66
Honduras	5	2.9	6	2.7	7	2.50	41	46	66
Israel	5	2.7	6	2.3	7	1.84	91	92	79
Kenya	25	2.7	29	2.4	32	1.81	28	39	45
Korea	44	0.9	46	0.7	48	0.57	76	80	74
Mexico	88	1.8	95	1.4	102	1.45	73	75	74
Nicaragua	4	3.0	5	2.7	5	2.55	54	57	69
Pakistan	116	2.5	132	2.4	148	2.41	31	34	64
Panama	3	1.9	3	1.6	3	1.47	54	57	75
Thailand	58	1.1	60	0.7	62	0.65	30	32	69
Vietnam	70	2.0	77	1.4	81	1.10	21	26	70

Source: World Bank, World Development Indicators Database, www.worldbank.org/data/wdi2005/index.html, accessed 17 October 2005.

9. According to the EKC hypothesis — coined by Seldon and Song (1994) following earlier papers by Grossman and Krueger (1991) and others — countries follow a two-stage development path. Owing to the scale effect (more production is associated with more emissions) and the composition effect (countries will increase their manufacturing output relative to agricultural and services output), initial economic growth is associated with higher levels of environmental pollution. However, as services become more important and the overall population becomes increasingly aware of environmental damage, the second stage of development is characterised by decreasing emission levels.

Size is not everything, however. The rate and nature of population growth also has an important bearing on demand for EG&S. The population of the Czech Republic has fallen slightly over the last decade, while in Guatemala, Honduras, Nicaragua and Pakistan, population growth rates in excess of 2% a year are putting increasing strain on the environment. In Israel, a similarly high growth rate, mostly due to immigration, is also accompanied by urbanisation; over 90% of Israel's population now lives in urban areas. Conversely, the populations of China, Guatemala, Honduras, Kenya, Pakistan, Thailand and Vietnam are still predominantly rural. However, the speed of rural-urban migration in these countries means that it will not be long before most of their populations are also concentrated in towns and cities.

Generally, in countries where the population is growing or where it is becoming concentrated in towns as a result of rural-urban migration, the demand for environment-related infrastructure related to water, sewage and solid-waste management has increased. The Czech Republic is a notable exception. There, the demand for infrastructural EG&S (and other EG&S) has increased, even though the population has been declining and rural-urban migration has been static, which suggests that other determinants are at play.

State of the environment

The state of the environment differs enormously in the 17 countries examined (Table 1.5). China, the world's third largest country, covers an area of 9.6 million square kilometres. Given China's size, the diversity of its topography, plant and animal life is only to be expected. Similarly, Brazil, the world's fifth largest country, has an astounding richness and diversity of land, flora and fauna. In contrast, Israel, which has only 22 140 square kilometres, is a dry country where agriculture is only possible in the north. Its main body of water, the Dead Sea, is too salty for most plants and animals.[10] As a result, Israel only has 0.05 hectare of arable land per inhabitant, slightly more than the 0.04 hectare of arable land per capita in Korea but ten times less than the 0.5 hectare per capita of arable land in Nicaragua. The amount of arable land per capita provides a useful indicator of how intensively the land is used and how much maintenance and management is required to conserve it.

Most of the countries examined are having difficulty coping with the environmental effects of large and rapidly urbanising populations. These pressures have exacerbated problems of water shortages (especially in Israel, Mexico and Kenya), sewage and solid-waste disposal. As a result, most of the studies highlight the need to improve the efficiency and quality of basic infrastructure-related environmental services such as water and sanitation.

Water shortages and access to clean water are recurring themes. According to the World Bank (2005), most of the countries surveyed provide upwards of 90% of their urban populations with access to an improved source of water, ranging from 89% in Kenya to 99% or 100% in Chile, Guatemala, Honduras, Israel and Panama. Rural populations are generally less well served. In 2002, 25% or more of the rural populations in almost half of the countries covered (Brazil, Chile, China, Kenya, Korea, Mexico, Nicaragua and Vietnam) still did not have access to an improved water source.

10. There has been much research into desalination processes.

Information on access to improved sanitation facilities[11] is also regularly included in the studies. In China, only 69% of the urban and 29% of rural populations have such access. The lack of foreign investment, modern technology and advanced management practices was blamed for these poor figures. However, the strength of a country's finances is not the only determining factor. Kenya, the country with the lowest GDP per capita (measured at PPP) among the countries examined, manages to provide improved sanitation to 56% of its urban and 43% of its rural population.

Table 1.5. Key indicators of the state of the environment, 2002 or latest available year

Country	Surface area (thousands of square kilometres)	Arable land (hectares per capita)	Urban population with access to improved sanitation facilities[1] (%)	Rural population with access to improved sanitation facilities (%)	Rural population with access to improved water source[2] (%)	Energy use (kg of oil equivalent per capita)	CO_2 emissions (metric tons per capita)[3]
Brazil	8 515	0.34	83	35	58	1 093	1.8
Chile	757	0.13	96	64	59	1 585	3.9
China	9 598	0.11	69	29	68	960	2.2
Cuba	111	0.24	99	95	78	1 262	2.8
Czech Rep.	79	0.30	..	..	..	4 090	11.6
Dominican Rep.	49	0.13	67	43	85	948	3.0
Guatemala	109	0.11	72	52	92	616	0.9
Honduras	112	0.16	89	5	82	505	0.7
Israel	22	0.05	100	..	100	3 191	10.0
Kenya	580	0.15	56	43	46	489	0.3
Korea	99	0.04	99	99	71	4 272	9.1
Mexico	1 958	0.25	90	39	72	1 560	4.3
Nicaragua	130	0.36	78	51	65	544	0.7
Pakistan	796	0.15	92	35	87	454	0.8
Panama	76	0.19	89	51	79	1 028	2.2
Thailand	513	0.26	97	100	80	1 353	3.3
Vietnam	332	0.08	84	26	67	530	0.7

1. Data refer to the percentage of the population with at least adequate excreta disposal facilities (private or shared, but not public) that can effectively prevent human, animal and insect contact with excreta. Improved facilities range from simple but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

2. Data refer to the percentage of the rural population with reasonable access to an adequate amount of water from an improved source, such as a household connection, public standpipe, borehole, protected well or spring, and rainwater collection. Unimproved sources include vendors, tanker trucks, and unprotected wells and springs. Reasonable access is defined as the availability of at least 20 litres a person a day from a source within one kilometre of the dwelling.

3. Data are for 2000.

Source: World Bank, World Development Indicators Database, www.worldbank.org/data/wdi2005/index.html, accessed 17 October 2005.

11. Note that the term "sanitation facilities" is used here as in the World Bank's *World Development Indicators* and should not be confused with "sanitation services", a term used at the World Trade Organization to refer to services related to street and beach cleaning, and snow removal.

Pressure from stakeholders, civil society and consumers

In all the countries examined, environmental pressure groups, often allied with interested academics, have grown in size and influence over the last two decades. Businesses, especially those dependent on customers in developing countries, have also emerged as agents for change. Many European and North American multinationals are now required by their shareholders to meet quality standards similar to those in their home countries. Sometimes, as in the case of Kenya's tourism industry, protection of the environment is seen as an important selling point. In many other countries, pressures from foreign buyers to deal only or mainly with companies that have instituted a certified environmental management plan have increased awareness of the environment in the business community and stimulated the emergence of associated services.

Multilateral environmental agreements and related mechanisms and institutions

All of the countries studied are signatories to multilateral environmental agreements (MEAs). Table 1.6 shows the dates of entry into force of a few key MEAs. The impact of becoming parties to these agreements has varied considerably. For some, the main effects have been to gain access to funding aimed at helping the countries comply with the agreements. For others, commitment to an MEA has strengthened and targeted domestic pressure on environmental issues that may otherwise have been ignored.

Commitment to a new MEA is not the only way inter-governmental pressure makes itself felt. Brazil's hosting of the first United Nations Conference on Environment and Development, in 1992, was a watershed event that galvanised local interests to push for new and tighter environmental regulations. Similarly, the presence of the headquarters of the United Nations Environment Programme (UNEP) in Nairobi has had a significant influence on Kenya's environmental policies.

Environmental policy

There seem to have been two distinct phases in the development of environmental policies in most of the countries surveyed. The first, beginning sometime between the mid-1980s and the mid-1990s, typically saw the enactment of a country's first major environmental laws.[12] These often followed earlier OECD examples, taking a command-and-control, and often technology-specific, approach to pollution control. However, the resources provided for implementing and enforcing these laws were often inadequate. Assaults on the environment frequently went unmonitored and unpunished.

The second phase, beginning in the early to late 1990s, saw the replacement of the earlier laws with more comprehensive and more integrated legislative packages. Some of the new laws are only now beginning to be implemented. Many of them allow for more flexibility in the application of user charges and other economic instruments. In Kenya, for example, the implementation of the Environmental Management and Co-ordination Act (1999) and the Water Act (2002) is expected to improve the country's weak regulatory framework, as the government has for the first time given power to environmental authorities to apply economic instruments to the management of the environment and natural resources.

12. A few countries introduced the notion of the citizens' right to a clean environment in their Constitutions.

Table 1.6. Membership of key MEAs and dates of ratification, acceptance, approval or accession

Country	Vienna Convention for the Protection of the Ozone Layer	Montreal Protocol on Substances that Deplete the Ozone Layer	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Convention on Biological Diversity	United Nations Framework Convention on Climate Change	Kyoto Protocol
Date of signature of MEA	1985	1987	1989	1992	1992	1997
Entry into force of MEA	1988	1992	1992	1994	1994	2005
Brazil	1990	1990	1992	1994	1994	2002
Chile	1990	1990	1992	1994	1995	2002
China	1989	1991	1991	1993	1994	2002
Cuba	1992	1992	1994	1994	1994	2002
Czech Republic	1993	1993	1993	1993	1994	2001
Dominican Republic	1993	1993	2000	1996	1999	2002
Guatemala	1988	1990	1989	1995	1996	1999
Honduras	1988	1993	1995	1995	1996	2000
Israel	1992	1992	1994	1995	1996	2004
Kenya	1989	1989	2000	1994	1994	2005
Korea	1993	1992	1994	1994	1994	2002
Mexico	1988	1989	1991	1993	1994	2000
Nicaragua	1993	1993	1997	1995	1996	1999
Pakistan	1993	1993	1994	1994	1994	2005
Panama	1989	1989	1991	1995	1995	1999
Thailand	1989	1989	1997	2004	1995	2002

Agreement	Subject
The 1985 Vienna Convention for the Protection of the Ozone Layer Protection	Aims to protect human health and the environment against adverse effects resulting or likely to result from human activities which modify or are likely to modify the ozone layer. www.unep.org
The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer	Aims to protect the ozone layer by taking precautionary measures to control equitably total global emissions of substances that deplete it, with the ultimate objective of their elimination on the basis of developments in scientific knowledge, taking into account technical and economic considerations and bearing in mind the developmental needs of developing countries. www.unep.org
The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal	Aims to ensure that the management of hazardous wastes and other wastes including their transboundary movement and disposal is consistent with the protection of human health and the environment whatever the place of disposal. www.basel.int
The 1992 Convention on Biological Diversity	Aims to conserve the biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising from the utilisation of genetic resources, taking into account all rights over those resources and technologies, and by appropriate funding. www.biodiv.org
The 1992 United Nations Framework Convention on Climate Change	Aims to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. www.unfccc.int
The 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change	Aims to ensure that the aggregate anthropogenic carbon dioxide equivalent emissions of the greenhouse gases listed in Annex A to the Protocol do not exceed the assigned amounts, with a view to reducing overall emissions of such gases by at least 5% below 1990 levels in the commitment. www.unfccc.org

Sources: UNEP (www.unep.org/dec/links/);
EC (www.europa.eu.int/comm/environment/international_issues/agreements_en.htm).

Industry's responses to the introduction of new environmental laws, voluntary schemes, co-operative mechanisms and improved enforcement methods, have all led to greater demand for EG&S. In addition, there has been a shift from traditional end-of-pipe activities to the use of cleaner technologies, which reduce pollutants at source. As a result, new environmental regulations and standards inspired by evolving technological developments have become important drivers within the industry.

In some of the countries surveyed, government departments have attempted to draw attention to the role of EG&S within a broader framework of (trade and) environmental policy, by setting up new offices dedicated to EG&S. For example, the Dominican Republic created a Commission on Environmental Services in 2001, within the Ministry of Environment and Natural Resources. In Honduras, the Unit for Environmental Goods and Services, within the Ministry of Natural Resources, aims to strengthen national capacities to address EG&S and is supported by a National Commission on Environmental Goods and Services. In Nicaragua, the Ministry of Environment and Natural Resources (MARENA) has an Office of Environmental Services that is in charge of identifying the benefits of trade in environmental goods and services.

Trade policy

Many of the countries surveyed began unilaterally to reduce tariffs and, in general, lower barriers to trade in environmental goods even before the completion of the Uruguay Round in 1994. Such liberalisation often went hand in hand with the enactment of a country's first major environmental laws (mid-1980s to mid-1990s) and privatisation schemes.

At the end of the Uruguay Round of multilateral trade negotiations (1986-94) many countries bound their tariff rates in their schedules of concessions. The idea behind "binding" a tariff is to give traders and investors market security and knowledge of the costs of trade in goods, as countries can only with difficulty raise the tariff above the bound rate. Any WTO member wishing to break its commitments (*i.e.* to raise a tariff above the bound rate) must negotiate with the countries most adversely affected, and this can result in compensation for their trading partners' losses of trade. During the Uruguay Round, developed countries increased the percentage of tariff lines for which tariff rates are bound, from 78% to 99%. Economies in transition increased their bindings from 73% to 98%. For developing countries, the increase was also considerable: from 21% to 73%. Among developed countries, the bound rates are generally the tariffs actually applied. However, most developing countries often apply lower tariffs than what they have bound, so the bound rates serve as ceilings.

Table 1.7 shows the current applied most-favoured nation (MFN) rates and the bound rates at the end of the Uruguay Round negotiations for environmental goods in selected groups of countries. The Quad (Canada, European Union, Japan, United States) had, and still has, the lowest MFN applied rates and bound rates, which are almost equivalent.

Fourteen of the countries surveyed took part in the Uruguay Round and made binding commitments in relation to tariffs on industrial goods, which include most of the goods currently used to protect the environment. Panama made binding commitments in 1997 when it joined the WTO, and China similarly made commitments in 2001. As of October 2005, Vietnam had not yet finalised its commitments as it was still in the process of acceding to the WTO.

Table 1.7. Weighted average tariff levels for environmental goods in *ad valorem* percentage terms[1]

Country group	Applied MFN rate[2]	Bound rate at the end of the Uruguay Round, 1995[3]
All countries	4.3	7.5
All high-income economies	1.9	3.1
OECD countries	3.7	6.0
Low and middle-income economies	8.1	15.6
Least developed countries	9.6	51.1
Quad countries (Canada, European Union, Japan, United States)	1.7	1.8
Czech Republic, Hungary, Poland, Slovak Republic	8.4	6.4
Emerging Asia (China, Hong Kong [China], India, Indonesia, Malaysia, Pakistan, Philippines, Singapore, Chinese Taipei, Thailand, Vietnam)	4.5	7.4
Emerging Eastern Europe (Estonia, Latvia, Lithuania, Romania, Russian Federation, Slovenia, Ukraine)	6.6	19.8
Korea, Mexico, Turkey	10.0	22.5
Emerging South America (Argentina, Brazil, Chile, Venezuela)	11.7	29.7

1. The definition of environmental goods is based on the combined APEC and OECD lists, but excluding goods from HS chapters 1-24.

2. Applied rates for each country are those at the beginning of 2005 or for the latest available year, and are weighted by the value of imports. Specific-rate tariffs (*i.e.* those levied per tonne or other unit) are not included.

3. Only WTO members for which bound tariff schedules were available are included.

Source: World Integrated Trade Solutions (http://wits.worldbank.org/).

It is noteworthy that the tariffs applied to most environmental goods in most of the developing countries studied are around 10%, a figure almost five times higher than the applied MFN rate of the Quad countries. Lowering the applied rates or narrowing the gap between bound rates and applied rates would give traders and investors additional market opportunities and greater security within the trading system.

Tariffs are not the only obstacles to trade. Technical regulations and industrial standards (otherwise known as technical barriers to trade, or TBTs) often vary from country to country and can make business difficult for producers and exporters. Surprisingly, however, few of the country studies mentioned any difficulty with TBTs or other non-tariff barriers (NTBs) in relation to trade in environmental goods.

Most of the country studies focused on the liberalisation of trade in environmental services. They note that it has been patchier than liberalisation of environmental goods and has encountered more obstacles. A recurring theme is the reluctance on the part of some countries to make commitments related to services such as sewage collection and treatment and solid-waste management (refuse disposal services) for fear that poorer members of their populations might have difficulty accessing these services.

A quick glance at the commitments made in environmental services (Table 1.8) shows that only five of the 17 countries have made any commitments and that the commitments made rarely cover the full range of environmental services. Vietnam has not made any commitments, but is not yet a member of the WTO. However, it is likely to

make commitments in environmental services when it joins as Panama and China and most other new members have done (WTO, 2003).

Table 1.8. Summary of countries making specific commitments in respect of environmental services during the Uruguay Round or on accession to the WTO

Country	Sewage services	Refuse-disposal services	Sanitation and similar services	Cleaning services of exhaust gases	Noise and vibration abatement	Nature and landscape protection services	Other environmental protection services
Brazil							
Chile							
China	X	X	X	X	X	X	X
Cuba							
Czech Republic	X	X	X				
Dominican Rep.							
Guatemala							
Honduras							
Israel	X	X	X	X	X		
Kenya							
Korea	X	X		X	X	X	X
Mexico							
Nicaragua							
Panama				X	X	X	
Pakistan							
Thailand	X	X	X	X	X	X	X

Sources: WTO, "Background Note by the Secretariat, Environmental Services", S/C/W46, 1998; and WTO, "Note by the Secretariat, Accession to the World Trade Organization", 28 May 2003, WT/ACC/10/REV1.

Where there has been reluctance to fully liberalise the service sectors by making specific multilateral commitments in WTO schedules or lowering tariffs on environmental goods, many countries have sought alternatives in the form of overseas funding, aid or investment through the creation of joint ventures with foreign firms.

Regional trade agreements

EG&S are specifically addressed in a few regional trade agreements (RTAs). During the late 1990s the Asia-Pacific Economic Co-operation (APEC) economies identified environmental goods and services as priority (or "fast track") sectors for early voluntary liberalisation. The original target was to have, in almost all cases, zero-rate tariffs by 2005 or before. The US-Jordan Free Trade Agreement, which entered into force in December 2001, will, over ten years, eliminate tariffs on many environmental goods and will remove trade restrictions on certain environmental services. The Canada-Costa Rica Free Trade Agreement, which entered into force in October 2002, provides immediate duty-free access to most environmental goods. Under CAFTA-DR, the United States, the Dominican Republic, and the Central American countries that are party to the Agreement

will accord substantial market access across their entire services regime, including environmental services, subject to very few limitations or restrictions.[13]

The reports on Brazil, Israel and Kenya mention that participation in bilateral and regional trade agreements has stimulated trade in EG&S. Brazil attributes the growth in its EG&S market to its participation in MERCOSUR, for example. Israel attributes the growth in its EG&S market to its free trade agreements with the United States, with the member states of the European Union and with its other major trading partners. Kenya's trade in goods has been facilitated by the regional schemes, EAC and COMESA. The study of Mexico indicates that participation in NAFTA has strongly stimulated trade in EG&S.

Table 1.9 shows the surveyed countries' membership in regional trade agreements. Mexico is a party to more trade agreements than the rest, which may account for the stimulation of its trade in EG&S.

The market for EG&S

Most of the countries reviewed do not have adequate data on their EG&S markets, and the task of estimating environmental market size is often complicated by differences in market definitions. Although the authors of the country studies consistently use a broad definition of EG&S, which in each case includes products of natural ecosystems and in some cases services provided by ecosystems, the results are not readily comparable. For example, one study includes ethanol as an environmental good, and another tourism as an environmental service. Such elastic definitions of EG&S make claims about the economic performance of individual EG&S markets that are difficult to substantiate or to refute.

For an indication of the overall size of the environment industry, it is useful to bear in mind some general statistics on EG&S. According to Grant Ferrier of Environmental Business International Inc. (EBI), in 1990 the industry was estimated to have generated revenues of around USD 360 billion worldwide. By 2001, revenues surpassed USD 550 billion, and in 2005 they are expected to reach USD 620 billion.[14] Revenues are split about equally between environmental goods and environmental services.

Firms in OECD member countries currently account for about 90% of the global EG&S market, but over-capacity has slowed market growth in many of their domestic markets. The most rapid rates of growth now occur in transition and developing countries.

13. Under the CAFTA-DR, parties use a so-called "negative list" approach to scheduling commitments on services, as opposed to the "positive list" approach used in the GATS.

14. Grant Ferrier, personal communication with Ronald Steenblik. The EBI definition encompasses more goods than appear on the OECD or APEC lists, and more services than included in the WTO (W/120) definition. For example, it includes revenues from sales of products from certified organic farms and sustainably managed forests, and revenues received by certified eco-tourism locations.

Table 1.9. Participation of selected countries in regional trade agreements

Country	APEC	ASEAN	CACM	CAFTA-DR	CEFTA	COMESA	EAC	MERCOSUR	LAIA	NAFTA	SAPTA
Brazil								●	●		●
Chile	●								●		●
China	●										
Cuba									●		
Czech Republic					●						
Dominican Rep.				●							
Guatemala			●	●							
Honduras			●	●							
Indonesia	●	●									
Israel							●				●
Kenya						●					
Korea	●										●
Mexico	●								●	●	●
Nicaragua			●	●							
Panama											
Pakistan											●
Thailand	●	●									
Vietnam	●	●									

APEC	Asia-Pacific Economic Co-operation
ASEAN	Association of Southeast Asian Nations
CACM	Central American Common Market
CAFTA-DR	Central American-Dominican Republic Free Trade Agreement
CEFTA	Central European Free Trade Agreement
COMESA	Common Market of Eastern and Southern Africa
EAC	East African Cooperation
LAIA	Latin American Integration Association
MERCOSUR	Southern Common Market
NAFTA	North American Free Trade Agreement
SAPTA	South Asian Preferential Trade Arrangement

Source: WTO.

Domestic markets for EG&S

In light of the different determinants of demand outlined above, it would not be surprising to find considerable differences in the domestic markets for EG&S in the countries examined. However, there are a number of striking similarities.

First, all 17 EG&S markets have grown over the last decade and are expected to expand significantly in the next five to ten years. Country studies that quantify annual growth forecast it to run at between 8% and 12% during the first decade of this century. Such figures imply that growth of the EG&S markets in these countries far outstrips growth in OECD countries, where EG&S markets are mature. Second, most of the studies note a significant shift in the structure of countries' EG&S industries, from traditional end-of-pipe activities to the use of cleaner technologies that reduce pollutants at source.

Third, although there are usually a few, large government-owned or multinational firms operating in the domestic markets for EG&S in most of the countries studied, the sector tends to be dominated by small and medium-sized enterprises (SMEs). The Brazilian state-owned company, SABESP, is the only company from a developing country ranked among the world's top 50 environmental companies (WTO, 1998). The possibility of mergers and acquisitions of environmental companies is barely mentioned in the studies, though such consolidation, to the extent it would allow exploitation of economies of scale and scope, could make goods and services cheaper in some countries.

A recurring theme in all of the studies is that information and data about the EG&S market are hard to come by. For most authors, the lack of appropriate statistics makes the assessment of the size of domestic EG&S markets difficult. Much of the information provided by national sources is qualitative and requires a fair amount of judgement.

Bearing in mind these caveats, a couple of the studies do highlight differences in growth patterns in their trade in EG&S. The study of China, for example, which expects 16% growth in environmental services, predicts that the markets for environmental equipment in that country will actually decline in the next few years. Clearly, more information is required before it can be inferred that these figures are representative of a more general trend.

A few studies quantify the number of companies or individuals employed in the EG&S market. The study of China reports some 10 000 environmental enterprises and institutions in 2000, employing 1.8 million people. The Israel study estimates that around 1 000 companies currently supply EG&S, triple the number at the beginning of the 1990s. Almost 95 000 people are employed in Korea's EG&S industry.

Although the relative importance of individual segments of the EG&S market varies among countries, most studies focus on water supply and wastewater treatment, solid-waste management, hazardous-waste management and air pollution control, the areas for which information is most readily available. These are highlighted as being the most important to the countries reviewed. It is therefore notable that in most of the countries surveyed public authorities remain largely responsible for delivering these services, regarded locally as public services, and long-term investment is made without any expectation of immediate or substantial returns. Monopolies, either municipal or state authorities or regulated private companies, have been built up around the provision of the relevant goods and services.

This situation is changing. All of the country studies report that privatisation and deregulation are creating an ever larger role for the private sector in the delivery of goods and services in all four areas, and particularly in solid-waste management and hazardous-waste management. There are few concerns about the participation of foreign and domestic private-sector suppliers in these areas, although issues of ownership and control of essential public infrastructure have been used by governments to resist liberalisation efforts in the past.

In countries that liberalised their EG&S markets in the 1990s, some domestic suppliers were disadvantaged in the short run. The Czech study, for example, describes how lack of adequate information available to domestic firms about the market, and a lack of local capacity, allowed foreign firms initially to dominate the market. However, Czech firms are strengthening and regaining market share.

Also, in countries that had liberalised their EG&S markets, there is anecdotal evidence of the contribution of liberalisation to solving environmental problems.[15] Some country reports acknowledge that locally produced goods have at times been unable to solve some local environmental problems, and that imports proved more useful. However, few or no examples are given.

Imports of EG&S

Many of the studies include figures for imports of EG&S. Interestingly, EG&S imports account for 5-10% of total imports in each country, and imports and foreign investments are expected to rise (both in real terms and in relation to total imports) over the coming years.

The nature of the goods and services imported varies from country to country. Chile's imports, for example, are concentrated in water and wastewater equipment and services. Kenya's imports include large or technologically sophisticated capital goods, such as trucks, tippers and wind turbines.

Most of these imports have originated from France, Germany, Japan or the United States. This is not surprising as these are the world's leading net exporters of environmental goods and services. Latin American countries show a preference for imports from the United States, while Asian countries seem to prefer Japanese products. For example, the United States was the leading exporter to Brazil of environmental technologies, with a 35% market share; Germany occupied second place (25%) and French companies ranked third (15%). Recent estimates show that the United States is also the leading supplier of Chile's environmental technology imports (45%), with the European Union[16] and Asia having 35% and 20% market shares, respectively.

Exports of EG&S

Exports of EG&S received careful attention in most of the country studies. Each report asserts that export capacity and overseas sales have been increasing, and will continue to do so. However, to repeat the earlier caution, most of the countries reviewed do not have good data on their EG&S markets. Moreover, definitions of environmental goods are not yet standardised across countries, hence the composition of each country's set of environmental goods varies. The report on Chile notes that, of the USD 438 million worth of EG&S the country exported in 2001 (representing about 2.4% of Chile's total exports), some 85% of the export value was accounted for by just one product: methanol.

Only the Czech report highlights the substantial barriers that exporters have faced and the problems associated with lack of capital and the inaccessibility of export credits,

15. For specific examples of how EG&S have contributed to solving environmental problems in developing countries, see Chapter 3 of this volume.

16. The term "European Union" refers here to the 15 member states of the European Union as of December 2003.

suggesting that it may only be a problem for countries in an advanced stage of development. Similarly, only a few studies suggest lowering applied tariff rates or narrowing the gap between bound and applied rates. Almost no studies refer to difficulties with non-tariff barriers (NTBs) or other technical barriers to trade.

Yet all countries have managed to export some EG&S. The "environmental goods" identified in the case studies as "environmental exports" include products of organic agriculture (Chile), water-conserving irrigation equipment (Israel), desalinisation equipment (Israel), efficient wood stoves (Kenya), mineral water (Kenya), and even wild game harvested from sustainably run ranches (Kenya). The targeting of such niche markets has been highly successful.

Some other goods and services are identified in the studies as being ripe for export. Israel is developing innovations for industries requiring specialised technologies. Czech suppliers are targeting markets in other countries in the region, as well as in Asia, such as China. In fact, China is the leading export destination for EG&S for most of the countries studied.

Selected sectors

Authors of the country studies were asked to focus on key environmental media or issue areas. As most include water supply and wastewater treatment, solid-waste management, hazardous-waste management and air pollution control, this section highlights some of the details of these four market sub-sectors. Table 1.10 shows the sectors selected by the authors of the country studies.

Table 1.10. Sectors of the EG&S industry highlighted in the country studies

Country	Water & wastewater treatment	Solid-waste management	Hazardous-waste management	Air pollution control
Brazil	X	X	X	In transport
Chile	X			X
China	X	X		X
Cuba	X	X		
Czech Republic		X		X
Dominican Republic	X	X	X	
Guatemala		X		
Honduras		X		
Israel	X			
Kenya	X	X		
Korea	X			
Mexico	X			
Nicaragua	X	X		X
Panama		X		
Pakistan	X	X	X	X
Thailand	X	X	X	X
Vietnam	X	X	X	X

Sources: OECD, UNCTAD and UNDP.

It is noteworthy that water and wastewater treatment, management of solid and hazardous waste, and air pollution control services are considered extremely important across all the countries surveyed, irrespective of their level of economic development. However, demand for technologies to address problems related to air pollution from power plants and factories seems to be greater in countries that can be considered "newly industrialising" (Chile, China, the Czech Republic and Korea, in particular) than in others.

Water supply and wastewater treatment

Water supply employs goods and services associated with the collection, purification and distribution of water, whereas wastewater treatment is associated with the operation of systems or the provision of other services for the collection, treatment and transport of wastewater and cooling water. Most of the countries reviewed focused on existing needs in water supply and wastewater treatment, and it is generally acknowledged that most domestic markets have undergone some transformation and improvement since the 1980s. The actual nature of change and the tangible improvements made have varied.

For example, in Chile, where the state was the main owner, administrator and enforcing body in the water and wastewater industry until 1989, the industry has since been run by independent firms. In Korea, water supply and wastewater services were among the first environmental services to involve private companies. The government has encouraged the participation of private companies, and several foreign firms have entered the market by establishing partnerships with major Korean contractors.

In the Dominican Republic, decentralised state-owned corporations still manage water services, but the private sector is playing an increasing role in the administration and collection of user charges. Similarly, in Brazil, where a new policy allows water supply and wastewater management services to be provided either by state companies (under current concessions), municipal-owned utilities (where concessions have not been given), or private companies (under new concessions), the transformation is only partial. Brazil's publicly owned Environmental Sanitation Technology Company (CETESB) still dominates the market, but has developed several cleaner production and capacity-building initiatives at state, national and international levels, services which it may be able to export to other MERCOSUR countries.

In Cuba, drinking water and wastewater management services are still state-owned and controlled, but are well developed. Around 95% of the population has access to an improved water source and to improved sanitation facilities. Nevertheless, large investments are needed to maintain and upgrade existing infrastructure, as well as to develop new facilities.

Although changes are well documented, the improvements made in each case are anecdotal. Some studies regard falling prices for water as a sign of improvement, while others acknowledge the link between rising prices, investment and improved levels of service. Few of the studies express concern over the privatisation of water supply and wastewater management, even in countries where these have traditionally been viewed as public services.

Whatever the structure and state of the water supply and wastewater treatment, most authors see constraints on the supply of water as potentially seriously constraining countries' economic growth. Water is a fundamental input to agriculture, energy production, manufacturing and tourism, and vital for achieving public-health goals. Rapid

population growth in many countries is expected to put further pressure on water resources.

Most of the authors acknowledge that their country's current pattern of water use is unsustainable. Low prices (whether fixed by publicly owned companies or through regulations governing private companies) and high levels of investment in infrastructure rarely go hand in hand. Almost all countries want to introduce pricing that reflects the real cost of the water supplied and to take urgent measures to boost supply and rationalise demand. Some countries fear future conflicts over water, and, indeed, conflicts over water access are already commonplace in Kenya.

Solid-waste management

Solid-waste management refers to the provision of services related to the collection, treatment, transport, storage or recovery of non-hazardous waste. It includes management and other services related to waste handling, the collection and purchasing of waste and scrap, and the operation of recycling plants. The management of low-level nuclear waste is also included.

In many of the countries studied, solid-waste management is characterised by low coverage, uncontrolled dumping of waste and inefficient public services. It is also one of the largest EG&S sectors in terms of revenue, and public procurement accounts for most of the market. Like water and wastewater treatment, solid-waste management has been, and still is, one of the key areas targeted for reform in the countries studied. However, the nature, depth and benefits of change have not been even.

No countries appear to have fully privatised solid-waste management, although Panama has opened up solid-waste management to private companies in all of its largest municipalities except Panama City. The largest contributing factor is the lack of confidence in the efficiency of public services.

In most countries, the shift from public to private management has been partial. For example, in Nicaragua the public sector remains largely responsible for the provision of most environmental services, particularly those associated with refuse collection and disposal, but some contracts have been offered to the private sector. Similarly, in Brazil, municipalities — which are legally responsible for the management of municipal solid waste — usually lack the necessary capital and know-how to build and operate modern landfills. They have therefore started to transfer the collection and disposal of municipal solid waste to the private sector, through bidding. In Honduras, waste management falls under the responsibility of municipal authorities. Still, municipal legislation authorises the outsourcing of approximately 50% of such services, in particular waste collection. Waste collection has been privatised in the 22 largest municipalities, and there are also small service providers, such as community groups and individuals, that operate in the informal sector. In some cases, concessions have been granted to international companies for the treatment and final disposal of solid and organic wastes. And in the Dominican Republic, foreign suppliers play a significant role in collecting and managing solid and hazardous waste; recycling is carried out entirely by private companies.

In Cuba, the collection and disposal of municipal solid waste, as well as recycling activities, are carried out entirely by state-owned companies. They face constraints related to lack of equipment, technology and finance. Likewise, in Kenya, local authorities, which remain wholly responsible for solid-waste management, have been unable to cope with the collection, treatment and disposal of municipal solid waste owing to the large

volumes of waste generated daily, insufficient investment and lax enforcement. The situation has led to very negative impacts on soil and water, the generation of greenhouse gases, and the endangering of the public's health and safety. It has also spurred residents (in relatively wealthy neighbourhoods) to form neighbourhood associations to organise rubbish collection and disposal themselves, or to contract with private firms to provide these services.

Again, although changes are well documented, the improvements are anecdotal. None of the studies expresses concern over the implications of privatising solid-waste management, which has traditionally been viewed as a public service in most countries.

Hazardous-waste management

Hazardous-waste management is sometimes lumped together with solid-waste management, and many of the studies treat the two together. Like solid-waste management, hazardous-waste management refers to the provision of services related to the collection, treatment, transport, storage or recovery of hazardous wastes. It includes design, management or other services for waste handling, and the operation of recycling plants. Services related to toxic wastes and high-level nuclear wastes are also included.

A large number of studies highlight that many companies say that they cannot afford to properly dispose of their hazardous wastes. There are not enough landfills able to handle special wastes, and the costs of incineration — the only alternative to land disposal in most localities — are high. Diffuse dumping of toxic wastes is a problem that has proved difficult to tackle. Little of the packaging for agrochemicals is disposed of properly, and waste from new technologies, such as computers and cellular-phone batteries (which often contain heavy metals), is rarely segregated.

The studies do not give the management of hazardous wastes the same attention as water and wastewater supply or (non-hazardous) solid-waste management, but some nevertheless note that it is a key area for reform. In the study of the Dominican Republic, which cites the liberalisation of hazardous-waste management as a success story, foreign suppliers now play a significant role in the collection and management of hazardous waste.

Air pollution control

Air pollution control includes managing systems or providing other services for the treatment or removal of exhaust gases and particulate matter from both stationary and mobile sources. Few of the country studies give details about their air pollution control, although most refer to it as an area in need of reform.

The Brazilian study observes that Brazil suffers from considerable problems with air pollution, especially in metropolitan areas, which contain about 70% of the country's population and industry. Private companies, selected through international bidding, carry out vehicle inspections as part of a pollution-abatement programme. The government is also looking into the possibility of providing incentives for natural gas technologies (switching from diesel), the use of hybrid electric buses in specific urban corridors, the use of cleaner diesel (with less sulphur), and the development of a large fleet of flexible-fuel (alcohol and gasoline) passenger vehicles. Indeed, cleaner fuels, especially cleaner diesel and natural gas and ethanol, form an important part of Brazil's strategy to improve its air quality.

Concluding observations

This synthesis report has drawn upon 17 country studies prepared by consultants to the OECD, UNCTAD and the UNDP, all nationals of the countries examined. Its general aim is to highlight common themes and experiences emerging from these studies and to draw attention to key trade and environmental policy linkages.

Much about the current and potential future markets for environmental goods and services in developing and newly industrialising countries is still poorly understood. It is commonly acknowledged that much of the information relating to trade in EG&S is anecdotal or difficult to substantiate. As countries respond to demands for a cleaner environment, the need for further analysis and improved data on the sector will become, if anything, even greater.

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Chapter 2

Environmental Goods: A Comparison of the APEC and OECD Lists

by

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This chapter compares two lists of environmental goods that have been used in the WTO negotiations on liberalising trade in environmental goods and services. It describes the genesis of the lists, which were compiled in the late 1990s. The OECD list was developed as a basis for analysing trade and tariffs. The APEC list emerged from nominations by member economies of the Asia-Pacific Economic Co-operation forum, as part of an effort to attain early voluntary liberalisation of trade in particular sectors. The concluding section of the chapter identifies common elements in the two lists and explains important differences.

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Introduction

Paragraph 31(iii) of the Doha Ministerial Declaration calls for negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services". "Environmental goods" were not further defined in the declaration. However, the OECD and APEC (Asia-Pacific Co-operation) had already done a substantial amount of work to identify the scope of environmental goods; each of these organisations established a list of candidate goods. Although the lists were developed for purposes other than the WTO negotiations, and therefore have to be considered as indicative, several countries have considered them useful starting points for those negotiations. In fact, in September 2002, the WTO Secretariat was asked to circulate both lists to the Non-agricultural Market Access Negotiating Group (NAMA), the WTO body that is conducting negotiations on environmental goods,[1] and subsequently to the Committee on Trade and Environment meeting in Special Session (CTE-SS), with which the NAMA works closely.[2] Since then, several other OECD members have submitted proposals that include some goods from both lists.

Genesis of the two lists

The dynamic nature of their market, together with the role they can play in strengthening environmental protection, have made environmental goods obvious candidates for a trade liberalisation initiative, one that could benefit the environment and boost international trade. However, trade negotiators face a basic difficulty: there is no well-defined " environmental goods sector". Rather, environmental goods are found in a wide range of industrial and trade classification nomenclatures. As one study noted, "This business is less a sector than an agglomeration of providers of many types of goods, services and technologies that are usually integrated into production processes and are often hard to tease out as separate items." (US Office of Technology Assessment, 1994, p. 149)

Specific end-of-pipe pollution abatement and clean-up technologies — such as catalytic converters for automobile exhausts — are obvious candidates for any list of environmental goods. Outside this narrow area, however, classifying goods as "environmental" raises fundamental issues. Many goods used for environmental protection and resource management have other uses: for example, pumps can be used in a wastewater treatment facility or in industrial uses not related to environmental remediation. Other goods may be considered "good for the environment" by virtue of their relative (as opposed to absolute) performance; as almost all goods and technologies have substitutes that are cleaner or more efficient, the resulting definition might be extremely broad. No attempt is made here to resolve classification issues, but readers are advised to bear them in mind when considering the product coverage of any list of environmental goods.

1. Under the negotiating structure adopted by the Trade Negotiations Committee in February 2002, negotiations on market access for non-agricultural products were to take place in the Negotiating Group on Market Access, and negotiations on services in the Council for Trade in Services in Special Session. Negotiations on trade and environment were to take place in the Committee on Trade and Environment meeting in Special Session.

2. The lists are contained in WTO documents TN/MA/S/6 and TN/TE/W/18.

The following sections trace separately the development of the OECD and APEC lists. In fact, their developmental phases ran closely parallel and intersected at several points, the one exercise informing the other. That is not surprising, as six (and later seven) countries[3] were members of both organisations. However, the lists were intended to serve different purposes. The OECD list was the result of an exercise to illustrate, primarily for analytical purposes, the scope of the "environment industry". The categories of goods could therefore be broad, because adding products to the list would have no specific policy consequences. By contrast, the APEC list resulted from policy discussions relating to anticipated changes in tariffs. Whereas the OECD list was meant to be indicative and a framework for undertaking economic analysis in general and analysis of trade flows and tariff barriers in particular, the APEC list — negotiations on which ended before full consensus was reached — was the direct result of negotiated offers in the context of a trade liberalisation initiative.

The OECD list

The OECD's interest in environmental goods and services arose as part of its work on environmental policy and industrial competitiveness. A 1992 report prepared by the Industry Committee described market developments in the environment industry and the role of environmental policies (OECD, 1992). A subsequent report (OECD, 1996a) expanded and deepened the analysis, collected available data, and showed a clear need to improve information on the industry and undertake further analysis.

Publication of these results prompted numerous questions. What was the situation for exports of environmental technologies? Was it possible to measure the impact on industrial competitiveness of the application of cleaner technologies? How could environmental and economic policy encourage and support growth, job creation and trade in goods and services of the environment industry? It soon became apparent that to answer such questions, it was necessary to address major statistical and methodological difficulties related to problems of industry delimitation and data availability.

In 1994 the US government (the Environmental Protection Agency and the Department of Commerce) hosted a meeting of experts in Washington, DC. The main aim was to identify ways to collect more comprehensive and consistent information, particularly on production, employment, trade, investment and R&D, and to provide a more solid foundation for policy analysis (OECD, 1996b). Before statistics could be gathered, however, a clearer definition and classification of the environmental goods and services industry was needed. To this end, the OECD, in collaboration with Eurostat (the Statistical Office of the European Communities), formed an Informal Working Group on the Environment Industry composed of experts from OECD countries who, as part of their work at national ministries, national statistical offices, or public or private research institutes, were responsible for collecting and analysing data on the environmental goods and services industry.

3. Australia, Canada, Japan, Korea (which joined the OECD late in 1996), Mexico, New Zealand and the United States.

At its first meeting in Luxembourg, in April 1995, the OECD/Eurostat Informal Working Group agreed on an interim definition of, and classification system for, the environment industry (OECD, 1996c). After considering various alternatives, the Working Group agreed on the following definition:

> The environmental goods and services industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use.

The Working Group went on to add, "For cleaner technologies, products and services, despite their importance, there is currently no agreed methodology which allows their contribution to be measured in a satisfactory way." (OECD/Eurostat, 1999, p. 10) This is why products defined in terms of their energy efficiency, for example, were not included in the original OECD list.

The definition and classification were tested during 1996 and 1997 by reorganising available data in OECD countries and collecting new data. In the meantime, Canada, the Commission of the European Communities, France and the United States started using the OECD/Eurostat classification to design and carry out new surveys and studies on the environment industry.

During 1997 the OECD/Eurostat Informal Working Group continued to refine and improve its interim definition and classification system. Meanwhile, the OECD's Joint Working Party on Trade and Environment (JWPTE) took an interest in the subject. The OECD/Eurostat Informal Working Group was concentrating on defining relevant industry activities (for both goods and services) to improve analysis and to obtain coherent, comparable statistics in national surveys; the JWPTE was interested in developing a framework for future trade liberalisation efforts in the environmental goods and services (EG&S) sector. In the absence of any internationally agreed product list of environmental goods, it attempted to develop such a list based on 6-digit HS (Harmonized System) trade nomenclature product numbers and arranged according to the groups, categories and sub-categories of environmental goods developed by the Informal Working Group. Given the nature of the OECD/Eurostat classification system, it was possible to identify a greater number of HS commodity codes for the six sub-categories of group A ("Pollution Management"), than for the two sub-categories of group B ("Cleaner Technologies and Products") or the ten sub-categories of group C ("Resources Management"). The final list, which is reproduced in Table 2.A1, was completed in 1998 and was published in both a JWPTE working paper (OECD, 1999) and the final report of the Informal Working Group (OECD/Eurostat, 1999). It was also reproduced, unchanged, in *Environmental Goods and Services: The Benefits of Further Global Trade Liberalisation* (OECD, 2001).

It must be stressed that the OECD list was meant to be illustrative rather than definitive, and particularly for use in analysing levels of tariff protection. As the "Note" to the list published in OECD/Eurostat (1999b) explains, "The list is not exhaustive; not all environmental goods are covered. Some environmental goods have no equivalent HS commodity code. Some HS commodity codes include goods which may not be environmental goods." It is with respect to the last point that some of the most important differences between the OECD and APEC lists occur. In producing the OECD list, no attempt was made to go beyond the 6-digit (sub-heading) HS codes and identify only those goods that could be considered "environmental". By contrast, the APEC list was produced through an essentially "bottom-up" process, and includes many "ex-headings"

(nationally defined tariff lines) of goods that fall under more aggregate commodity descriptions.

The APEC list

The roots of the APEC list of environmental goods can be traced to a November 1995 meeting in Osaka, Japan, at which APEC leaders agreed to identify industries in which the progressive reduction of tariffs could have a positive impact on trade and on economic growth in the Asia-Pacific region, or for which there was regional industry support for early liberalisation. A year later, at their meeting in Subic Bay, Philippines, APEC leaders issued more precise instructions, directing ministers responsible for trade (hereafter "trade ministers") to "identify sectors where early voluntary liberalisation would have a positive impact on trade, investment and economic growth in the individual APEC economies as well as in the region and submit recommendations on how this can be achieved".

At their May 1997 meeting in Montreal, APEC trade ministers directed officials to identify sectors that might be candidates for early voluntary liberalisation. A wide variety of APEC economies then put forward 62 nominations from more than 40 sectors, for consideration at a subsequent meeting of senior officials in August. Most proposals were supported by several economies, but few were supported by all (Yamazawa and Scollay, 2003). Environmental goods and services, as a distinct category, was proposed by four economies — Canada, Japan, Chinese Taipei and the United States — drawing on the original working OECD definition of the environmental sector to guide the initial work of classification (Dee *et al.*, 1998). Ultimately, a total of nine economies proposed goods under this category.

By the time of the November 1997 APEC leaders' meeting in Vancouver, the nominations had been arranged into 41 sectors. At that meeting, 15 sectors clearly enjoyed the greatest support for early voluntary sectoral liberalisation (EVSL). These 15 sectors were then divided into two tiers. The first comprised nine sectors identified for fast-track treatment: environmental goods and services, fish and fish products, forestry products, medical equipment and instruments, energy, toys, gems and jewellery, chemicals, and a telecommunications mutual recognition agreement. The second tier comprised sectors (oilseeds and oilseed products, food, rubber, fertilisers, automotive products, civil aircraft) which were judged to require more preparatory work before they would be ready for implementation.[4]

Acting on the decisions of leaders and ministers in Vancouver, senior officials instructed sectoral co-ordinators to finalise agreements or arrangements that would include, in addition to market opening, elements of facilitation and economic and technical co-operation. Building on work undertaken in autumn 1997, and including extensive inter-session work, two additional rounds of experts' meetings were held in Penang and Kuala Lumpur to further develop the Vancouver proposals in advance of the June 1998 Kuching meeting of APEC trade ministers. By the time of the meeting, a framework for addressing EVSL, including draft product lists, end tariff rates and timetables, had been worked out. Both at Kuching and in subsequent meetings in 1998, including in Kuantan, further efforts were made to develop each of the proposals.

4. Proposals for the second tier of sectors were further developed for assessment and review by APEC ministers at the Kuching meeting in June 1998 (Dee *et al.*, 1998).

Table 2.A2 provides the revised, consolidated list of environmental goods (also known as the "Kuantan version"), the list that was eventually transmitted to the WTO.

Because environmental goods are not defined as a sector in the HS nomenclature, liberalisation of necessity had to be pursued on a product-specific basis (Oxley, 1999). Proceeding from the OECD definition of activities that form part of the environmental industry, APEC economies identified, by HS codes, a positive list of products to be covered under the agreement. Tariffs for the specified products were, in principle, to be completely eliminated by 1 January 2003.[5] However, in recognition of the need to deal with product-specific concerns raised by individual economies, some flexibility was allowed. In the case of environmental goods, for example, elimination of some tariffs could be delayed until 2005 for a small number of products, or until 2007 in the case of developing economies (Table 2.1).

Table 2.1. APEC's EVSL for environmental goods: flexibility proposals by the sectoral co-ordinator

Schedule target	Implementation schedule
Preferred outcome	Tariffs eliminated over 4 years, in 4 equal cuts, with the first cut taking place six months after conclusion of the agreement, subject to the completion of domestic legislative procedures, and subsequent cuts taking place by 1 January 2001, 2002 and 2003.
Minimum conformity	Industrialised economies: 90% of tariff lines to be reduced to 0% by 1 January 2003. Developing economies: 80% of tariff lines to be reduced to 0% by 1 January 2003.
Flexibility	Industrialised economies: any remaining non-zero tariff lines to be reduced to 0% by 1 January 2005. Developing economies: the first tranche (at least half) of any remaining non-zero tariff lines to be reduced to 0% by 1 January 2005; the last tranche of non-zero tariff lines to be reduced to 0% by 1 January 2007

Sources: Sectoral co-ordinator for environmental goods and services, "Report on agreements/arrangements for market opening, facilitation and other measures", 11 November 1998; Government of New Zealand, "Preparations for the 1999 Ministerial Conference — APEC's 'Accelerated Tariff Liberalisation' (ATL) Initiative — Communication from New Zealand", Document No. WT/GC/W/138 (26 January 1999), World Trade Organization, Geneva.

In the negotiations, there was a certain amount of caution on the part of some economies that may have been reluctant to see items with high tariffs targeted for liberalisation. In addition, some economies were quite sensitive to the "dual use" issue. They reasoned that, while certain items might have a use, even an important use, in an environmental context, they might also be used in other contexts, with the result that the effects of tariff liberalisation would not be limited to the environment sector. Further, even when HS tariff lines contained items that were essential to the environment industry, other products that were not so environmentally relevant might also fall under the same 6- or 8-digit tariff sub-heading.

The APEC economies found ways to address many of these concerns, for example through: *i)* the inclusion of a 6-digit heading if the products were predominantly environmental, or so central to environmental uses that their inclusion was absolutely necessary; or *ii)* the specification of an "ex-heading" when APEC economies wished to

5. Targets for the environmental goods and services sectors were initially "to be determined" and were only finalised subsequent to the June 1998 Kuching meeting of APEC trade ministers.

provide duty-free treatment to a specific product. In the latter cases, it would be left to individual economies to specify how that product would be reflected in their own national tariff schedules. All of these issues tended to make economies cautious about inclusion of HS sub-headings and products, and this made the APEC list shorter than it might otherwise have been.

Notably absent from the consolidated list of environmental goods were chemicals used for processes such as water purification or wastewater treatment. Chemicals were omitted not because they were regarded as non-essential for environmental protection and remediation, but because APEC members wanted to avoid entangling the EVSL initiative for environmental goods with the one for chemicals, particularly as the latter called only for harmonising tariff rates (Tables 2.A3 and 2.A4). The proposal for EVSL of chemicals had a longer history, beginning with the Uruguay Round's Chemical Tariff Harmonisation Agreement (CTHA), to which several APEC economies were already signatories as part of their Uruguay Round tariff commitments (Box 2.1).

The logic of avoiding overlap between EVSL lists was *not* applied to goods from the medical equipment and instruments sector, 36 of which are included in the environmental goods list under the category for monitoring and analysis equipment.[6] There is also a smaller overlap between the list for energy and the list for environmental goods, with 17 tariff lines common at the 6-digit level, ten of which refer to different ex-headings.

During the remainder of 1998, additional technical experts' meetings took place to elaborate the details of the various EVSL frameworks. The resultant proposal, presented to trade ministers and APEC leaders at their annual meeting in Kuala Lumpur in November 1998, was a comprehensive package that included undertakings on four elements: tariffs, services, non-tariff measures and economic and technical co-operation (Ecotech). While taking note of the progress made in finalising the EVSL package, ministers could not agree to move forward on its tariff elements. A decision was therefore taken to refer the tariff elements of the EVSL proposals to the WTO, for possible adoption on a binding basis by the full WTO membership. In so doing, the ministers also pledged to work "constructively to achieve critical mass in the WTO necessary for concluding agreement in all nine [first-tier EVSL] sectors".[7] Malaysia, as APEC Chair, communicated this outcome to the WTO General Council in December 1998.

New Zealand, as APEC Chair for 1999, later circulated two papers to WTO members, explaining the history of the EVSL initiative and providing details on the liberalisation targets, flexibility approaches, and positions reached by APEC economies for each sector by the time of the Kuala Lumpur ministerial and leaders' meetings. The expectation was that the tariff elements of the Accelerated Tariff Liberalisation (ATL) initiative — as the EVSL initiative became known in the WTO — would be advanced as a whole for consideration and adoption at the Third WTO Ministerial Conference in Seattle (December 1999). Owing to the complicated nature of the Seattle meeting, however, little progress was made on the package.

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6. Several products included on the list (particularly under HS 9027 and 9031) also form part of the schedule of commitments entered into by Parties to the WTO's Information Technology Agreement, several of whom are also members of APEC.

7. The APEC ministers also noted that "This process of expanding participation beyond APEC will not prejudice the position of APEC members with respect to the agenda and modalities to be agreed at the Third WTO Ministerial Conference."

Box 2.1. The EVSL initiative for chemicals

Chemicals such as hydrated lime and magnesium dioxide are used in many environmental processes, such as water purification, wastewater treatment and air pollution control. They were omitted from APEC's EVSL initiative for environmental goods because they were covered under a separate EVSL initiative for chemicals.

The chemicals EVSL initiative — later to become part of the Accelerated Tariff Liberalisation initiative — had its origins in the Uruguay Round of multilateral trade negotiations. In 1991, chemical associations from several countries proposed that chemical tariffs be harmonised at 0%, 5.5% or 6.5%, depending on the class of the chemical product. The harmonisation initiative covered all of HS Chapters 28-39, except for a handful of items that were considered to be part of the Uruguay Round agricultural negotiations. The industry proposal became the basis for the Uruguay Round Chemical Tariff Harmonisation Agreement (CTHA), to which about two dozen countries became signatories.[1] Since then, several other countries have adopted the CTHA as part of their WTO accession commitments, and others still in the process of acceding have signalled their willingness to undertake the CTHA commitments. Currently, over 30 (mainly OECD member) countries are in the process of implementing the CTHA, with more to join once their accession negotiations are completed.

When APEC ministers called for the nomination of sectors for EVSL in mid-1997, the United States and Singapore each nominated the full range of products covered by the CTHA and the tariff rates agreed to in the Uruguay Round for those products. Australia and Hong Kong, China, joined with the United States and Singapore to co-sponsor a broad chemicals initiative. Several other proposals were also received for sub-sectors of the chemicals sector, and fertilisers was selected by APEC ministers as a separate product group for liberalisation beyond that provided for in the CTHA.

1. At the end of the Uruguay Round, the CTHA encompassed the Quad (Canada, the European Commission [on behalf of the 12 EU member states], Japan, and the United States), Korea, Norway, Singapore and Switzerland. In 1995 this number increased with the addition of three new member states to the European Union.

Source: Government of New Zealand, "Preparations for the 1999 Ministerial Conference — APEC's 'Accelerated Tariff Liberalisation' (ATL) Initiative — Communication from New Zealand — Addendum", Document No. WT/GC/W/138/Add.1 (22 April 1999), World Trade Organization, Geneva.

Meanwhile, work on other aspects of the EVSL initiatives — namely, reducing non-tariff barriers, facilitating trade and encouraging economic and technical co-operation — has continued within APEC. For example, APEC members have been encouraged to submit and support proposals for economic and technical co-operation projects that will facilitate trade in environmental goods. An APEC Cleaner Production Strategy[8] has been developed and approved which includes a list of generic, illustrative activities for implementing the strategy: *i)* cleaner production training modules; *ii)* sector-based demonstration projects and case studies; *iii)* technical conferences and seminars; *iv)* environmental management systems (*e.g.* ISO 14001) workshops and training activities; *v)* study tours and cleaner production fellowships; *vi)* technical exchanges; *vii)* electronic information exchanges; *viii)* use of industrial extension support systems to promote cleaner production among SMEs; and *ix)* development of guidebooks and

8. www.apec.org/apec/ministerial_statements/sectoral_ministerial/environment/1997_environment.html.

manuals. In 2003, the APEC Secretariat circulated a questionnaire[9] to its members on the impacts on APEC economies of measures to liberalise and facilitate trade in environmental services. Member economies have since presented case studies of their experiences on a voluntary basis, to generate momentum for services liberalisation in light of its perceived benefits.

Comparison of the OECD and APEC lists

Table 2.A5 combines the OECD and APEC lists of environmental goods into a single composite list, to facilitate comparison. Goods were organised according to the categories and sub-categories used in the OECD/Eurostat scheme and, within those sub-categories, ordered by 6-digit HS nomenclature sub-headings. In most cases, categories used in the APEC list correspond to those in the OECD list;[10] hence the assignment of goods from the APEC list to OECD categories was straightforward, although assumptions had to be made as to the sub-categories to which a few goods should be assigned. Also, in nine cases (see note to Table 2.A5), goods from the APEC list were assigned to OECD categories other than those to which they belong in the original APEC list. An example is ozone, an ex-heading under HS 8543.89: in the APEC list it appears under wastewater management; in the composite list it was also assigned to potable water treatment.

Counting only entries with corresponding HS codes, the OECD list appears to be about 50% longer than the APEC list (Table 2.2). However, when one eliminates multiple listings at the 6-digit level, they are more similar in length: there are 132 unique HS codes in the OECD list, compared with 104 in the APEC list. The composite list has 233 entries identified with an HS code, covering 198 goods. These magnitudes are small compared with the total number of lines contained in WTO members' national tariff schedules, which range from fewer than 6 000 (in the schedules of Australia and India) to over 11 000 (in the schedules of Hungary, Korea, Mexico and Turkey).[11]

Strictly speaking, the two lists overlap little at the HS six-digit level. In all, less than 30% of the goods in the combined list are common to both lists, and about half of the goods on either list can be found on the other. The greatest areas of overlap are found in the categories of recycling equipment (OECD sub-category A.3.6), incineration equipment (sub-category A.3.7), and measuring and monitoring equipment (sub-category A.6.1). Even then, for about one-quarter of the common goods, the APEC list refers to one or two specific goods, rather than to all the goods contained within the tariff line. For example, the OECD product list refers to "Parts for spark-ignition internal combustion piston engines", whereas the APEC list covers only the ex-heading category of industrial mufflers.

9. www.apec.org/apec/documents_reports/group_on_services/2003.html#I.

10. The exception is the APEC category "Other recycling systems" (ORS), which corresponds to the OECD sub-category "3.6. Recycling equipment" under the general category of "3. Solid waste management".

11. WTO Secretariat, "WTO Members' Tariff Profiles", WTO Document No. TN/MA/S/4/Rev.1, Geneva.

Table 2.2. Summary statistics of APEC and OECD lists of environmental goods

Statistic	Number or %
OECD list	
Total HS sub-headings	164
Unique HS sub-headings	132
APEC list	
Total HS sub-headings	109
Unique HS sub-headings	104
— of which qualified by ex-heading specification	44
Composite list	
Total HS sub-headings	233
Unique HS sub-headings	198
Tariff lines common to both the OECD and APEC lists	54
— of which qualified by ex-heading specification	13
Percentage overlap (54 out of 198)	27 %

Source: Table 2.A5.

One reason for the surprising lack of overlap is a difference of emphasis. Under the category "Heat/energy savings and management", the OECD list specifies 14 tariff lines and the APEC list only three. The OECD list contains five tariff lines each under the sub-categories "Hazardous waste storage and treatment equipment" and "Waste collection equipment"; the APEC list contains none. On the other hand, the APEC list contains a much larger number of goods under the category "Environmental monitoring, analysis and assessment", including some goods not mentioned in the OECD list, such as gas and electricity meters. Almost all of the goods contained in the OECD list under this category also appear on the APEC list.

Another reason for the small degree of overlap is the omission of some tariff lines from the APEC list because the particular goods were already included on lists prepared for other EVSL initiatives, notably for chemicals. Thus, while particular chemicals, such as chlorine, hydrogen peroxide and magnesium hydroxide, which fall within HS Chapters 28 through 39, are sprinkled across the OECD product list under categories ranging from air pollution control to renewable energy (in the case of methanol), with most listed under wastewater management, they are, with one exception,[12] absent from the APEC list for environmental goods. However, all of the chemicals appearing on the OECD list were covered by APEC's separate, and more encompassing, EVSL proposal for chemicals.

In several cases, the APEC list provides greater specificity for goods mentioned in the OECD list but for which no HS codes were provided. Examples are trash compactors and

12. The exception relates to two products listed under HS 3926.90 (Other articles of plastics and articles of other materials of HS 3901 to 3914; other): bio-film medium that consists of woven fabric sheets that facilitate the growth of bio-organisms; and rotating biological contactor consisting of stacks of large (HDPE) plates that facilitate the growth of bio-organisms. The APEC list includes these under wastewater management.

parts for trash compactors (corresponding to the OECD's sub-category "compactors"), electromagnets (OECD: "magnetic separators"), inflatable oil spill recovery barges (OECD: "oil spillage cleanup equipment"), wind-powered electric generating sets (OECD: "wind turbines"), and hydraulic turbines and water wheels (OECD: "hydroelectric plant"). Had the OECD gone into greater detail for these sub-categories, the degree of overlap between the two lists would no doubt have been greater.

Notably, the APEC list includes specific products — including several goods from or for agriculture — corresponding to categories of goods suggested by the OECD but for which no HS codes were specified and no concrete examples were provided. For example, New Zealand had nominated biodegradable erosion-control matting and ecologically safe ground covers (both ex-headings of HS 4601.20), as well as hot-water weed-killing systems (an ex-heading of HS 8436.80), for EVSL. All three of these items are classified in the APEC list as relating to wastewater management. (Under the OECD list they would more logically be classified as goods used to make agriculture more sustainable.) Similarly, Canada nominated booms or socks consisting of ground cobs of corn (maize) contained in a textile covering (an ex-heading of HS 2302.10) as an environmental good used in remediation and cleanup.

Conclusions

In reviewing the history of the OECD and APEC product lists of environmental goods, it is clear that the two exercises were interlinked and informed each other. For example, the drafters of the APEC list consciously based their categories of environmental goods in large part on the work being undertaken at the time by the OECD/Eurostat Informal Working Group on the Environment Industry.[13] At the broad level, therefore, the two lists are quite similar.

However, the objectives of the two exercises differed, as did the procedures for generating the lists. The OECD's larger list was created deductively: starting from general categories based on classifications appearing in the environment industry manual (OECD/Eurostat, 1999), and adding more specific examples, where available, in order to produce an estimate of average tariffs[14] on a previously undefined class of goods. The APEC approach started with nominations, not unlike the request-offer procedures traditionally used in trade negotiations. This yielded a list of goods which was then arranged according to an agreed classification system.

It is important also to understand the APEC list in the context of the larger EVSL initiative with which it was associated. Environmental goods constituted only one of 15 sectors falling under the initiative, and one of nine when it was referred to the WTO and became part of the Accelerated Tariff Liberalisation initiative. Neither the APEC nor the OECD exercise sought to exclude any categories of goods *a priori*. However, because of the broad coverage of the EVSL initiative and its segmentation into distinct sectors, each with a different set of liberalisation target dates and rates, certain goods such as chemicals, which are clearly necessary for limiting or correcting environmental damage, were not included in the EVSL initiative for environmental goods. This was more apt to be the case as liberalisation targets for other sectors diverged further from those for environmental goods.

13. See WTO document No. WT/GC/W/138.Add.1 (22 April 1999).

14. For the latest information on tariffs, see the table at www.oecd.org/env.

Moreover, since the aim of the APEC list was to obtain more favourable (different) tariff treatment for environmental goods, APEC member economies limited themselves to considering only those goods that could be readily distinguished by customs agents and treated differently for tariff purposes. For this reason, issues related to "like products", products defined by particular processes or production methods, and products defined by their life-cycle impacts, were not addressed, with the result that some goods were omitted that may have been included in the OECD list. This constraint of practicality could be relaxed in the OECD analytical study because its aim was to illustrate what could potentially be included.

Perhaps the most elementary observation to make from any comparison of the various lists of environmental goods produced to date is that the number of goods that could be included in an eventually agreed list is potentially large. Clearly, both the OECD and the APEC lists have helped frame the current WTO negotiations on environmental goods. But it is also clear that many, if not most, WTO members regard the lists as just that: helpful but not definitive.

Table 2.A1. The OECD's illustrative product list of environmental goods

Category and product description	HS code
A. POLLUTION MANAGEMENT	
1. Air pollution control	
1.1 Air-handling equipment	
Vacuum pumps	8414.10
Compressors of a kind used in refrigerating equipment	8414.30
Air compressors mounted on a wheeled chassis for towing	8414.40
Other air or gas compressors or hoods	8414.80
Parts for air or gas compressors, fans or hoods	8414.90
1.2 Catalytic converters	
Filtering or purifying machinery and apparatus for gases	8421.39
Parts for filtering or purifying machinery	8421.99
1.3 Chemical recovery systems	
Limestone flux	2521.00
Slaked (hydrated) lime	2522.20
Magnesium hydroxide and peroxide	2816.10
Activated earths	
Filtering or purifying machinery and apparatus for gases*	8421.39
Parts for filtering or purifying machinery*	8421.99
1.4 Dust collectors	
Filtering or purifying machinery and apparatus for gases*	8421.39
Parts for filtering or purifying machinery*	8421.99
1.5 Separators/precipitators	
Other glass fibre products	7019.90
Machinery for liquefying air or other gases	8419.60
Other machinery for treatment of materials by change of temperature	8419.89
Filtering or purifying machinery and apparatus for gases*	8421.39
Parts for filtering or purifying machinery*	8421.99
1.6 Incinerators, scrubbers	
Other furnaces, ovens, incinerators, non-electric	8417.80
Filtering or purifying machinery and apparatus for gases*	8421.39
Parts for filtering or purifying machinery*	8421.99
Industrial or laboratory electric resistance furnaces	8514.10
Industrial or laboratory induction or dielectric furnaces	8514.20
Other industrial or laboratory electric furnaces and ovens	8514.30
Parts, industrial or laboratory electric furnaces	8514.90
1.7 Odour control equipment	
Parts for sprayers for powders or liquids	8424.90
2. Wastewater management	
2.1 Aeration systems	
Compressors of a kind used in refrigerating equipment*	8414.30
Air compressors mounted on a wheeled chassis for towing*	8414.40
Other air or gas compressors or hoods*	8414.80
Parts for air or gas compressors, fans or hoods*	8414.90
2.2 Chemical recovery systems	
Limestone flux*	2521.00
Slaked (hydrated) lime*	2522.20
Chlorine	2801.10
Anhydrous ammonia	2814.10
Sodium hydroxide solid	2815.11
Sodium hydroxide in aqueous solution	2815.12
Magnesium hydroxide and peroxide*	2816.10
Activated earths*	

Category and product description	HS code
Aluminium hydroxide	2818.30
Manganese dioxide	2820.10
Manganese oxides (other)	2820.90
Lead monoxide	2824.10
Sodium sulphites	2832.10
Other sulphites	2832.20
Phosphinates and phosphonates	2835.10
Phosphates of triammonium	2835.21
Phosphates of monosodium or disodium	2838.22
Phosphates of trisodium	2835.23
Phosphates of potassium	2835.24
Calcium hydrogenorthophosphate	2835.25
Other phosphates of calcium	2835.26
Other phosphates (excl. polyphosphates)	2835.29
Activated carbon	3802.10
Water filtering or purifying machinery and apparatus	8421.21
Other machinery for purifying liquids	8421.29
Parts for filtering or purifying machinery*	8421.99
2.3 Biological recovery systems	
2.4 Gravity sedimentation systems	
Flocculating agents	
2.5 Oil/water separation systems	
Other centrifuges	842119
Parts of centrifuges	8421.91
Water filtering or purifying machinery and apparatus*	8421.21
Other machinery for purifying liquids*	8421.29
Parts for filtering or purifying machinery*	8421.99
2.6 Screens/strainers	
Other articles of plastic	3926.90
Water filtering or purifying machinery and apparatus*	8421.21
Other machinery for purifying liquids*	8421.29
Parts for filtering or purifying machinery*	8421.99
2.7 Sewage treatment	
Flocculating agents	
Woven pile & chenille fabrics of other textile materials	5801.90
Tanks, vats, etc., > 300l	7309.00
Tanks, drums, etc., >50 l < 300 l	7310.10
Cans < 50 l, closed by soldering or crimping	7310.21
Other cans < 50 l	7310.29
Hydraulic turbines	8410.00-13
Parts for hydraulic turbines	8410.90
Incinerators, non-electric*	8417.80
Weighing machines capacity <30 kg	8423.81
Weighing machines capacity >30 kg <500 kg	8423.82
Weighing machines	8423.89
Parts for sprayers for powders or liquids*	8424.90
Industrial/lab electric resistance furnaces*	8514.10
Industrial/lab induction, dielectric furnaces*	8514.20
Industrial/lab electric furnaces & ovens, n.e.s.*	8514.30
Parts, industrial & lab electric furnaces*	8514.90
2.8 Water pollution control, wastewater reuse equipment	
2.9 Water handling goods and equipment	
Articles of cast iron	7325.10
Root control equipment	
Positive displacement pumps, hand-operated	8413.20
Other reciprocating positive displacement pumps	8413.50
Other rotary positive displacement pumps	8413.60
Other centrifugal pumps	8413.70
Other pumps	8413.81
Valves, pressure reducing	8481.10

Category and product description	HS code
Valves, check	8481.30
Valves, safety	8481.40
Other taps, cocks, valves, etc.	8481.80
Instruments for measuring the flow or level of liquids	9026.10
Instruments for measuring or checking pressure	9026.20
3. Solid waste management	
3.1 Hazardous waste storage and treatment equipment	
Other articles of cement, concrete	6810.99
Other articles of lead	7806.00
Other electric space heating and soil heating apparatus	8516.29
Lasers	9013.20
Vitrification equipment*	
3.2 Waste collection equipment	
Household & toilet articles of plastic	3924.90
Brooms, hand	9603.10
Brushes as parts of machines, appliances	9603.50
Mechanical floor sweepers	9803.90
Trash bin liners (plastic)	
3.3 Waste disposal equipment	
Compactors	
Refuse disposal vehicles	
Polypropylene sheeting, etc.	3920.20
3.4 Waste handling equipment	
3.5 Waste separation equipment	
Magnetic separators	
3.6 Recycling equipment	
Magnetic separators*	
Machinery to clean, dry bottles, etc.	8422.20
Other mixing or kneading machines for earth, stone, sand, etc.	8474.39
Other machines for mixing/grinding, etc.	8479.82
Other machines, n.e.s., having individual functions	8479.89
Tire-shredding machinery	
3.7 Incineration equipment	
Other furnaces, ovens, incinerators, non-electric*	8417.80
Parts of furnaces, non-electric	8417.90
Industrial or laboratory electric resistance furnaces*	8514.10
Industrial or laboratory induction or dielectric furnaces*	8514.20
Other industrial or laboratory electric furnaces and ovens*	8514.30
Parts, industrial or laboratory electric furnaces*	8514.90
4. Remediation and cleanup	
4.1 Absorbents	
4.2 Cleanup	
Other electric space heating and soil heating apparatus*	8516.29
Lasers*	9013.20
Vitrification equipment*	
4.3 Water treatment equipment	
Surface active chemicals (not finished detergents)	
Oil spillage cleanup equipment	
Other electrical machines and apparatus with one function	8543.89
5. Noise and vibration abatement	
5.1 Mufflers/silencers	
Parts for spark-ignition internal combustion piston engines	8409.91
Parts for diesel or semi-diesel engines	8409.99

Category and product description	HS code
Silencers and exhaust pipes, motor vehicles	8708.92
5.2 Noise deadening material	
5.3 Vibration control systems	
5.4 Highway barriers	
6. Environmental monitoring, analysis and assessment	
6.1 Measuring and monitoring equipment	
Thermometers, pyrometers, liquid-filled	9025.11
Other thermometers, pyrometers	9025.19
Hydrometers, barometers, hygrometers, etc.	9025.80
Other instruments for measuring liquids or gases	9026.80
Parts of instruments for measuring, checking liquids or gases	9026.90
Instruments for analysing gas or smoke	9027.10
Chromatographs, etc.	9027.20
Spectrometers, etc.	9027.30
Exposure meters	9027.40
Other instruments using optical radiation	9027.50
Other instruments for physical or chemical analysis	9027.80
Parts for instruments, incl. microtomes	9027.90
Ionising radiation measuring & detecting instruments	9030.10
Other optical instruments	9031.49
Other measuring or checking instruments	9031.80
Manostats	9032.20
Hydraulic/pneumatic automatic regulate, control instruments	9032.81
Other automatic regulate, control instruments	9032.89
Auto emissions testers	
Noise measuring equipment	
6.2 Sampling systems	
6.3 Process and control equipment	
Thermostats	9032.10
Electrical process control equipment	
On-board monitoring/control	
6.4 Data acquisition equipment	
6.5 Other instruments/machines	
B. CLEANER TECHNOLOGIES AND PRODUCTS	
1. Cleaner/resource efficient technologies and processes	
Electrochemical apparatus/plant	
Extended cooking (pulp)	
Oxygen delignification	
Ultrasonic cleaning	
Fluidised bed combustion	
2. Cleaner/resource efficient products	
CFC substitutes	
Hydrogen peroxide	2801.10
Peat replacements (*e.g.* bark)	
Water-based adhesives	
Paints and varnishes, in aqueous medium, acrylic or vinyl	3209.10
Other paints and varnishes, in aqueous medium	3209.90
Double-hulled oil tankers	
Low-noise compressors	
C. RESOURCES MANAGEMENT GROUP	
1. Indoor air pollution control	

Category and product description	HS code
2. Water supply	
2.1 Potable water treatment	
2.2 Water purification systems	
Chlorine*	2801.10
2.3 Potable water supply and distribution	
Water, incl. natural or artificial mineral water	2201.00
Distilled and conductivity water	2851.00
Ion exchangers (polymer)	3914.00
3. Recycled materials	
3.1 Recycled paper	
3.2 Other recycled products	
4. Renewable energy plant	
4.1 Solar	
Instantaneous gas water heaters	8419.11
Other instantaneous or storage water heaters, non-electric	8419.19
Photosensitive semiconductor devices, incl. solar cells	8541.40
4.2 Wind	
Windmills	
Wind turbines	
4.3 Tidal	
4.4 Geothermal	
4.5 Other	
Methanol	2905.11
Ethanol	2207.10
Hydroelectric plant	
5. Heat/energy savings and management	
Catalysts	3815.00
Multiple walled insulating units of glass	7008.00
Other glass fibre products*	7019.90
Heat exchange units	8419.50
Parts for heat exchange equipment	8419.90
Heat pumps	
District heating plant	
Waste heat boilers	
Burners: fuel other than oil or gas	
Fluorescent lamps, hot cathode	8539.31
Electric cars	
Fuel cells	
Gas supply, production and calibrating metres	9028.10
Liquid supply, production and calibrating metres	9028.20
Thermostats*	9032.10
6. Sustainable agriculture and fisheries	
7. Sustainable forestry	
8. Natural risk management	
Satellite imaging	
Seismic instruments	
9. Eco-tourism	
10. Other	

* Indicates that the HS code appears previously in the table.

Table 2.A2. Proposed product coverage under APEC's EVSL initiative for environmental goods

	Environ. activity[1]	HS	ex[2]	HS 6-digit description	Additional product specification
1	R/C	2302.10	ex	Bran, sharps and other residues, whether or not in the form of pellets, derived from the sifting, milling or other working of corn	Booms or socks consisting of ground corn cobs contained in a textile covering
2	WWM	3926.90	ex	Other articles of plastics and articles of other materials of HS 3901 to 3914; other	Bio-film medium consisting of woven fabric sheets that facilitate the growth of bio-organisms
3	WWM	3926.90	ex	Other articles of plastics and articles of other materials of HS 3901 to 3914; other	Rotating biological contactor consisting of stacks of large (HDPE) plates which facilitate the growth of bio-organisms
4	WWM	4601.20	ex	Mats, matting and screens of vegetable materials	Erosion control matting (biodegradable)
5	WWM	4601.20	ex	Mats, matting and screens of vegetable materials	Ecologically safe ground covers (biodegradable)
6	WWM	5603.14	ex	Non-wovens, whether or not impregnated, coated, covered or laminated: of manmade filaments; weighing more than 150 g/m^2	Fabric of polyethylene/ polypropylene/ nylon for filtering wastewater.
7	WWM	5911.90	ex	Textile products and articles, for technical uses, specified in note 7 to this chapter; other	Environmental protection cloth
8	M/A	6902.10	ex	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight, singly or together, more than 50% of the elements Mg, Ca or Cr, expressed as MgO, CaO or Cr_2O_3	Industrial incineration
9	M/A	6902.20	ex	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight more than 50% of alumina (Al_2O_3), of silica (SiO_2) or of a mixture or compound of these products	Industrial incineration
10	M/A	6902.90	ex	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; other	Industrial incineration
11	M/A	6903.10	ex	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of graphite or other carbon or of a mixture of these products	Laboratory refractory equipment
12	M/A	6903.20	ex	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of alumina (Al_2O_3) or of a mixture or compound of alumina and silica (SiO_2)	Laboratory refractory equipment
13	M/A	6903.90	ex	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; other	Laboratory refractory equipment
14	M/A	6909.19	ex	Ceramic wares for laboratory, chemical or other technical uses; other	Laboratory equipment

	Environ. activity[1]	HS	ex[2]	HS 6-digit description	Additional product specification
15	M/A	7017.10		Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of fused quartz or other fused silica	
16	M/A	7017.20		Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of other glass having a linear coefficient of expansion not exceeding 5 x 10^{-6} per Kelvin within a temperature range of 0 ºC to 300º C	
17	M/A	7017.90		Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; other	
18	APC	8404.10		Auxiliary plant for use with boilers of HS 8402 or 8403 (for example, economisers, super-heaters, soot removers, gas recoverers)	
19	APC	8404.20		Condensers for steam or other vapour power units	
20	APC	8405.10	ex	Producer gas or water gas generators, with or without their purifier; acetylene gas generators and similar water process gas generator, with or without their purifiers	Include only those with purifiers
21	N/V	8409.91	ex	Parts suitable for use solely or principally with the engines of HS 8407 or 8408; suitable for use solely or principally with spark-ignition internal combustion piston engines.	Industrial mufflers
22	APC	8409.99	ex	Parts suitable for use solely or principally with the engines of HS 8407 or 8408; other	Industrial mufflers
23	REP	8410.11		Hydraulic turbines and water wheels of a power not exceeding 1 000 kW	
24	REP	8410.12		Hydraulic turbines and water wheels of a power exceeding 1 000 kW but not exceeding 10 000 kW	
25	REP	8410.13		Hydraulic turbines and water wheels of a power exceeding 10 000 kW	
26	REP	8410.90		Hydraulic turbines and water wheels; parts, including regulators	
27	WWM	8413.60	ex	Pumps for liquids, whether or not fitted with a measuring device; other rotary positive displacement pumps	Submersible mixer pump to circulate water in wastewater treatment process; sewage pumps, screw type
28	WWM	8413.70	ex	Pumps for liquids, whether or not fitted with a measuring device; other centrifugal pumps	Centrifugal pumps lined to prevent corrosion; centrifugal sewage pumps
29	PWT	8413.81	ex	Pumps for liquids, whether or not fitted with a measuring device; other pumps	Wind turbine pump
30	M/A	8414.10		Vacuum pumps	
31	APC	8414.59		Fans (and blowers) other than table, floor, window, ceiling or roof fans with a self-contained electric motor of an output not exceeding 125W	
32	M/A	8414.80		Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; other	
33	S/H	8417.80	ex	Industrial or laboratory furnaces and ovens, including incinerators, non-electric; other than bakery ovens and furnaces for treatment of ores	Waste incinerators
34	S/H	8417.90	ex	Parts of industrial or laboratory furnaces and ovens, including incinerators, non-electric	Parts of waste incinerators

	Environ. activity[1]	HS	ex[2]	HS 6-digit description	Additional product specification
35	REP	8419.19	ex	Other instantaneous or storage water heaters, non-electric	Solar water heaters
36	M/A	8419.40		Distilling or rectifying plant	
37	H/E	8419.50		Heat exchange units	
38	M/A	8419.60		Machinery for liquefying air or other gases	
39	M/A	8421.19		Centrifuges, including centrifugal dryers, other than cream separators and clothes dryers	
40	WWM	8421.21		Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water	
41	WWM	8421.29		Filtering or purifying machinery and apparatus for liquids; other	
42	APC	8421.39		Filtering or purifying machinery and apparatus for gases; other	
43	M/A	8421.91	ex	Parts of centrifuges, including centrifugal dryers	Centrifuges, accessories & parts; except clothes dryers and clothes dryer furniture
44	APC	8421.99		Parts of filtering or purifying machinery and apparatus for liquids or gases	
45	ORS	8422.20		Machinery for cleaning or drying bottles or other containers	
46	WWM	8428.33	ex	Other continuous-action elevators and conveyors, for goods or materials; other, belt type	Belt-type above-ground conveyor used to transfer solids or slurries between plants
47	WWM	8436.80	ex	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery	Hot-water weed-killing system
48	S/H	8462.91	ex	Machine tools for working metal, other than punching or notching and combined punching and shearing; hydraulic presses	Shredders/balers for metals; hydraulic
49	S/H	8472.90	ex	Other office machines	Paper shredders
50	S/H	8474.10	ex	Sorting, screening, separating or washing machines	Machines of a kind for use in screening and washing coal
51	ORS	8474.10	ex	Sorting, screening, separating or washing machines	Waste foundry sand reclamation equipment
52	ORS	8474.32	ex	Machines for mixing mineral substances with bitumen	Asphalt recycle equipment
53	WWM	8479.82	ex	Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Agitator for wastewater treatment
54	ORS	8479.82	ex	Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Other than kneading machinery
55	S/H	8479.89	ex	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Radioactive waste press
56	WWM	8479.89	ex	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Trash compactors
57	PWT	8479.90	ex	Parts of machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Parts of trash compactors
58	REP	8502.31		Generating sets, electric, wind-powered	
59	S/H	8505.90	ex	Electromagnets; other, including parts	Electromagnet
60	S/H	8514.10	ex	Industrial or laboratory furnaces and ovens; electric, resistance-heated	Waste incinerators or other waste treatment apparatus

	Environ. activity[1]	HS	ex[2]	HS 6-digit description	Additional product specification
61	S/H	8514.20	ex	Industrial or laboratory furnaces and ovens; electric, induction or dielectric	Waste incinerators or other waste treatment apparatus
62	S/H	8514.30	ex	Industrial or laboratory furnaces and ovens, electric, other	Waste incinerators or other waste treatment apparatus
63	S/H	8514.90	ex	Parts of industrial or laboratory electric furnaces and ovens or other laboratory induction or dielectric heating equipment	Parts of waste incinerators
64	REP	8541.40	ex	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes	Solar cells
65	WWM	8543.89	ex	Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter; other	Ozone production system
66	R/C	8907.10	ex	Inflatable rafts	Inflatable oil spill recovery barges
67	R/C	8907.90	ex	Other floating structures	Pollution protection booms
68	M/A	9015.40		Photogrammetric surveying instruments and appliances	
69	M/A	9015.80		Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses	
70	M/A	9015.90	ex	Parts and accessories of surveying, hydrological, meteorological or geophysical instruments and appliances, excluding compasses	Photogrammetric instruments; parts and accessories for articles of HS 9015.40
71	M/A	9022.29		Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	
72	M/A	9022.90	ex	Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	Parts and accessories for goods of HS 9022.29
73	M/A	9025.11		Thermometers and pyrometers, not combined with other instruments: liquid-filled, for direct reading	
74	M/A	9025.19		Thermometers and pyrometers, not combined with other instruments: other than liquid-filled, for direct reading	
75	M/A	9025.80		Hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments	
76	M/A	9025.90		Parts and accessories for hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments	
77	M/A	9026.10		Instruments and apparatus for measuring or checking the flow or level of liquid	
78	M/A	9026.20		Instruments and apparatus for measuring or checking pressure	
79	M/A	9026.80		Other instruments and apparatus	
80	M/A	9026.90		Parts and accessories for articles of HS 9026	
81	M/A	9027.10		Gas or smoke analysis apparatus	
82	M/A	9027.20		Chromatographs and electrophoresis instruments	

	Environ. activity[1]	HS	ex[2]	HS 6-digit description	Additional product specification
83	M/A	9027.30		Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)	
84	M/A	9027.40		Exposure meters	
85	M/A	9027.50		Other instruments and apparatus using optical radiations (ultraviolet, visible, infrared)	
86	M/A	9027.80		Other instruments and apparatus for physical or chemical analysis	
87	M/A	9027.90		Microtomes; parts and accessories	
88	M/A	9028.10		Gas meters	
89	M/A	9028.20		Liquid meters	
90	M/A	9028.30		Electricity meters	
91	M/A	9028.90		Parts and accessories for articles of HS 9028	
92	M/A	9030.10		Instruments and apparatus for measuring or detecting ionising radiations	
93	M/A	9030.20		Cathode-ray oscilloscopes and cathode-ray oscillographs	
94	M/A	9030.31		Multimeters	
95	M/A	9030.39		Other instruments and apparatus, for measuring or checking voltage, current, resistance or power, without a recording device	
96	M/A	9030.83		Other instruments and apparatus for measuring or checking electrical quantities, with a recording device	
97	M/A	9030.89		Other instruments and apparatus for measuring or checking electrical quantities	
98	M/A	9030.90	ex	Parts and accessories (for nominated articles of HS 9030)	
99	M/A	9031.10		Machines for balancing mechanical parts	
100	M/A	9031.20		Test benches	
101	M/A	9031.30		Profile projectors	
102	M/A	9031.80		Other measuring or checking instruments, appliances and machines, not elsewhere specified in this chapter	
103	M/A	9031.90	ex	Parts and accessories (for nominated articles of HS 9031)	
104	M/A	9032.10		Thermostats	
105	M/A	9032.20		Manostats	
106	M/A	9032.81		Hydraulic and pneumatic instruments and apparatus	
107	M/A	9032.89		Automatic regulating or controlling instruments, other	
108	M/A	9032.90		Parts and accessories	
109	M/A	9033.00		Parts and accessories (not specified or included elsewhere in this chapter) for machines, appliances, instruments or apparatus of Ch. 90	

1. APC = air pollution control; H/E = heat/energy management; M/A= monitoring/analysis, N/V = noise/vibration abatement; ORS = other recycling systems; PWT = potable water treatment; R/C = remediation/cleanup; S/H = solid/hazardous waste; WWM = wastewater management.

2. An "ex" in the column indicates that only the "ex-heading" product (described in the last column) is nominated.

Source: World Trade Organization, "List of Environmental Goods — Paragraph 31 (iii) — Note by the Secretariat", Document No. TN/TE/W/18, 20 November 2002, Geneva.

Table 2.A3. APEC's EVSL proposal for chemicals: product list[1]

HS	Item description (exclusions)
28	Inorganic chemicals; organic or inorganic compounds of precious metals, of rare earth metals, of radioactive elements or of isotopes
29	Organic chemicals (but excluding HS 2905.43, mannitol, and 2905.44, D-glucitol [sorbitol])
30	Pharmaceutical products
31	Fertilisers
32	Tanning or dyeing extracts; tannins and their derivatives; dyes, pigments and other colouring matter; paints and varnishes; putty and other mastics; inks
33	Essential oils and resinoids; perfumery, cosmetic or toilet preparations (but excluding HS 3301: essential oils, including concretes and absolutes; resinoids; oleoresins; extracts obtained by enfleurage of maceration; other terpenic and aqueous solutions)
34	Soap, organic surface active agents, washing preparations, lubricating preparations, waxes
3506	Prepared glues and other adhesives, put up for retail sale, not exceeding a net weight of 1 kg
3507	Enzymes; prepared enzymes not elsewhere specified or included
36	Explosives; pyrotechnic products; matches; pyrophoric alloys; certain combustible preparations
37	Photographic or cinematographic goods
38	Miscellaneous chemical products (but excluding HS 3809.10, finishing agents with a basis of amylaceous substances; and HS 3823.23, sorbitol other than that of HS 2095.44)
39	Plastics and articles thereof

1. Tables 2.A3 and 2.A4 list the tariff nominations contained in the EVSL proposal for chemicals (supported by the United States, Singapore, Australia, and Hong Kong, China). These were specified for the meeting of the APEC leaders in November 1997 (reproduced in Dee *et al.*, 1998). The tariff nominations were put forward as HS codes common to the customs tariff schedules of each country. Two-digit nominations mean that the entire chapter was proposed; four-digit nominations relate to specific sub-chapters.

Table 2.A4. APEC's EVSL for chemicals: flexibility proposals by the sectoral co-ordinator

Target	
End tariff rates	CTHA harmonised rates (*i.e.* 0% to 6.5%)
End dates for implementation	By 2001 for rates below or equal to 10%; by 2004 for other rates
Minimum conformity	80% of tariff lines to reach CHTA rates (0% to 6.5%) by 2004
Flexibility	For the remaining 20% of tariff lines: • 15% to CHTA rates by 2006 • 5% (not exceeding 10% of imports) to CHTA rates by 2008 • Applied tariff rates of 20% or more to be reduced to 10% by 2004

Table 2.A5. Comparison of products covered under APEC's EVSL initiative for environmental goods and the OECD's illustrative list of environmental goods

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
A. POLLUTION MANAGEMENT					
1. **Air pollution control**					
	X	8404.10		Auxiliary plant for use with boilers of HS 8402 or 8403 (for example, economisers, super-heaters, soot removers, gas recoverers)	
	X (ex)	8405.10		Producer gas or water gas generators, with or without their purifier; acetylene gas generators and similar water process gas generators, with or without their purifiers	Includes only those with purifiers
1.1 Air-handling equipment					
X	X	8414.10		Vacuum pumps	
X		8414.30		Compressors of a kind used in refrigerating equipment	
X		8414.40		Air compressors mounted on a wheeled chassis for towing	
	X	8414.59		Fans (and blowers) other than table, floor, window, ceiling or roof fans with a self-contained electric motor of an output not exceeding 125 W	
X	X	8414.80		Other air or gas compressors or hoods	
X		8414.90		Parts for air or gas compressors, fans or hoods	
1.2 Catalytic converters					
X	X	8421.39		Filtering or purifying machinery and apparatus for gases	
X	X	8421.99		Parts for filtering or purifying machinery	
1.3 Chemical recovery systems					
X		2521.00		Limestone flux	
X		2522.20		Slaked (hydrated) lime	
X		2816.10		Magnesium hydroxide and peroxide	
X				Activated earths	
X	X	8421.39	*	Filtering or purifying machinery and apparatus for gases	
X	X	8421.99	*	Parts for filtering or purifying machinery	
1.4 Dust collectors					
X	X	8421.39	*†	Filtering or purifying machinery and apparatus for gases	
X	X	8421.99	*†	Parts for filtering or purifying machinery	
1.5 Separators/precipitators					
X		7019.90		Other glass fibre products	
X	X	8419.60		Machinery for liquefying air or other gases	
X		8419.89		Other machinery for treatment of materials by change of temperature	
X	X	8421.99	*†	Parts for filtering or purifying machinery	
1.6 Incinerators, scrubbers					
X	X (ex)	8417.80		Other furnaces, ovens, incinerators, non-electric waste incinerators	
X	X	8421.39	*†	Filtering or purifying machinery and apparatus for gases; other	
X	X	8421.99	*†	Parts of filtering or purifying machinery and apparatus for liquids or gases	
X	X (ex)	8514.10		Industrial or laboratory electric resistance furnaces	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.20		Industrial or laboratory induction or dielectric furnaces	Waste incinerators or other waste treatment apparatus

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
X	X (ex)	8514.30		Other industrial or laboratory electric furnaces and ovens	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.90		Parts, industrial or laboratory electric furnaces	Parts of waste incinerators
1.7 Odour control equipment					
X		8424.90		Parts for sprayers for powders or liquids	
2. Wastewater management					
2.1 Aeration systems					
X		8414.30	*	Compressors of a kind used in refrigerating equipment	
X		8414.40	*	Air compressors mounted on a wheeled chassis for towing	
X	X	8414.80	*†	Other air or gas compressors or hoods	
X		8414.90	*	Parts for air or gas compressors, fans or hoods	
	X (ex)[3]	8543.89	†	Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter; other	Ozone production system
2.2 Chemical recovery systems					
X		2521.00	*	Limestone flux	
X		2522.20	*	Slaked (hydrated) lime	
X		2801.10		Chlorine	
X		2814.10		Anhydrous ammonia	
X		2815.11		Sodium hydroxide solid	
X		2815.12		Sodium hydroxide in aqueous solution	
X		2816.10	*	Magnesium hydroxide and peroxide	
X			*	Activated earths	
X		2818.30		Aluminium hydroxide	
X		2820.10		Manganese dioxide	
X		2820.90		Manganese oxides (other)	
X		2824.10		Lead monoxide	
X		2832.10		Sodium sulphites	
X		2832.20		Other sulphites	
X		2835.10		Phosphinates and phosphonates	
X		2835.21		Phosphates of triammonium	
X		2835.22		Phosphates of monosodium or disodium	
X		2835.23		Phosphates of trisodium	
X		2835.24		Phosphates of potassium	
X		2835.25		Calcium hydrogenorthophosphate	
X		2835.26		Other phosphates of calcium	
X		2835.29		Other phosphates (excl. polyphosphates)	
X		3802.10		Activated carbon	
X	X	8421.21		Water filtering or purifying machinery and apparatus	
X	X	8421.29		Other machinery for purifying liquids	
X	X	8421.99		Parts for filtering or purifying machinery	
2.3 Biological recovery systems					
2.4 Gravity sedimentation systems					
	X			Flocculating agents	
2.5 *Oil/water separation systems*					
X	X	8421.19		Other centrifuges	
X	X	8421.21	*†	Water filtering or purifying machinery and apparatus	

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
X	X	8421.29	*†	Other machinery for purifying liquids	
X	X	8421.91		Parts of centrifuges	
X	X	8421.99	*	Parts for filtering or purifying machinery	
2.6 *Screens/strainers*					
X	X (ex)	3926.90		Other articles of plastics and articles of other materials of HS 3901 to 3914; other	1. Bio-film medium consisting of woven fabric sheets that facilitate the growth of bio-organisms
				Other articles of plastics and articles of other materials of HS 3901 to 3914; other	2. Rotating biological contactor consisting of stacks of large (HDPE) plates that facilitate the growth of bio-organisms
	X (ex)	5603.14		Non-wovens, whether or not impregnated, coated, covered or laminated: of man-made filaments; weighing more than 150g/m^2	Fabric of polyethylene, polypropylene, or nylon for filtering wastewater
X	X	8421.21	*†	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water	
X	X	8421.29	*†	Filtering or purifying machinery and apparatus for liquids; other	
X	X	8421.99	*†	Parts for filtering or purifying machinery	
2.7 *Sewage treatment*					
X				Flocculating agents	
X		5801.90		Woven pile & chenille fabrics of other textile materials	
	X (ex)	5911.90		Textile products and articles, for technical uses, specified in note 7 to this chapter; other	
X		7309.00		Tanks, vats, etc., > 300 litres	
X		7310.10		Tanks, drums, etc., >50 litres <300 litres	
X		7310.21		Cans < 50 litres, closed by soldering or crimping	
X		7310.29		Other cans < 50 litres	
X		8410.00		Hydraulic turbines 00	
X	X	8410.11		Hydraulic turbines 11	
X	X	8410.12		Hydraulic turbines 12	
X	X	8410.13		Hydraulic turbines 13	
X	X	8410.90		Parts for hydraulic turbines	
X	X	8417.80	*	Incinerators, non-electric	
X		8423.81		Weighing machines capacity <30 kg	
X		8423.82		Weighing machines capacity >30 kg <500 kg	
X		8423.89		Weighing machines	
X		8424.90	*	Parts for sprayers for powders or liquids	
	X (ex)	8428.33		Other continuous-action elevators and conveyors, for goods or materials; other, belt type	Belt-type above-ground conveyor used to transfer solids or slurries between plants
	X (ex)	8479.82		Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Agitator for wastewater treatment
X	X (ex)	8514.10	*†	Industrial/lab electric resistance furnaces	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.20	*†	Industrial/lab induction, dielectric furnaces	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.30	*†	Industrial/lab electric furnaces & ovens, n.e.s.	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.90	*†	Parts, industrial/lab electric furnaces	Parts of waste incinerators
2.8 Water pollution control, wastewater reuse equipment					

List coverage		HS[1]	Product description	Additional product specification
OECD	APEC			
2.9 Water handling goods and equipment				
X		7325.10	Articles of cast iron	
X		8413.20	Root-control equipment	
X		8413.50	Positive displacement pumps, hand-operated [centrifugal pumps]	
X	X (ex)	8413.60	Pumps for liquids, whether or not fitted with a measuring device; other rotary positive displacement pumps	Submersible mixer pump to circulate water in wastewater treatment process; sewage pumps, screw type
X	X (ex)	8413.70	Pumps for liquids, whether or not fitted with a measuring device; other centrifugal pumps	Centrifugal pumps lined to prevent corrosion; centrifugal sewage pumps
X		8413.81	Other pumps	
X		8481.10	Valves, pressure-reducing	
X		8481.30	Valves, check	
X		8481.40	Valves, safety	
X		8481.80	Other taps, cocks, valves, etc.	
X	X	9026.10	Instruments for measuring the flow or level of liquids	
X	X	9026.20	Instruments for measuring or checking pressure	
3. Solid waste management				
3.1 Hazardous waste storage and treatment equipment				
X		6810.99	Other articles of cement, concrete	
X		7806.00	Other articles of lead	
X		8516.29	Other electric space heating and soil heating apparatus	
X		9013.20	Lasers	
X			Vitrification equipment	
3.2 Waste collection equipment				
X		3924.90	Household & toilet articles of plastic	
X		9603.10	Brooms, hand	
X		9603.50	Brushes as parts of machines, appliances	
X		9603.90	Mechanical floor sweepers	
X			Trash bin liners (plastic)	
3.3 Waste disposal equipment				
X		3920.20	Polypropylene sheeting, etc.	
	X (ex)	8462.91	Machine tools for working metal, other than punching or notching and combined punching and shearing; hydraulic presses	Shredders/balers for metals; hydraulic
	X (ex)	8472.90	Other office machines	Paper shredders
X			Compactors	
	X (ex)[3]	8479.89	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Trash compactors
	X (ex)[4]	8479.90	Parts of machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Parts of trash compactors
X			Refuse disposal vehicles	
3.4 Waste handling equipment				
3.5 Waste separation equipment				
	X (ex)	8474.10	Sorting, screening, separating or washing machines	Machines of a kind for use in screening and washing coal
	X (ex)	8505.90	Electromagnets; other, including parts	Electromagnet

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
X				Magnetic separators	
3.6 Recycling equipment					
X	X	8422.20		Machinery for cleaning or drying bottles or other containers	
	X (ex)	8474.10	†	Sorting, screening, separating or washing machines	Waste foundry sand reclamation equipment
	X (ex)	8474.32		Machines for mixing mineral substances with bitumen	Asphalt recycle equipment
X		8474.39		Other mixing or kneading machines for earth, stone, sand, etc.	
X	X (ex)	8479.82		Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Other than kneading machinery
X	X (ex)	8479.89	†	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Radioactive waste press
X			*	Magnetic separators	
X				Tire-shredding machinery	
3.7 Incineration equipment					
	X (ex)[5]	6902.10		Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight, singly or together, more than 50% of the elements Mg, Ca or Cr, expressed as MgO, CaO or Cr_2O_3	Industrial incineration
	X (ex)[5]	6902.20		Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight more than 50% of alumina (Al_2O_3), of silica (SiO_2) or of a mixture or compound	Industrial incineration
	X (ex)[5]	6902.90		Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; other	Industrial incineration
X	X (ex)	8417.80	*†	Industrial or laboratory furnaces and ovens, including incinerators, non-electric; other than bakery ovens and furnaces for treatment of ores	Waste incinerators
X	X (ex)	8417.90		Parts of Industrial or laboratory furnaces and ovens, including incinerators, non-electric	Parts of waste incinerators
X	X (ex)	8514.10	*†	Industrial or laboratory furnaces and ovens; electric, resistance heated	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.20	*†	Industrial or laboratory furnaces and ovens; electric, induction or dielectric	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.30	*†	Industrial or laboratory furnaces and ovens, electric, other	Waste incinerators or other waste treatment apparatus
X	X (ex)	8514.90	*†	Parts of industrial or laboratory electric furnaces and ovens or other laboratory induction or dielectric heating equipment	Parts of waste incinerators
4. Remediation and cleanup					
4.1 Absorbents					
	X (ex)	2302.10		Bran, sharps and other residues, whether or not in the form of pellets, derived from the sifting, milling or other working of corn	Booms or socks consisting of ground corn cobs contained in a textile covering
4.2 Cleanup					
X		8516.29		Other electric space-heating and soil-heating apparatus	
X		9013.20	*	Lasers	
X				Vitrification equipment	
4.3 Water treatment equipment					
X				Surface active chemicals (not finished detergents)	
X	X (ex)	8543.89	†	Other electrical machines and apparatus with one function	Ozone production system

List coverage		HS[1]	Product description	Additional product specification
OECD	APEC			
	X (ex)	8907.10	Inflatable rafts	Inflatable oil spill recovery barges
	X (ex)	8907.90	Other floating structures	Pollution protection booms
X			Oil spillage cleanup equipment	
5. Noise and vibration abatement				
5.1 Mufflers/silencers				
X	X (ex)	8409.91	Parts suitable for use solely or principally with the engines of HS 8407 or 8408; suitable for use solely or principally with spark-ignition internal combustion piston engines	Industrial mufflers
X		8409.99	Parts for diesel or semi-diesel engines	
X		8708.92	Silencers and exhaust pipes, motor vehicles	
5.2 Noise-deadening material				
5.3 Vibration control systems				
5.4 Highway barriers				
6. Environmental monitoring, analysis and assessment				
6.1 Measuring and monitoring equipment				
	X (ex)	6903.10	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of graphite or other carbon or of a mixture of these products	Laboratory refractory equipment
	X (ex)	6903.20	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of alumina (Al_2O_3) or of a mixture or compound of alumina and of silica (SiO_2)	Laboratory refractory equipment
	X (ex)	6903.90	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; other	Laboratory refractory equipment
	X (ex)	6909.19	Ceramic wares for laboratory, chemical or other technical uses; other	Laboratory equipment
	X	7017.10	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of fused quartz or other fused silica	
	X	7017.20	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of other glass having a linear coefficient of expansion not exceeding 5×10^{-6} per Kelvin within a temperature range of 0 ºC to 300 ºC	
	X	7017.90	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; other	
	X	8414.10	Vacuum pumps	
	X	8414.80	Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; other	
	X	8419.40	Distilling or rectifying plant	
	X	8419.60	Machinery for liquefying air or other gases	
	X	8421.19	Centrifuges, including centrifugal dryers, other than cream separators and clothes dryers	
	X (ex)	8421.91	Parts of centrifuges, including centrifugal dryers	Centrifuges, accessories & parts; except clothes dryers and clothes-dryer furniture
	X	9015.40	Photogrammetric surveying instruments and appliances	

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
	X	9015.80		Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses	
	X (ex)	9015.90		Parts and accessories of surveying, hydrological, meteorological or geophysical instruments and appliances, excluding compasses	Photogrammetric instruments; parts and accessories for articles of HS 9015.40
	X	9022.29		Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	
	X (ex)	9022.90		Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	Parts and accessories for goods of HS 9022.29
X	X	9025.11		Thermometers and pyrometers, not combined with other instruments: liquid-filled, for direct reading	
X	X	9025.19		Thermometers and pyrometers, not combined with other instruments: other than liquid-filled, for direct reading	
X	X	9025.80		Hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers and psychrometers, recording or not, and any combination of these instruments	
	X	9025.90		Parts and accessories for hydrometers and similar floating instruments, thermometers, pyrometers, barometers, hygrometers, and psychrometers, recording or not, and any combination of these instruments	
	X	9026.10	†	Instruments and apparatus for measuring or checking the flow or level of liquid	
	X	9026.20	†	Instruments and apparatus for measuring or checking pressure	
X	X	9026.80		Other instruments and apparatus	
X	X	9026.90		Parts and accessories for articles of HS 9026	
X	X	9027.10		Gas or smoke analysis apparatus	
X	X	9027.20		Chromatographs and electrophoresis instruments	
X	X	9027.30		Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)	
X	X	9027.40		Exposure meters [including sound-level meters]	
X	X	9027.50		Other instruments and apparatus using optical radiations (ultraviolet, visible, infrared)	
X	X	9027.80		Other instruments and apparatus for physical or chemical analysis	
X	X	9027.90		Microtomes; parts and accessories	
	X	9028.10		Gas meters	
	X	9028.20		Liquid meters	
	X	9028.30		Electricity meters	
	X	9028.90		Parts and accessories for articles of HS 9028	
X	X	9030.10		Instruments and apparatus for measuring or detecting ionising radiations	
	X	9030.20		Cathode ray oscilloscopes and cathode-ray oscillographs	
	X	9030.31		Multimeters	
	X	9030.39		Other instruments and apparatus, for measuring or checking voltage, current, resistance or power, without a recording device	
	X	9030.83		Other instruments and apparatus for measuring or checking electrical quantities, with a recording device	
	X	9030.89		Other instruments and apparatus for measuring or checking electrical quantities	
	X (ex)	9030.90		Parts and accessories (for nominated articles of HS 9030)	

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
	X	9031.10		Machines for balancing mechanical parts	
	X	9031.20		Test benches	
	X	9031.30		Profile projectors	
X		9031.49		Other optical instruments	
X	X	9031.80		Other measuring or checking instruments, appliances and machines, not elsewhere specified in this chapter	
	X (ex)	9031.90		Parts and accessories (for nominated articles of HS 9031)	
X	X	9032.20		Manostats	
X	X	9032.81		Hydraulic and pneumatic instruments and apparatus	
X	X	9032.89		Automatic regulating or controlling instruments, other	
	X	9032.90		Parts and accessories	
	X	9033.00		Parts and accessories (not specified or included elsewhere in this chapter) for machines, appliances, instruments or apparatus of Ch. 90	
X				Auto emissions testers	
6.2 Sampling systems					
6.3 Process and control equipment					
X	X	9032.10		Thermostats	
X				Electrical process control equipment	
X				On-board monitoring/control	
6.4 Data acquisition equipment					
6.5 Other instruments/machines					
B. CLEANER TECHNOLOGIES AND PRODUCTS					
1. Cleaner/resource-efficient technologies and processes					
X				Electrochemical apparatus/plant	
X				Extended cooking (pulp)	
X				Oxygen delignification	
X				Ultrasonic cleaning	
X				Fluidised bed combustion	
2. Cleaner/resource-efficient products					
X				CFC substitutes	
X		2847.00[6]		Hydrogen peroxide	
X				Peat replacements (*e.g.* bark)	
X				Water-based adhesives	
X		3209.10		Paints and varnishes, in aqueous medium, acrylic or vinyl	
X		3209.90		Other paints and varnishes, in aqueous medium	
X				Double-hulled oil tankers	
X				Low-noise compressors	
C. RESOURCES MANAGEMENT GROUP					
1. Indoor air pollution control					
2. Water supply					
2.1 Potable water treatment					
2.2 Water purification systems					
X		2801.10	*	Chlorine	
	X (ex)[3]	8543.89	†	Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter; other	Ozone production system

List coverage		HS[1]		Product description	Additional product specification
OECD	**APEC**				
2.3 Potable water supply and distribution					
X		2201.00		Water, incl. natural or artificial mineral water	
X		2851.00		Distilled and conductivity water	
X		3914.00		Ion exchangers (polymer)	
3. Recycled materials					
3.1 Recycled paper					
3.2 Other recycled products					
4. Renewable energy plant					
4.1 Solar energy					
X		8419.11		Instantaneous gas water heaters	
X	X (ex)	8419.19		Other instantaneous or storage water heaters, non-electric	Solar water heaters
X	X (ex)	8541.40		Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light-emitting diodes	Solar cells
4.2 Wind energy					
X				Windmills	
X				Wind turbines	
	X (ex)	8413.81		Pumps for liquids, whether or not fitted with a measuring device; other pumps	Wind turbine pump
	X	8502.31		Generating sets, electric, wind-powered	
4.3 Tidal energy					
4.4 Geothermal energy					
4.5 Other					
X		2207.10		Ethanol	
X		2905.11		Methanol	
X				Hydroelectric plant	
	X	8410.11	†	Hydraulic turbines and water wheels of a power not exceeding 1 000 kW	
	X	8410.12	†	Hydraulic turbines and water wheels of a power exceeding 1 000 kW but not exceeding 10 000 kW	
	X	8410.13	†	Hydraulic turbines and water wheels of a power exceeding 10 000 kW	
	X	8410.90	†	Hydraulic turbines and water wheels; parts, including regulators	
5. Heat/energy savings and management					
X		3815.00		Catalysts	
X		7008.00		Multiple-walled insulating units of glass	
X		7019.90	*	Other glass fibre products	
	X	8404.20		Condensers for steam or other vapour power units	
	X (ex)	8409.99		Parts suitable for use solely or principally with the engines of HS 8407 or 8408; other	Industrial mufflers
X	X	8419.50		Heat exchange units	
X		8419.90		Parts for heat exchange equipment	
X				Heat pumps	
X				District heating plant	
X				Waste heat boilers	
X				Burners: fuel other than oil or gas	
X		8539.31		Fluorescent lamps, hot cathode	
X				Electric cars	

List coverage		HS[1]		Product description	Additional product specification
OECD	APEC				
X				Fuel cells	
X	X	9028.10	†	Gas supply, production and calibrating metres	
X	X	9028.20	†	Liquid supply, production and calibrating metres	
X		9032.10	*	Thermostats	
6. Sustainable agriculture and fisheries					
	X (ex)[3]	4601.20		Mats, matting and screens of vegetable materials	1. Erosion control matting (biodegradable)
					2. Ecologically safe ground covers (biodegradable)
	X (ex)[3]	8436.80		Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery	Hot-water weed-killing system
7. Sustainable forestry					
8. Natural risk management					
8.1 Satellite imaging					
8.2 Seismic instruments					
9. Eco-tourism					
10. Other					

1. An asterisk (*) indicates that the HS code appears previously in the OECD list; a cross (†) indicates that the HS code appears previously in the APEC list.

2. An "ex" in the column indicates that only the "ex-heading" product (described in the last column) is nominated.

3. Classified under "Wastewater management" in the APEC list.

4. Classified under "Potable water treatment" in the APEC list.

5. Classified under "Monitoring/analysis" in the APEC list.

6. Originally listed as HS 2801.10 in the OECD list.

Source: Tables 2.A1 and 2.A2.

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Chapter 3

Liberalising Trade in "Environmental Goods": Some Practical Considerations

by

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This chapter explores some practical issues that have arisen in the WTO negotiations on environmental goods and services, especially issues pertaining to liberalising trade in environmental goods. Since environmental goods are not covered by a single chapter of the Harmonized Commodity Description and Coding System (HS) — the international basis for codifying trade and tariffs — an agreement on environmental goods must be defined by reference to an agreed list. In such a case, when the most detailed (6-digit) product level is insufficiently specific, it becomes necessary to agree to create common commodity descriptions at the 8- or 10-digit level in national tariff schedules. Another important concern is the so-called "dual use" problem: many goods with environmental uses also can be used for non-environmental purposes. Possible solutions to these problems are explored, drawing on past experience in negotiating and implementing sectoral liberalisation agreements. The chapter also discusses issues relating to separate tariff lines for whole plants and to goods distinguished by their superior environmental performance in use. Finally, it considers some procedural and institutional issues that will have to be addressed before an agreement is concluded, notably whether to allow for the periodic addition of new goods to the agreement, and how to deal with the problem of changes over time in the relative environmental performance of competing goods.

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Introduction

Under paragraph 31(iii) of the Doha Ministerial Declaration, ministers mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services". "Environmental goods" are not an internationally defined category, and will have to be defined by the negotiators, most likely in the form of a positive list of products to be covered under an eventual agreement. The negotiations on environmental goods are taking place in two groups: the Committee on Trade and Environment meeting in Special Session (CTE-SS) and the Non-agricultural Market Access Negotiating Group (NAMA).

The first product lists circulated to the negotiating groups were drawn up not by individual countries but by intergovernmental organisations and predated the Doha Declaration. Several countries have supported the product list produced by APEC as part of that organisation's earlier early voluntary sectoral liberalisation (EVSL) initiative. Others have made reference to the illustrative product list produced by the OECD. As of October 2005, seven OECD countries or regional groupings (Canada, the European Union, Japan, Korea, New Zealand, Switzerland and the United States) and two other WTO members (Qatar and Chinese Taipei) had circulated product lists. Other lists and candidate products are likely to be circulated by WTO members before the negotiations are concluded.

What will emerge from this process is anybody's guess. It is possible that negotiators might agree to liberalise a much broader range of goods, and, depending on the depth of the tariff cuts, this could reduce the need for a separate agreement on environmental goods.[1] However, there is no intrinsic contradiction between horizontal and sectoral trade liberalisation: the history of GATT and WTO negotiations provides plenty of examples of the combining of horizontal cuts in tariffs with sector-specific initiatives. Because there is a chance that the negotiations might lead to some form of sectoral agreement on environmental goods, it is worth thinking ahead to some of the practical issues that might arise as the negotiations move forward.

This chapter explores some of those practical issues that will need to be considered by negotiators in order to accommodate the unique features of the sector. It first considers the possible scope of an agreement on environmental goods, and describes criteria and procedures that might be used to deal with particular classes of goods. If proposals currently before the WTO provide an indication of the agreed product list that may eventually emerge from negotiations, it may include some goods that are not separately identified in current Harmonized System (HS) commodity classification sub-heading descriptors, and perhaps some goods that would require the institution of complementary procedures. Translating the "goods" side of an agreement on environmental goods into "the language of trade" might, accordingly, require additional negotiations on harmonising the encoding of products in countries' tariff nomenclatures. The institutional consequences of including particular types of goods within a tariff liberalisation

1. In this regard, the following observation by the Director of the WTO's Market Access Division is salient: "[I]t should be noted that while some participants have supported the need to define environmental goods, others have expressed the view that a definitional exercise is not required at this stage. According to them, for the moment priority should be given to reaching agreement on the modalities for the reduction of tariffs on all goods. Following completion of this exercise, the Group could evaluate whether additional reductions were necessary on environmental goods" (WT/CTE/GEN/9 and TN/MA/7 of 21 February 2003).

agreement are then explored, drawing on lessons from past sectoral liberalisation initiatives, particularly the 1996 Ministerial Declaration on Trade in Information Technology Products (also known as the Information Technology Agreement, or ITA)2 and the Uruguay Round "zero-for-zero" initiative on Trade in Pharmaceutical Products.

This chapter aims simply to explore possibilities and consequences. No conclusions should be drawn from the examples given as to the likelihood or not of particular negotiated outcomes. Moreover, simply because a category of good is examined, no inferences should be made as to the implied desirability or not of including it in an agreement on environmental goods.

Challenges confronting the negotiations on environmental goods

Negotiators lack an internationally agreed definition of an environmental good

Countries seeking to negotiate a sector-specific agreement on liberalising a class of goods usually start with at least a rough idea of the products to be covered. When delegates to the Uruguay Round of multilateral trade negotiations were drawing up the Agreement on Agriculture, for example, there was a working assumption that it would pertain mainly to basic agricultural products. Some differences of opinion may have arisen over where to draw the boundary between a primary and a processed agricultural good, but these were minor issues, marginal to the negotiations. Moreover, the definition of agriculture was already well established in national and international statistics on production and trade.

WTO delegates working towards an agreement on environmental goods do not have the benefit of such a solid foundation — hence the decision to address definitional issues in parallel with discussions on modalities. Working definitions of environmental goods already exist, to be sure. Both APEC and the OECD, in drafting their product lists, referred to the definition agreed to by a combined OECD and Eurostat working group in the late 1990s: environmental goods include those that "measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems … [including] cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use" (OECD/Eurostat, 1999, p. 10). This definition is quite broad, however, and can in theory encompass goods of almost any sort, from biodegradable fabrics to machines to chemicals. More to the point, it has been criticised as too limiting by some WTO members, notably developing countries that see themselves only as net importers of the kinds of manufactured goods proposed so far.

One result of the fluid state of discussions on definitions is that negotiators may eventually have to consider how to address proposals from countries that include types of goods that could be called "problematic". During the APEC exercise, drafters of the EVSL product list had to grapple with environmental goods with multiple uses, some of which are not "environmental", and goods that are defined by their superior environmental performance over otherwise comparable goods, such as energy-efficient refrigerators. At the WTO, some countries have already come forward with proposed lists of goods that include not only the aforementioned types of goods but also goods that are sold as entire plants. No countries have yet proposed goods defined by the processes or

2. The ITA concerns the progressive elimination of import duties for certain categories of goods mainly used in the information technology sector or for the production of these goods.

production methods (PPMs) involved in their manufacturing, extraction or harvesting, but some independent observers (*e.g.* Howse and van Borke, 2005) have asked whether they could be considered for inclusion.

These categories of goods are problematic for different reasons. Some may be unacceptable to certain countries because their inclusion would create additional procedures or an incentive to try to bribe customs officials to have their goods classified more favourably. Others would necessitate reaching international consensus on criteria for creating new distinctions between products. Still others would have implications for keeping the product coverage of the agreement up to date.

Harmonized System (HS) descriptors are not always sufficiently specific at the 6-digit level

Should the WTO negotiators produce a scope and definition for "environmental goods",[3] it will not fundamentally alter the process by which the coverage of any agreement on environmental goods will be determined. In particular, at least on the evidence of the product lists submitted to date, countries will endeavour to express their nominations for products with reference to the Harmonized Commodity Description and Coding System tariff nomenclature (Box 3.1).

The Harmonized System comprises around 5 000 commodity groups, but does not provide a unique code for every product that might enter international trade. For example, its description of chemicals is more specific than that of electrical or mechanical devices. For this reason, several countries' proposed product lists contain many references to "ex" heading products — *i.e.* products proposed for liberalisation that are more specific than the 6-digit HS descriptions. For instance, the United States' product list contains "machines of a kind for use in screening and washing coal" which are included under the broad, 6-digit HS sub-heading 8474.10, "sorting, screening, separating or washing machines". Similarly, Japan has proposed "ultrasonic dish-washing machines" as an "ex-heading" product under HS 8422.11, "Dish washing machines … of the household type".

Unless negotiators intentionally confine product coverage to goods already separately identified under the HS, they will have to agree at the very least on some process for ensuring that the product description and encoding of "ex-heading" goods are consistent and carried out expeditiously across countries. Especially for new products, the problem is that it is not always clear to customs authorities which HS heading to use: depending on their technical characteristics, similar goods can sometimes be classified under two or more headings.[4]

Modalities of the negotiations have to be worked out

These additional complications have important implications for the modalities of the negotiations and the sequences in which certain decisions might be taken. Negotiators will encounter numerous decision points along the way, including whether to reach consensus on a single list of goods common to all parties, or a list that allows countries

3. The CTE-SS has been responsible for discussing issues related to the definition and identification of environmental goods, whereas the NAMA will be responsible for modalities and implementation.

4. Such goods would seem to present a problem for negotiators mainly when there is ambiguity about where to classify certain goods *and* one of the tariff lines under which the designated good could be classified is *not* included in an agreement.

some flexibility in terms of which products they designate for liberalisation; whether to treat the final result as a one-off decision, or as an on-going process; if the latter, how to keep the product list current. These and related issues are addressed after the next section, which explores issues related to problematic goods.

Box 3.1. The Harmonized System

The Harmonized Commodity Description and Coding System tariff nomenclature, generally referred to as the "Harmonized System", or simply "HS", is sometimes called "the true language of international trade". It is a multipurpose international product nomenclature, developed by the World Customs Organization (WCO), under which products are arranged in a legal and logical structure supported by well-defined rules.[1] The system is used by more than 190 countries and economies as a basis for their customs tariffs and for the collection of international trade statistics. All modern, computerised customs declaration systems now depend on the HS classification. Over 98% of the merchandise in international trade is classified in terms of the HS.

The Harmonized System grew out of an international customs nomenclature that itself was an amalgam of national systems used by the major trading nations. Over time, however, the range of manufactured goods has grown rapidly in an environment "where product cycles are counted in months and no longer in years" (WCO, 2001). Consequently, quite a few HS sub-headings have become catch-alls for many types of manufactured goods not elsewhere specified. One that stands out in this regard is HS 8479.89, which refers to "other" machines and mechanical appliances having individual functions not specified or included elsewhere in Chapter 84 (nuclear reactors, boilers, machinery and mechanical appliances; parts thereof). This sub-heading could potentially cover such diverse products as ultrasonic cleaning devices, machinery and apparatus for cleaning the soil, and trash compactors.

Most countries maintain national customs nomenclature based on the HS, and some of these national nomenclatures are very detailed, containing up to 15 000 separate tariff lines. Countries that are parties to the International Convention on the Harmonized Commodity Description and Coding System ("the HS Convention") — which includes most members of the WTO — are free to establish their own customs codes beyond those applied by all countries down to the 6-digit level. However, these national codes must still be consistent with the HS. That is to say, a country cannot create an 8-digit code for a kind of light bulb and begin that code with the first 6 digits of the sub-heading that the HS has reserved for a carrot.

1. The official interpretation of the HS is given in the multi-volume *Explanatory Notes* (WCO, 2001). The *Explanatory Notes* are also available on CD-Rom, and on line, as part of a commodity database giving the HS classification of more than 200 000 internationally traded commodities.

Challenges for defining the scope of the sector

Products with multiple end uses

Many products used for environmental protection or improvement have several possible uses and are not exclusively environmental. For example, separating harmful waste products from an effluent stream often calls for a centrifuge. Yet centrifuges have a host of other industrial applications, particularly in food processing and medicine. One report from the mid-1990s estimated that, at the time, only 10% of centrifuges were being sold for environmental purposes (Melling, 1996). Similar conditions hold for many other products, such as pumps, filters, incinerators and chemicals that are used to bind polluting compounds into particular substances.

Of course, negotiators can always choose to ignore the "non-environmental" uses of a goods category and agree simply to accelerate liberalisation of *all* goods covered under a

6-digit HS sub-heading, regardless of how the good or goods falling under that heading are used. This approach typically works best if the 6-digit HS code is specific, *i.e.* refers to only one type of good. If experience with previous sectoral agreements is any guide, negotiators may still want to set a threshold share for environmental use when determining whether to include a particular good with multiple uses. In drawing up the so-called Uruguay Round "zero-for-zero" initiative on Trade in Pharmaceutical Products, for example, negotiators tended to include a designated active pharmaceutical ingredient if more than half of its consumption was used in the production of finished pharmaceutical products. By contrast, APEC economies, when they began drawing up a list of environmental goods for their EVSL initiative, took a less formulaic approach. Some economies, perhaps not wanting to see items on which they levied high tariffs targeted for liberalisation, were quite sensitive to the multiple-use issue and made it plain that, for certain products, they did not want the effects of tariff liberalisation to extend beyond environmental uses (see Chapter 1 in this volume). This approach, not unlike the traditional request-and-offer approach used in market-access negotiations, made the final APEC list shorter than it otherwise might have been, but it allowed quite a number of "less sensitive" products with multiple uses, such as laboratory equipment, to remain on the list.

Frequently the dual-use problem arises from the lack of specificity of a HS sub-heading. Again, negotiators can simply agree to liberalise some goods that are not "environmental" because they are covered by the same 6-digit HS codes as one or more goods that are. Alternatively, they can try to resolve the problem by narrowing down the product descriptions to appropriate 8- or 10-digit (national) tariff line codes, indicated in the list by an "ex" next to the corresponding 6-digit HS sub-heading. That is, essentially, how APEC economies often chose to deal with the issue.

Yet another approach is available to negotiators: differentiation on the basis of the good's expected use. Indeed, the logic behind an agreement on environmental goods could create an incentive to differentiate imports on the basis of their end use. Normally — except in the special cases of arms, sensitive information technology and substances that can be diverted to the manufacture of weapons of mass destruction — it is importers rather than exporters that care whether a good brought in under a low tariff ends up in some other (higher tariff) end use. In the case of environmental goods, however, exporters may want to demonstrate to certain groups that they are party to an agreement that relates primarily to "environmental" products. They are thus more likely to take an interest in agreeing to a product list that excludes "non-environmental" uses of multiple-use products.

Differentiation according to end use is not a new idea. The 1973 Agreement on Trade in Civil Aircraft,[5] for example, accorded duty-free or duty-exempt treatment to an agreed list of products, "if such products are for use in civil aircraft or ground-flying trainers and for incorporation therein, in the course of their manufacture, repair, maintenance, rebuilding, modification or conversion". In dealing with the multiple end-use problem associated with components, coverage of the agreement was restricted only to products:[6]

> … [that have] the essential character of a complete or finished part, component, sub-assembly or item of equipment of a civil aircraft or ground flying trainer (*e.g.* an article which has a civil aircraft manufacturer's number),

5. Available from www.wto.org/english/docs_e/legal_e/air-79_e.htm.

6. Annex para. 2 of the Agreement.

> materials in any form (*e.g.* sheets, plates, profile shapes, strips, bars, pipes, tubes or other shapes) unless they have been cut to size or shape and/or shaped for incorporation in civil aircraft or a ground flying trainer (*e.g.* an article which has a civil aircraft manufacturer's part number).

In both of the above cases, a characteristic that was readily observable to a customs agent was used to differentiate parts, components, equipment and even materials. Even something as non-functional as a manufacturer's part number could serve as a distinguishing characteristic. Another example can be found in Japan's customs tariff schedules, which allow carpet tiles, carpets and other textile floor coverings "of a size and shape suitable for incorporation in motor vehicles" (differentiated at the 9-digit level) to be imported duty-free. And the EU distinguishes on the basis of end use in respect of certain ICT components not covered by the WTO Information Technology Agreement, when they are destined as inputs to goods that are covered by the ITA.

More recently, the WTO's 30 August 2003 "Decision on implementation of paragraph 6 of the Doha Declaration on the TRIPS Agreement and public health"[7] also enlisted artificial distinguishing features to control Trade in Pharmaceutical Products produced under compulsory licence. According to paragraph 2(b)(ii) of the decision:

> (ii) products produced under the licence shall be clearly identified as being produced under the system set out in this Decision through *specific labelling or marking*. Suppliers should distinguish such products through *special packaging* and/or *special colouring/shaping* of the products themselves, provided that such distinction is feasible and does not have a significant impact on price. (emphasis added)

For most of the above examples, a small number of companies import the affected goods. Given the large and diverse customer base for environmental goods, designing a system for clearing products differentiated by end use quickly and inexpensively through customs would present a real challenge.

One simple method is for the customs officials of the importing country to affix a label or other identifier to either the "environmental" or the "non-environmental" product. This would only work for products that are not delivered in bulk form and would rule out some chemicals (but not necessarily those delivered in containers). Generally, the practice of tax authorities (*e.g.* to distinguish beverages containing distilled spirits from alcohol used for industrial purposes) is to label or otherwise mark the product attracting the higher tax as proof that the tax has been paid. The logic is that the merchant has an incentive not to remove or destroy the designation. However, one could also imagine marking products in an indelible way to designate either the higher- or the lower-taxed product (or, alternatively, the product on which an import duty is imposed).

More technologically sophisticated approaches for differentiating according to end use have often involved irreversibly changing the product's characteristics. Tax authorities have been chemically marking goods for tax differentiation purposes for a long time. In many OECD countries, for example, diesel fuel sold for uses that attract a lower or no excise tax (normally fuel destined for use in farm equipment, commercial fishing boats, generators and other equipment that is not propelled) has a chemical dye added to give it a distinctive colour (usually red or green) that differentiates it from "normal" diesel fuel. Persons caught using tax-exempt fuel for non-authorised purposes are typically required to pay the taxes due, plus a fine. Another example is the incorporation of microscopic chemical markers, usually polymers, known as "taggants",

7. Available at www.wto.org/english/tratop_e/trips_e/implem_para6_e.htm.

into manufactured products. As a result of the International Civil Aviation Organization (ICAO) Treaty of 1991, signed by 39 countries, many manufacturers of military explosives are now adding micro-taggants to their products to assist investigators in tracing terrorist bombs.

No system for differentiating whether otherwise identical products are being used "properly" — in this hypothetical context, in accordance with an agreed environmental end use — can be 100% effective. Compliance invariably requires post-import monitoring and enforcement, which can be costly and administratively burdensome.[8] The effectiveness of the monitoring and enforcement may itself become an issue. The need for governments to be able to demonstrate that the coverage of an agreement on environmental goods excludes "non-environmental" uses of multiple-use products might, at the extreme, lead some countries to require proof that an importer's monitoring and enforcement is effective. However, there is nothing that would prevent a party to an agreement from applying the same low tariff to all uses of the good in question.

To conclude, the multilateral trading system allows for differentiating products according to their end use, and there are several ways of doing so. But, ultimately, the choice of whether to apply the same low tariffs to goods used for environmental and for non-environmental purposes would rest with the importer. The latter can always decide to apply lower tariffs than those scheduled in their bound rates.

Entire plants and systems

Current trade in environmental goods and services, particularly equipment used for the recycling or recovery of waste or for end-of-pipe pollution control, often involves the sale of entire plants. In the absence of a separate tariff line for such plants, the components of these plants may be imported under separate tariff headings, many of which are too general to be considered "environmental", or the plants may be designated "priority" projects and the relevant tariffs waived. The latter procedure certainly allows the importer a degree of flexibility, but from the exporter's perspective it is arbitrary and subject to political influence.

This problem has led some in the industry to conclude that individual tariff headings should be created for certain types of whole plants. This is already possible under the Harmonized System, as for food-processing plants (*e.g.* 8438.10 and 8438.20), brewery machinery (8438.40) and floating or submersible drilling or production platforms (8905.20). In principle, the same could be done for pollution control equipment or for geothermal power plants. A plant for recovering sulphuric acid, for example, when operated as a part of a smelter, could be classified by national authorities as "filtering or purifying machinery" under HS 8421.39.[9]

Product descriptors for entire plants or systems can help to keep the focus on function, thereby circumventing the "limited shelf life" problem of environmental technologies and reducing the uncertainty over classification and customs duties arising from constant technological change. If the manufacturer of, say, a recycling plant changed some component or piece of technology, its position in the customs

8. For example, the need to be able to verify how a product has been used once it has been imported may require spot checks of importers' records and warehouses.

9. Such interpretations of the HS are not necessarily shared by all, however. Moreover, if the plant were to be operated as an independent entity, classification under this sub-heading could be problematic.

nomenclature would not change. Thus, recycling plants adopting this new component would continue to benefit from the same tariff treatment.

The main factor limiting the creation of new tariff lines for whole plants is the structure of the HS itself. Although countries may create separate tariff lines in their own customs nomenclatures, the descriptors must be consistent with their corresponding HS headings and sub-headings. This limits whole plants to a handful of current "functional" headings in the HS, mainly under Chapter 84 (Nuclear reactors, boilers, machinery and mechanical appliances; parts thereof). Table 3.1 gives examples of possible headings under which entire plants could be classified.

Table 3.1. Examples of "functional" HS headings for classifying entire plants or systems

HS	HS description	Possible examples of entire plants
8402.19	Other vapour-generating boilers, including hybrid boilers	Cogeneration of heat and power plants (energy-efficient heat and power production technology)
8419	Machinery, plant or laboratory equipment, whether or not electrically heated (excluding furnaces, ovens and other equipment under heading no. 8514), for the treatment of materials by a process involving a change of temperature such as heating, cooking, roasting, distilling, rectifying, sterilising, pasteurising, steaming, drying, evaporating, vaporising, condensing or cooling, other than machinery or plant of a kind used for domestic purposes; instantaneous or storage water heaters, non-electric	Recycling plants for chemical industry; flash smelters
8421	Centrifuges, including centrifugal dryers; filtering or machinery and apparatus, for liquids or gases.	Sulphuric acid recovery plant
8424	Mechanical appliances (whether or not hand-operated) for dispersing or spraying liquids or powders; fire extinguishers, whether or not charged; spray guns and similar appliances; steam or sand blasting machines and similar jet projecting machines.	
8439	Machinery for making pulp of fibrous cellulosic material or making or finishing paper or paperboard.	Paper plants using recycled material
8456	Machine-tools for working any material by removal of material, by laser or other light or photon beam, ultrasonic, electro-discharge, electro-chemical, or plasma arc processes.	
8475	Machines for assembling electric or electronic lamps, tubes or valves or flashbulbs, in glass envelopes; machines for manufacturing or hot working glass or glassware.	Glass recycling plants
8479	Machines and mechanical appliances having individual functions, not specified or included elsewhere in this Chapter.	Oil recovery systems

In addition to agreeing on where to classify whole plants, negotiators would also need to agree on special customs clearance procedures. Only occasionally are plants actually shipped in one piece: they are usually imported disassembled, and often the machinery and other components (normally covered by separate tariff lines) arrive separately.[10] Typical rules for treating a whole plant under one tariff line therefore require that all the components enter the country through the same port of entry, are billed to the same importer, and are imported within a specified time period (*e.g.* six weeks), or some

10. Sometimes this is done because of tariff escalation, and not simply to minimise transport costs. For example, prefabricated buildings and even log cabins are often shipped disassembled in order to avoid paying the higher tariffs levied on complete structures.

combination thereof. Finally, if a WTO agreement on environmental goods should lead to the creation of new tariff lines for whole plants, negotiators could minimise future disputes by specifying whether or not the agreement also covers parts (items that are necessary for the plant to operate) and accessories (items that are not necessary for the plant to run but which enhance its performance). This distinction was not initially made in the ITA and required subsequent clarification.

Goods of interest because of the processes or methods used to produce them

Some countries, and many commentators, have wondered whether or not goods defined by their processes or production methods (PPMs) could conceivably be included in an agreement on environmental goods. This is a controversial question because an affirmative answer could have consequences for the multilateral trading system as a whole. Many, if not most, WTO members have deep reservations about defining goods on the basis of PPMs, especially non-product-related PPMs.

Differentiation on the basis of PPMs is certainly possible for statistical purposes. Several countries already differentiate (certified) products of organic agriculture from agricultural products not so designated. And some, following the 7 July 2000 "Recommendation of the Customs Co-operation Council on the Insertion in National Statistical Nomenclatures of Subheadings to Facilitate the Collection and Comparison of Trade Data on Hand-made Products", have established, in their HS-based statistical nomenclatures, new subdivisions for hand-made (artisanal) products. In both cases, provisions in respect of the certification of the organic or hand-made products are also laid down in the countries' statistical nomenclatures.

Differentiation for statistical purposes is not the same as differentiation for levying input duties, however. WTO agreements require that products imported from the territory of any member be accorded treatment no less favourable than that accorded to like products of national origin and to like products originating in any other country. While the important concept of "like product" has been variously interpreted by WTO dispute settlement panels and the Appellate Body, a fairly limited role has been allowed to date for distinguishing products on the basis of their PPMs (Box 3.2).[11]

Carpets provide a salient example. The HS contains a sub-heading (5702.10) for "'Kelem', 'Schumacks', 'Karamanie' and similar hand-woven rugs". Ostensibly, this sub-heading appears to define the relevant goods in terms of their production method. Many countries offer lower tariffs for such carpets, and at least one has established a certification arrangement for the purpose of extending duty-free treatment to certain hand-loomed and folklore textile articles under its Generalised System of Preferences.[12] But, strictly speaking, such carpets can, if necessary, be subjected to tests (*e.g.* inspection of the knots for mistakes and irregularities) that confirm whether they were indeed made by hand.

11. As one analyst (von Moltke, 1999) has observed, "The concept of like products is in many ways the linchpin of the GATT/WTO system. Its two central principles, most-favoured nation treatment (MFN) and national treatment are critically dependent on this concept." The key passages in GATT 1947 are Articles I.1 and III.2.

12. See, for example, www.jedco.gov.jo/jedco/gsp.htm.

Box 3.2. Processes and production methods

Processes and production methods (PPMs) — how products are manufactured, or natural resources are extracted — can have significant environmental impact. Countries have adopted a variety of regulations that attempt to mitigate the negative impacts of processes and production methods, often successfully. Measures that address environmental problems at the production stage may raise complex trade issues if a country tries to impose national requirements on imported products, or tries to enforce its standards or production requirements on activities outside its jurisdiction. WTO rules relating to goods are attached to "products". The national treatment and most-favoured nation obligations under the GATT and the Technical Barriers to Trade (TBT) Agreement require that imported products must be "treated no less favourably" than "like" domestic, or other origin, products. These rules do not explicitly recognise or prohibit import restrictions based on non-product-related characteristics, however. Indeed, there are some multilateral environmental agreements that contain trade-related measures related to processes and production methods, although these tend to apply to narrowly defined circumstances.

Recent interpretation of the relevant GATT rules, in a highly qualified ruling involving the protection of endangered species, suggests that it might be acceptable to apply national measures based on non-product-related PPMs to imports.[1] The application of such measures, however, is subject to strict conditions and must respect the rules of the trading system, notably the principle of non-discrimination.

1. See the WTO Appellate Body and Arbitrator's reports relating to the dispute over "United States — Import prohibition of certain shrimp and shrimp products", Document Nos. WT/DS58/AB/R (12 October 1998), WT/DS58/AB/RW (22 October 2001) and WT/DS58/RW (15 June 2001). Available at www.wto.org/english/tratop_e/dispu_e/distab_e.htm.

Source: OECD (2001), p. 224.

Goods defined by their relative environmental performance in use

Japan includes on its product lists goods that can perform a particular task — generate electricity, wash clothes, clean dishes — using less energy, water or other natural-resource-based inputs than competing products in the market. The included products are deemed intrinsically preferable by virtue of their distinct technology. In addition, a wide range of manufactured products can be deemed to be more "resource-efficient" than other goods using approximately the same technology, usually because of slight differences in controls or in the mix of inputs used (*e.g.* thickness of the insulating material). While it is conceptually feasible to include such goods in an agreement on environmental goods, important practical implementation issues would have to be addressed.

Such goods, because they can be defined in terms of characteristics embodied in the product, pose no problems for the HS *per se*. The international community could, if it chose, define separate tariff lines for, say, room air-conditioning units with energy-efficiency ratios greater than and less than 10. However, environmental preference in such cases depends on the good's relative performance at a given point in time. Because of continuous technological progress, performance rated highly energy-efficient in the present year is likely to be considered average or below-average five years hence.

According separate treatment to goods differentiated by their energy-efficient rating or some other environmental performance criterion (or criteria) would first require obtaining consensus among countries on thresholds or boundaries. Given that many of the goods that might be candidates for inclusion in an agreement on environmental goods are currently the subject of government-run voluntary labelling schemes, this would involve recognition of the certifying bodies awarding the labels, *e.g.* on the basis of equivalence.

In addition, including such goods in an agreement on environmental goods would virtually ensure the need to create an institutional framework (*e.g.* an expert technical group) for keeping the classification criteria up to date.

However, nothing would prevent parties to an environmental goods agreement, if they so decided, from defining a good with reference to an existing standard, even a private one. The Parties to the ITA, for example, have on at least one occasion defined a good with reference to a private international standard, such as the one (for Item No. 199) established by the Personal Computer Memory Card International Association (PCMCIA):[13]

> Printed Circuit Assemblies for products falling within this agreement, including such assemblies for external connections such as cards that conform to the PCMCIA standard. Such printed circuit assemblies consist of one or more printed circuits of heading 8534 with one or more active elements assembled thereon, with or without passive elements. "Active elements" means diodes, transistors and similar semiconductor devices, whether or not photosensitive, of heading 8541, and integrated circuits and micro assemblies of heading 8542.

An important issue, again, is how to deal with changes in the standard over time. Countries would also need to come to some agreement on how to treat goods that, for example, qualify for the same national label but are accorded different tariff treatment.

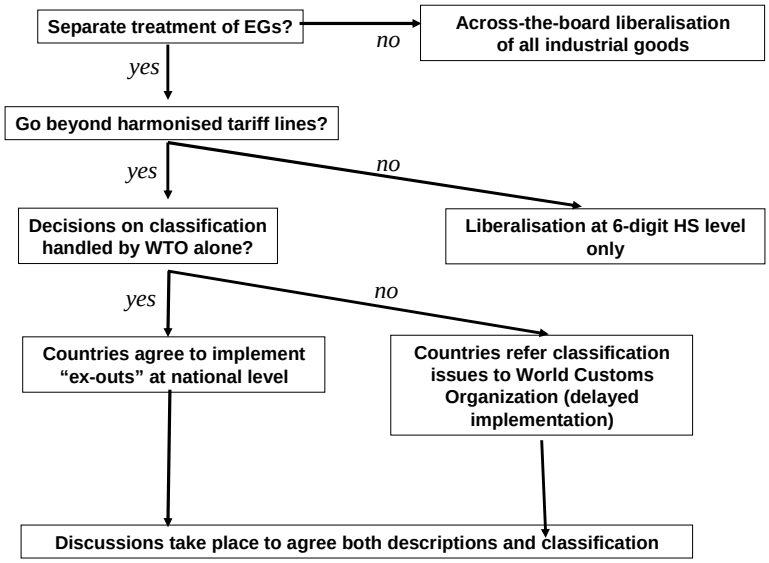
Procedural and institutional issues

The WTO mandate to undertake negotiations on environmental goods [DDA paragraph 31(iii)] has set in motion a process with several decision points along the path towards consensus and implementation. Figure 3.1 shows some of the decisions that negotiators might confront as they attempt to address this mandate.

The simplest and most straightforward way for countries to liberalise a list of goods would be to agree to include in that list only goods described under the Harmonized System at the time when the agreement is concluded, thus obviating any need to change either the HS or national customs nomenclatures. Such an approach, in the case of environmental goods, implies that the negotiators could reach consensus on how to deal with the specificity issue. WTO negotiators could choose to frame the question as APEC negotiators did. That is to say, they could agree either to include only goods that are unambiguously environmental at the 6-digit HS level, or find a rule for determining whether a particular 6-digit HS sub-heading is sufficiently environmental to be included on the list. This could range from including the sub-heading if even a single product covered by it is an environmental good to including the sub-heading only if a majority (*i.e.* some agreed percentage of goods or value of goods) of the goods traded under that category are environmental goods.

13. The PCMCIA is an international standards body and trade association founded in 1989 to establish standards for integrated circuit cards and to promote interchangeability among mobile computers where ruggedness, low power requirements, and small size were critical. The association currently has a membership of over 200 companies. See www.pcmcia.org/about.htm.

Figure 3.1. Partial decision tree for negotiations on environmental goods: questions of classification



From a trade perspective, a liberal inclusion rule would have many advantages, for exporters and importers alike. An analysis by the WTO Secretariat (WTO, 2002) of exports and imports of goods included in the product list circulated by Japan to the NAMA, for example, showed that while most developing countries were net importers of goods on the list compiled at the HS 6-digit level, the ratios between exports and imports tended to be larger when all tariff lines (including those identified by an "ex" qualifier) in the Japanese list were included in the analysis than when only tariff lines without an "ex" were included. A more recent analysis undertaken by UNCTAD also showed that, analysed at the 6-digit level, developing countries (as a group) were major net exporters of a number of industrial goods used to provide environmental services, such as fluorescent lamps, ethanol, methanol, mats and screens of vegetable materials, and thermometers (UNCTAD, 2003). In addition, UNCTAD examined trade in a selected list of "environmentally preferable products", chosen on the basis of their product or disposal characteristics. At the 6-digit level, although developed countries dominated both import and export trade, developing countries were, as a group, net exporters of this basket of products.

However, countries may decide that certain goods currently classified under general HS sub-headings are too "sensitive", and that wholesale liberalisation at the 6-digit HS level would adversely affect domestic producers of those products. Others may feel that it would be inappropriate to include, in an agreement purporting to liberalise trade in "environmental" goods, goods that could be claimed not to help to protect or enhance the environment. For whatever reasons, it seems likely that some "ex" heading goods will be included in any agreement on environmental goods and therefore some procedure for identifying unique tariff lines, at least for those products, would have to be agreed to.

Dealing with classification issues

All WTO sectoral agreements contain language, usually in an annex, that identifies the products covered by the agreement. Typically, Article 1 of the Annex will begin "This Agreement shall cover the following products", followed by a list of products registered in order of their HS chapter, heading or 6-digit sub-heading. At some point in the process of drafting a sectoral agreement, especially one that includes goods that will need to be treated separately in national nomenclatures, negotiators arrive at several decision points. First, they have to decide *whether* to resolve all classification issues from the start or to leave some to be resolved later. They must also decide on *where* to introduce new tariff nomenclature or changes to existing tariff nomenclature. As explained below, this issue is largely driven by institutional responsibilities, and thus by established timetables as well.

Option 1: Amend the Harmonized System

There are reasons why countries might prefer to give separate status in an amended Harmonized System to all goods included in an agreement on environmental goods. The HS is nearly universal in its application, transparent (it can be accessed via the Internet), and administered by an impartial intergovernmental organisation, the World Customs Organization. However, for reasons having to do both with the WCO's timetable and the innate conservatism of the process (because of the ramifications of changes to the HS for customs authorities), amending the HS would not be a viable option in the short term, except perhaps for those goods that are clearly identifiable and traded in volumes sufficient to meet the WCO's threshold criteria.[14]

The main obstacle to amending the HS in advance of concluding an agreement on environmental goods is the timing of the WCO's review cycles. The WCO's Council generally considers amendments in four-year cycles, with implementation taking place from one to two years following notification to members (Article 16.4 of the HS Convention; see Annex 3.A1).[15] The most recently completed review was approved by the WCO Council in June 2004 and will be implemented internationally on 1 January 2007. Amendments under the next review cycle are not scheduled to be implemented until 2012.

Is there a way to speed up the process? The WCO is asked this question frequently and is acutely aware that the process of revising and subsequently implementing amendments to the HS is a protracted one. Reducing the length of the implementation period appears to be out of the question, however, as during the first and second review cycles only 45% and 58% of Contracting Parties to the HS Convention were able to implement the amendments to the HS by the established deadlines (WCO, 2001). In

14. For a product group to obtain a 6-digit HS sub-heading, the volume of world trade in the good must be at least USD 50 million a year; the corresponding threshold for obtaining a 4-digit HS sub-heading is annual trade worth at least USD 100 million. However, exceptions have been made for social or environmental reasons. For example, in the changes adopted in the 2002 revisions to the HS, categories were added to help countries comply with their obligations under multilateral environmental agreements to combat illicit trafficking in endangered species and dangerous and harmful substances and products.

15. Decisions merely concerning the *interpretation* or *application* of the Harmonized System, such as classification decisions and amendments to the *Explanatory Notes* or to the *Compendium of Classification Opinions*, become effective two months after approval by the HS Committee. These are reflected in the amending supplements of the relevant WCO publications and can also be found on the WCO's Web site.

particular, truncation of the implementation period would be counterproductive if it led to the use of different versions of the HS over long periods. According to the WCO, reducing the drafting process from four to three years might be achievable and thus shorten the overall review cycle from five to four years. But the rate of progress during the last HS review cycles suggests that the drafting periods are becoming longer, not shorter.

Alternatively, the WCO Council could simply issue recommendations calling upon signatories to amend national tariff and statistical nomenclatures on an interim basis (*i.e.* between Article 16 amendments to the Harmonized System). The advantage is that it can be done annually. The disadvantage is that this kind of recommendation is not binding on Contracting Parties to the HS Convention, which alone decide whether and at what speed to implement them.

One other consideration may also favour amending national customs nomenclatures, as opposed to the HS: the long-term aim of the WCO to keep the HS as simple as possible, and even to streamline it.[16] Giving separate status in the HS to, say, 100 new goods — a not inconceivable result of an agreement on environmental goods — would be no trivial task for the WCO, especially if it were necessary to restructure some headings to provide additional space when most of the available codes are currently occupied.

Option 2: Countries agree to harmonise national practices for classifying products

Although changes can only be made to the HS by the WCO, nothing prevents Contracting Parties from establishing additional subdivisions in their national customs nomenclatures to identify goods that could not (*e.g.* within a given time frame) be given separate status in the HS. Contracting Parties must, however, ensure that the mandatory subdivisions (*i.e.* up to the 6-digit level) remain unchanged.

When drafting a sectoral agreement that includes goods that will need to be treated separately in national nomenclatures, as well as goods defined at the 6-digit or higher HS level, negotiators have several options. One is simply to agree to produce two product lists: one (A) comprising the HS headings or parts thereof to be covered under the agreement, the other (B) listing specific products for which HS codes do *not* exist, but which the Parties have decided will be covered by the agreement wherever they are classified in the HS. This was the approach taken in the 1996 Ministerial Declaration on Trade in Information Technology Products. Such an approach would enable negotiators to conclude an agreement more quickly (which may be desirable for various reasons) than if they waited until consensus was reached on all outstanding classification issues. It also ensures that the results of liberalisation are implemented equally regardless of differences in classification. It does not necessarily reduce negotiating costs in the long run.

In the case of the ITA, the decision essentially to leave implementation on a large number of products to national customs authorities worked well enough for some goods, but not for others. Different national customs authorities assigned national customs nomenclatures that referred to different HS codes, resulting in the reclassification or

16. Indeed, it was agreed during the most recent review cycle that, in addition to reviewing specific sectors (such as high technology), a general review of the HS would take place. One goal of the current review cycle is to simplify the HS, particularly in the pharmaceutical, information technology and textile sectors.

misclassification of goods entering trade. Eventually, customs authorities approached the WCO and sought their interpretive opinion.

The lesson here is that the process of harmonising the classification of goods to HS headings should begin early in the process — if possible before an agreement is finalised — to avoid costly delays and disputes later. This may have to be preceded by a "discovery" process to learn where the main divergences of opinion are likely to occur. In this regard, the fact that countries proposing environmental goods to the NAMA have also indicated the HS headings under which they would classify those goods, or sought advice from the WCO[17] on where best to classify them, may portend less protracted discussion of classification than took place in connection with the ITA.

If WTO members decided to take the A-and-B list route, some mechanism would have to be provided for resolving outstanding classification issues. The WTO already has experience in dealing with liberalising trade in goods through the creation of national subdivisions of the HS. Parties to the ITA, for example, created a new Committee of Participants on the Expansion of Trade in Information Technology Products which meets several times a year "with the objective of ultimately harmonising national practices of classifying products within the HS nomenclature" (Fliess and Sauvé, 1999). However, the WCO's Harmonized System Committee may nonetheless still need to be involved, especially in providing advice on interpretation. They have done this on many occasions for both the ITA and the initiative on Trade in Pharmaceutical Products.

One list or two?

The A-and-B list approach described above is meant to deal with the problem of unresolved questions of classification. Multiple lists can also be used to allow countries flexibility in terms of the products that they are willing to designate for liberalisation.

WTO members normally agree on sectoral liberalisation by agreeing on a common set of goods, irrespective of whether they are able to agree ahead of implementation on how the products are to be classified. The merit of a single list is its administrative simplicity: every country liberalises the same set of goods. Alternatively, as proposed by the United States, negotiators could produce two lists: a core list, which would be liberalised by all WTO members, and a complementary list, from which countries could choose to liberalise a negotiated percentage of goods.

According to the US proposal, the core list would comprise products for which there is consensus that they constitute environmental goods. A second, complementary list would contain products for which definitive consensus could not be reached but which a significant number of countries, if not all, deem important for environmental protection, pollution prevention or remediation, and sustainability. For the core list, members would be required to reduce tariffs, or, as appropriate, eliminate them altogether, within a certain period. For the complementary list, members would be required only to identify specific products representing a defined percentage of the total tariff lines on the list, and to subject these products to the same reduction or elimination agreed for the core list of products. Each country would choose the specific products to include in this percentage.

17. Qatar, for example, has already indicated that it is seeking information from the WCO on where to classify a class of goods not currently separately identified in the HS: natural-gas-based fuel cell technologies (*e.g.* fuel cell power plants, fuel cells for residential use, and fuel cells for commercial use). See "Harmonized System (HS) classification codes of gas-related goods — submission by the State of Qatar — Paragraph 31 (iii)", TN/TE/W/27 and TN/MA/W/33, 25 April 2003.

The "less than full reciprocity provisions" in the Doha mandate could then be satisfied by requiring developing countries to eliminate tariffs on a smaller percentage of products on the complementary list than the percentage that would apply to developed countries.

Keeping the list current

Negotiators of any agreement on environmental goods will eventually find themselves at a critical juncture: to treat it as a one-off exercise or to make it a living agreement, subject to periodic and continuing review. Should negotiators choose the latter path, they will have to consider how to deal with at least two technical issues. The first relates to the need periodically to consider whether to add new products to the list. (Removing those no longer considered "environmental" would be problematic.[18]) The second relates to the possible need, if products defined by their relative environmental performance characteristics are included, to keep redefining the boundaries between most and least efficient.

Expanding the product coverage

Providing for the possibility to expand the product coverage of a tariff liberalisation agreement is particularly necessary when the initial coverage does not tally exactly with a well-defined sector in the HS. The need to include a review mechanism for considering the steady stream of new products coming to market as a result of technological breakthroughs was anticipated by the drafters of both the ITA (which covers selected products in several HS Chapters, including 38, 70, 84, 85 and 90) and the initiative on Trade in Pharmaceutical Products. In both cases, the WTO members concerned agreed to meet periodically under the auspices of the WTO's Council on Trade in Goods to review the product coverage of the agreements.[19]

Keeping up with technological change is a general problem,[20] one that is by no means confined to environmental goods, pharmaceuticals and information technology. However, identifying environmental goods that are embodied in particular processes which have been defined as "cleaner" creates additional complexities. Cleaner technology, by

18. Dropping a good from the product coverage of a tariff reduction or elimination agreement would presumably be done in most cases for symbolic reasons only: once a tariff is bound it cannot be raised to an earlier, higher value, except through procedures specified under Article XXVIII of the General Agreement on Tariffs and Trade 1947. For example, during the first review of the initiative on Trade in Pharmaceutical Products (November 1995 to 11 July 1996), it emerged that 25 products (out of a list of over 6 000) were found to be used predominantly for non-pharmaceutical purposes and had been inadvertently included among those pharmaceuticals already receiving duty free treatment. Members concerned were asked to notify the WTO Secretariat of any changes they planned to make to their schedules "according to the existing procedures" (WTO Document No. G/MA/W/10 of 11 October 1996).

19. In the case of the ITA it was not just a question of keeping the agreement relevant: IT producers were particularly concerned to make it impossible for participants to reclassify products for which the ITA eliminated tariffs into categories with import duties (including new categories resulting from technological changes). Because technology changes so rapidly in this sector, they saw that "there could be plenty of opportunities for ITA participants to manipulate the existing product classification system so as to nullify the ITA's tariff concessions and trade-liberalising effects" (Fliess and Sauvé, 1999).

20. Commenting on the process of periodically updating the list of designated active ingredients for pharmaceutical products, for example, the European Federation of Pharmaceutical Industries and Associations (2001, p. 2) notes that it "is unable to keep up with the pace of product development and may be generating unproductive administrative costs".

definition, involves upstream changes in production and products as opposed to the installation of end-of-pipe facilities for separating out harmful effluents. Such changes are motivated as much by opportunities to save on production costs as to meet environmental regulations.

This dual motivation is intrinsic to many kinds of cleaner technologies, since pollution prevention is often accomplished primarily through better process control. One example from the automotive industry has been the use of robots to spray paint more precisely, which not only saves on input costs but also reduces emissions of volatile organic compounds (VOC). In the chemicals industry, costs and pollution are reduced by checking more diligently for leaks, cleaning heat exchange tubes more often, and applying better process control in order to eliminate hot and cold spots or to speed reactions. Over time, as preventing pollution becomes more economical than cleaning it up, and as pollution is managed as another kind of resource use, identifying the "environmental good" component of many industrial processes will become more difficult.

As industries find solutions to pollution through control of processes, they also rely more and more on specialised service providers. Accordingly, it is fast becoming obsolete to treat environmental goods and environmental services as separate components of environmental protection. Improved access to environmental goods may be of limited value if there is too little access to environmental services such as monitoring and measurement, and to related ones like engineering and construction.

Addressing the problem of moving targets

Some of the products proposed in the environmental goods lists circulated to date have been included because they are judged more efficient than competing products in their use of energy or material inputs such as water. Such technologies raise problems of relativism and moving targets. A technology that reduces resource use or pollution today may be relatively dirty in a few years, as more advanced technologies become available. Including such goods would necessitate some mechanism for regularly updating the product list to account for constantly moving targets.

Countries could simply agree to assign the task of reviewing the technical criteria to a WTO committee or technical working group. Such a body would meet at regular intervals to consider the suitability of the current criteria, much as standard-setting bodies responsible for updating specifications for energy-efficient products already do. Alternatively, for some products, countries could agree simply to reference an established, recognised international standard, either private or public, to avoid duplicating work undertaken elsewhere. They could even agree that product specifications will automatically change as the standard is updated, thus obviating the need to create a new international body of technical experts.[21]

However, there are several potential drawbacks to such an approach. First, the burden of communicating changes in the standard to customs agents would not be trivial. Second, relinquishing control of the key technical criteria of a product description to another body — particularly a private standardising body — could raise difficult issues. Not least of these would be the question of what to do if some WTO members were to declare that they did not agree with a decision taken by the standardising body.

21. Such a clarification was not made for Item No. 199 (which references a private standard) under the ITA.

Concluding remarks

This chapter has explored some of the practical issues that WTO delegates may have to address as they consider possible responses to negotiations mandated in the Doha Ministerial Declaration under paragraph 31(iii). At the very least, they will have to decide whether to cover goods not currently separately identified in the Harmonized System and, if so, whether to resolve classification issues before concluding an agreement or to leave that task until later. Decisions on this matter could have consequences for the work programme of the WTO and most probably the WCO.

Depending on what countries ultimately propose, negotiators may also have to consider how to treat goods: *i)* with multiple uses, some of which are not "environmental"; *ii)* goods sold as entire plants or systems; *iii)* goods of interest because of the processes or production methods by which they were manufactured, extracted or harvested; and *iv)* goods defined by their superior environmental performance. Procedures for including such goods under a trade liberalisation agreement exist, though usually not without imposing some costs on the multilateral trading system because of the need to create additional documentation or institutions. But the basic conclusion has to be: if there is a will to include goods within these categories, there is usually a way to do so.

Should negotiators decide to create a mechanism to periodically review an agreed product list of environmental goods, and to entertain the possibility of revising it, they will eventually have to decide what institution or institutions should be assigned the various tasks. These tasks relate to the evaluation of proposals for goods to add to the list and to the creation or modification of customs codes. Environmental goods, like many other goods, are subject to rapid technological changes. Identifying them can be difficult, however, particularly if the definition extends to goods defined by their relative environmental performance in use.

Annex 3.A1

Amending the Harmonized System (HS) of tariff nomenclature

The initial impetus for the HS, when it was developed during the 1970s and 1980s, was to facilitate trade. Studies had shown that differences in product classification systems across countries imposed heavy transaction costs on trade. International standardisation was seen as a way to reduce the root causes of those transaction costs — translation between codes and disputes over classification — as much as possible, though the framers of the HS recognised that such problems could never be eliminated entirely. Use of the HS is meant to ensure that a customs administration applies tariffs and produces statistics in accordance with uniform and internationally agreed classification standards. It is also intended to promote as close a correlation as possible between import and export trade statistics and production statistics. Today the HS is used as the basis not only for tariffs and trade statistics but also for:

- Harmonising non-preferential rules of origin.
- Conducting trade negotiations (*e.g.* the WTO schedules of tariff concessions).
- Applying transport charges and collecting statistics on transport.
- Monitoring the movement of controlled goods (*e.g.* wastes, narcotics, chemical weapons, substances that deplete the ozone layer, endangered species).
- Collecting internal taxes.
- Areas of customs controls and procedures, including risk assessment, information technology and compliance.

The HS is governed by the 1983 "International Convention on the Harmonized Commodity Description and Coding System", which took effect on 1 January 1988. Most members of the WCO are also Contracting Parties to the HS Convention. However, about 50 WCO members have not yet taken that step. Being a Contracting Party obliges a country to bring its customs tariffs and statistical nomenclature into conformity with the HS and to publicly report its import and export statistics at the 6-digit HS level.

Maintenance of the HS is carried out by the WCO through its Harmonized System Committee (HSC), which is comprised of representatives of the Contracting Parties to the HS Convention. Each member has one official representative and one vote. The HSC examines policy matters, takes decisions on classification questions, settles disputes and prepares amendments to the *Explanatory Notes*.[22] Though HSC decisions are not binding, members are aware that they are committed to implement them and that if they do not

22. The HSC acts as an international tribunal with regard to the classification of goods in the Harmonized System. In this respect it is the sole international body able to give an authentic opinion on tariff classification.

they are obliged to inform the WCO Secretariat and explain why. Every four to six years, the HSC also prepares amendments updating the HS nomenclature. These reviews are conducted by the HSC's HS Review Sub-committee, which is assisted in its work by the Scientific Sub-committee, in particular on questions involving the classification of chemical products.

The Preamble to the HS Convention stresses the importance of ensuring that the Harmonized System is kept up to date in light of changes that may occur in technology or in patterns of international trade. Article 16 sets out procedures for amending the HS Convention (Box 3.3). Since the HS Convention entered into force, there have been hundreds of requests for amendments. These are normally submitted to the WCO by member administrations.

Box 3.3. Amending the HS Convention

1. The Council may recommend amendments to this Convention to the Contracting Parties.

2. Any Contracting Party may notify the Secretary General of an objection to a recommended amendment and may subsequently withdraw such objection within the period specified in paragraph 3 of this Article.

3. Any recommended amendment shall be deemed to be accepted six months after the date of its notification by the Secretary General provided that there is no objection outstanding at the end of this period.

4. Accepted amendments shall enter into force for all Contracting Parties on one of the following dates:

(a) where the recommended amendment is notified before 1 April, the date shall be the first of January of the second year following the date of such notification,

or

(b) where the recommended amendment is notified on or after 1 April, the date shall be the first of January of the third year following the date of such notification.

5. The statistical nomenclatures of each Contracting Party and its customs tariff nomenclature or, in the case provided for under paragraph 1(c) of Article 3, its combined tariff/statistical nomenclature, shall be brought into conformity with the amended Harmonized System on the date specified in paragraph 4 of this Article.

6. Any State or Customs or Economic Union signing without reservation of ratification, ratifying or acceding to this Convention shall be deemed to have accepted any amendments thereto which, at the date when it becomes a Contracting Party, have entered into force or have been accepted under the provisions of paragraph 3 of this Article.

Source: "International Convention on the Harmonized Commodity Description and Coding System (done at Brussels on 14 June 1983), As amended by the Protocol of Amendment to the International Convention on the Harmonized Commodity Description and Coding System of 24 June 1986", World Customs Organization, Brussels. www.wcoomd.org/ie/En/Conventions/conventions.html.

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Chapter 4

Managing Request-Offer Negotiations under the GATS The Case of Environmental Services

by

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This study is part of ongoing OECD work on trade in services, in co-operation with UNCTAD, to assist WTO members manage request-offer negotiations under the GATS. The objective is to help officials in WTO members both to gain greater insight into issues of importance in the environmental services sector and to see how they might be approached in the negotiations. The current GATS negotiations offer WTO members an opportunity to achieve greater liberalisation of environmental services, and this may lead to significant economic and environmental benefits for all countries. Nevertheless, liberalisation, particularly of environmental infrastructure services, must be appropriately designed and supported by a strong regulatory framework. Making commitments in these services thus raises questions relating to their nature, although the flexibility provided for in the GATS makes it possible to schedule them to take account of their characteristics. Risks of market failure to achieve social objectives appear to be less significant for environmental services unrelated to infrastructure and for support services.

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Introduction

This chapter contributes to ongoing OECD-UNCTAD work aimed at helping WTO members conduct request-offer negotiations successfully under the GATS.[1] It seeks to make the generic negotiating checklists developed in Part II of "Managing Request-Offer Negotiations under the GATS" (OECD, 2002) more specific by applying them to environmental services. The objective is to help WTO members gain greater insight into issues of importance in the environmental services sector and to see how they might be approached in the negotiations.

Today, half of the world's population still lacks access to basic sanitation and one person in five does not have access to safe drinking water. More than 90% of sewage in developing countries is discharged untreated directly into rivers, lakes and coastal waters and about half of the urban population lacks adequate waste disposal. Air pollution has also been a growing problem, as urban expansion and industrialisation have been accompanied by increasing road traffic and energy consumption.

Strengthening the environmental services sector is therefore very important. It is increasingly recognised that more trade and investment in environmental services can provide developing and developed countries alike with greater access to these services, potentially leading to significant environmental and economic benefits (a "win-win" outcome). The current set of GATS negotiations offers WTO members at all levels of development an opportunity to achieve greater liberalisation in an orderly and flexible manner.

There is, at the same time, increasing awareness that opening environmental services markets to foreign competition is no easy task. It involves a broad set of policies, regulatory instruments and institutions. This is particularly true for environmental services, which encompass a wide variety of services with different concerns and priorities. It is therefore necessary to plan liberalisation carefully, ensure compatibility with national and development goals and put the necessary regulations in place. This can pose challenges, particularly for developing countries, which are more likely to have weaker regulatory regimes and more limited administrative and negotiating capacity.

The central purpose of the checklists on environmental services developed here is to help WTO members by highlighting some key issues which they may wish to consider in framing and assessing requests and offers. The checklists are indicative in nature. Considering the great diversity of WTO members' economic interests, export potential and development needs, country-specific fine-tuning is required to enhance their operational value.

After the overview of key trends in global environmental markets and trade presented in the next section, current developments in the GATS are reviewed, including definitional issues, current commitments and progress in ongoing negotiations. The following section then discusses the benefits flowing from greater openness of environmental services markets. Next, the characteristics and priorities of different kinds of environmental services are presented. Options available to WTO members when scheduling commitments are then reviewed, and key issues for consideration in the

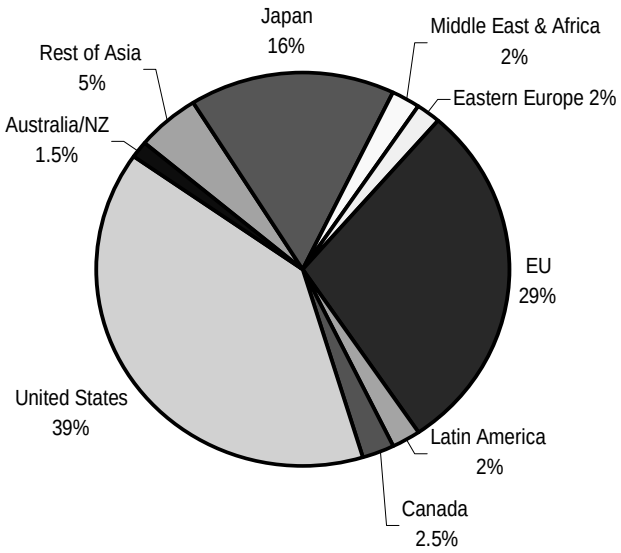
1. Under this joint OECD-UNCTAD project, sectoral negotiating checklists have been completed on insurance (OECD, 2003), energy (UNCTAD, 2003a) and legal services (OECD, 2004). A further checklist on construction services will be completed by UNCTAD.

negotiations are discussed. The final section presents the checklists of questions that WTO members may wish to consider in approaching the request-offer process.

Trends in global environmental markets and trade

The global environmental market as a whole (including environmental goods and services) reached an estimated USD 563 billion in annual revenues in 2002; the United States, the EU and Japan accounted for about 85% (Figure 4.1). The industry is estimated to have grown by over 15% between 1996 and 2002. Most analysts expect that it will continue to expand, reaching over USD 600 billion by 2010, roughly the size of the pharmaceuticals or information technology industries.

Figure 4.1. The global environmental industry by region, 2002



Source: Environmental Business International (EBI).

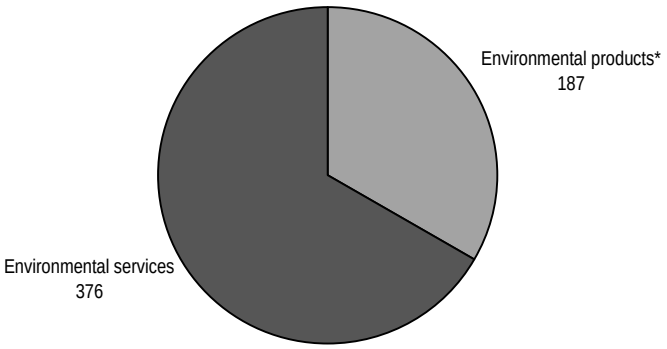
It is difficult to view the environmental services sector as a coherent whole. Traditionally, environmental services have been understood in terms of the infrastructure that provides water and waste treatment services, often by the public sector. More recently, however, a need has been felt to move beyond these infrastructure services, creating demand for other "non-infrastructure" environmental services (*e.g.* air pollution control) and environment-related support services (*e.g.* environmental consulting).[2] This is due to several factors, including new regulatory requirements for the management and control of pollution, growing public sensitivity to environmental problems, and trends in private participation and liberalisation that have generated private demand for a range of environmental services.

2. The distinction between environmental infrastructure, "non-infrastructure" and support services is used throughout the chapter for analytical purposes. (It derives from a similar distinction developed by UNCTAD.) However, it is not a classification of environmental services, nor does it aim to replace the current WTO classification or any other classifications of environmental services discussed in the next section of the chapter.

In 2002, the environmental services sector accounted for over 65% of the environmental industry (Figure 4.2). The infrastructure segments of water, sewage and solid waste management represented over 80% of the global environmental services market, although environmental non-infrastructure and support services are becoming increasingly important (see Figure 4.3).

Figure 4.2. Size of the global environmental industry by segments, 2002

USD billions

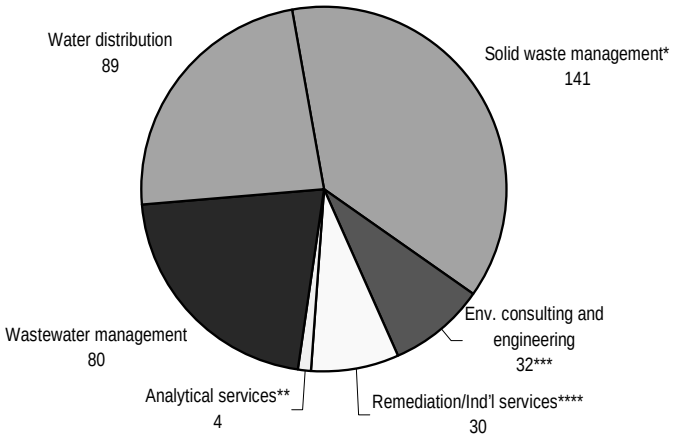


*Mainly equipment and products recovered from waste.

Source: EBI.

Figure 4.3. The global environmental services segment, 2002

USD billions



Note: The categories are those used by EBI and do not correspond to sub-sectors in the WTO classification.

* Also includes hazardous-waste management.

** Includes testing of "environmental samples" (soil, water, air and some biological tissues).

*** Includes engineering, consulting, design, assessment, permitting, project management and monitoring.

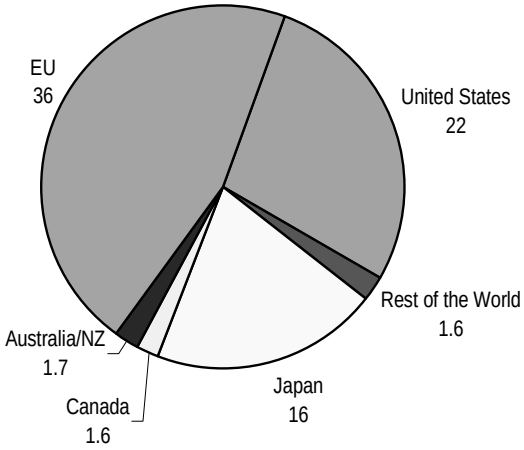
**** Includes physical clean-up of environmental sites, buildings and environmental cleaning of operating facilities.

Source: EBI.

Many of the same factors — increased environmental regulation, public awareness and trends in private participation — are also contributing to the increase in international trade in environmental services. While it is difficult to obtain an idea of the volume of trade because of data limitations, some rough estimates exist for the environmental industry, including both goods and services. These figures suggest that the EU, the United States and Japan were the leading exporters in 2002, accounting together for roughly 90% of total exports (Figure 4.4). Australia, New Zealand and Canada are expanding their environmental exports, but do not account for a large share of the global market. Developing countries are net importers of environmental services, although their exports are increasing. Currently, their exports tend to go mainly to regional markets.

Figure 4.4. Global exports of environmental goods and services, 2002

USD billions



Note: The figures are based on best estimates derived from interviews with companies, researchers and government agencies and are not the product of more comprehensive research comparable to the other EBI figures and tables presented in this chapter.

Source: EBI.

Table 4.1 lists the top 50 companies worldwide supplying both environmental goods and services based on revenue; they accounted in 2001 for almost 20% of global environmental revenue, or over USD 100 billion. Among the top 50 firms based on revenue, 22 were from the United States, Germany and Japan each had eight, France and the United Kingdom each had four, Denmark had two and Canada and Spain each had one. Of the top ten, four were from the United States, France and Japan each had two and Germany and the United Kingdom each had one. An interesting aspect is the share of some of these companies' business-to-business activities not only in related consulting services, but also in infrastructure services (*e.g.* outsourced industrial wastewater and sewage management). For example, the French company Vivendi Environnement (called Veolia Environnement since 2003), which has operations in more than 100 countries, earns 40% of its turnover from manufacturing customers.[3] Suez has 485 000 industrial and commercial clients worldwide.[4]

3. www.veoliaenvironnement.com/en/profiles/companies.

4. www.suez.com/metiers/english/environnement/index.php.

Table 4.1. Top 50 environmental companies worldwide, 2001

	Company	Country	Environmental revenue (USD millions)
1	Vivendi Environnement SA	France	17 230
2	Suez (Ondeo, Sita)	France	13 970
3	Waste Management	United States	11 320
4	Allied Waste	United States	5 470
5	RWE Entsorgung AG	Germany	4 790
6	Bechtel Group Inc.	United States	2 640
7	Severn Trent	United Kingdom	2 380
8	Ebara Corp	Japan	2 300
9	Republic Services	United States	2 260
10	Mitsubishi Heavy Industries	Japan	2 160
11	Kubota (Ind'l Eq div.)	Japan	1 830
12	Betz Laboratories Inc. (now GE Betz)	United States	1 820
13	Hochtief AG	Germany	1 760
14	AWG plc (Anglian Water)	United Kingdom	1 740
15	Shaw Group (IT Corp, S&W)	United States	1 610
16	Safety Kleen Corp.	United States	1 510
17	Earth Tech	United States	1 460
18	United Utilities	United Kingdom	1 440
19	CH2M Hill Cos.	United States	1 420
20	Vestas	Denmark	1 280
21	Kurita Water Industries	Japan	1 260
22	Noell Gmbh	Germany	1 100
23	Washington Group International (M-K)	United States	1 040
24	Fomento de Construcciones y Contratas	Spain	1 040
25	Hitachi Zosen	Japan	970
26	Takuma (Envl Eq & M/M divs)	Japan	920
27	Kelda Group (Yorkshire)	United Kingdom	910
28	Philip Services	Canada	810
29	Bilfinger + Berger	Germany	810
30	NEG Micon	Denmark	790
31	Babcock Borsig (Deutsche Babcock)	Germany	790
32	Black & Veatch	United States	730
33	Foster Wheeler Corp. (part of Tetra Tech)	United States	730
34	Linde	Germany	720
35	Fluor Daniel Inc.	United States	720
36	Rethmann Entsorgungs	Germany	710
37	URS Corp	United States	700
38	Organo	Japan	700
39	Parsons Engineering Science	United States	680
40	Philipp Holzmann	Germany	600
41	Tsukishima Kikai	Japan	590
42	MWH Global (Montgomery-Watson)	United States	570
43	Alstom	France	560
44	Tetra Tech Inc.	United States	550
45	Rhodia Eco Services	France	510
46	Casella Waste Systems Inc. (Rutland, VT)	United States	480
47	Battelle Memorial Institute	United States	450
48	Camp Dresser & McKee Inc.	United States	440
49	Jacobs Engineering	United States	410
50	Stericycle	United States	390

Source: EBI.

The largest environmental companies are thus concentrated in developed countries. However, companies from developing countries participate increasingly in the water and sewage sub-sectors, as well as in environmental support services like environmental consulting. These are often companies from Asia and Latin America, which have acquired technological and services capabilities, in part through joint-venture investment in the environmental sector in their own countries (Zarrilli, 2003).

Most trade in environmental services takes place through commercial presence (Mode 3) with the accompanying presence of natural persons (Mode 4). The importance of cross-border trade (Mode 1) and consumption abroad (Mode 2) is also increasing, particularly for environmental support services. Cross-border supply may be particularly relevant for transmitting architectural and engineering specifications and design plans for environmental projects, or reports of specialist environmental consultants. The Internet has greatly increased the scope for cross-border supply of such services.

Current developments in the GATS

Definition of environmental services

In the WTO services sectoral list (W/120), which is largely based on the Provisional United Nations Central Product Classification (Provisional CPC), the environmental services sector comprises: *i)* sewage services; *ii)* refuse disposal services; *iii)* sanitation and similar services; and *iv)* other (cleaning services for exhaust gases, noise abatement services, nature and landscape protection services, and other environmental services not elsewhere classified).[5] The classification reflects a traditional view of environmental services as largely public infrastructure services supplied to the general community, and focuses mainly on waste management and pollution control.

In recent years, the OECD and Eurostat have developed for analytical purposes a more comprehensive classification of the environmental industry, for both goods and services. This classification aims to be as complete and flexible as possible for classifying the industry as it is at present and allowing for changes such as the development of new types of environmental services. It is divided into three broad categories according to the type of economic activity: *i)* pollution management group; *ii)* cleaner technologies and products group; and *iii)* resources management group (see OECD/Eurostat, 1999, for details).

The WTO Committee on Specific Commitments has also been exploring ways to modernise the existing GATS classification of environmental services. Several members have submitted proposals suggesting alternative definitions of environmental services that could be used for submitting requests and offers. The EC proposes the creation of seven sub-sectors based on the environmental medium (air, water, soil, waste, noise and so forth); these closely resemble the first category of the OECD/Eurostat classification (pollution management group). The EC submission, like the OECD/Eurostat classification system, includes a category for "Services related to the collection, purification and distribution of water", which is not classified in either W/120 or the Provisional CPC, but which is often closely associated with environmental services (WTO, 2000a).

5. Subsequent versions of the CPC Classification (CPC Ver. 1.0 and 1.1) have introduced greater disaggregation in some of the sub-sectors of environmental services. For example, sewage services have been divided into sewage treatment services and tank emptying and cleaning services.

A communication by Switzerland is close to the EC proposal, except for water distribution, which Switzerland did not include (WTO, 2001a). Australia is also in favour of broadening the current classification and supports in principle the EC's proposed approach (WTO, 2001b). The United States supports proposals that incorporate a core list of environmental services composed primarily of the currently classified environmental services sectors (WTO, 2000b), though in its preliminary offer it proposed to reorganise the sectoral description according to the EC proposal (with some differences, see below). Colombia considers it would be useful to establish a model list incorporating new services not already included in the current classification (WTO, 2001c).

An important feature of the GATS classification (and of most classifications) is that services sectors are classified in a mutually exclusive way. In other words, services in one sector cannot be covered by another sector. In addition to the identification of "core" environmental services, some members propose establishing a list that would cover services that are not environmental *per se*, but which are nevertheless important to the provision of environmental services, for instance because they have environmental end uses (such as engineering or R&D). These environment-related services would be subject to a "cluster" or "checklist", which could be used as an *aide-mémoire* during negotiations. The results would be scheduled in the relevant (non-environmental) GATS sectors.

Existing commitments and beyond

Under the GATS, all WTO members are subject to limited general obligations, which apply, for the most part, to all services sectors including environmental services.[6] These include most-favoured nation (MFN) treatment and transparency. Market access (Article XVI) and national treatment (Article XVII) are not general obligations, but are granted in sectors which a member lists in its national schedule of specific commitments and to the extent indicated in the schedule.

During the Uruguay Round, 38 WTO members (counting the then 12 EC member states as one) made commitments on one or more of the four sub-sectors of environmental services. The number of commitments in the individual sub-sectors is roughly equal: 29 on sewage, refuse disposal and other environmental services; 30 on sanitation and similar services; and slightly fewer on individual segments of other environmental services. Of the 20 members that subsequently acceded to the WTO, all except Mongolia have made commitments in at least one sub-sector of environmental services.

The Uruguay Round was just a first step in a longer-term process of multilateral rule making and liberalisation for services trade. WTO members agreed "to enter into successive rounds of negotiations with a view to achieving a progressively higher level of liberalisation" (GATS Article XIX). Negotiations on services started in January 2000 as part of the "built-in agenda"; at Doha, in November 2001, WTO members agreed to begin a new, comprehensive round of negotiations and to build on the work done on services since 2000.

In the course of discussions on environmental services, a question was raised about the reference in the Doha Ministerial Declaration to environmental services and whether it might influence a decision on the appropriate forum to conduct negotiations on these

6. Air traffic rights and services directly related to the exercise of traffic rights are excluded from the scope of the GATS.

services.[7] Consultations in the Committee on Trade and Environment in Special Session (CTE-SS) revealed that there is broad support for the idea that the negotiations on environmental services should be conducted as part of the overall services negotiations in the Special Session of the Council for Trade in Services (WTO, 2002).

In the first phase of the negotiations, several WTO members tabled general proposals outlining their interests in the negotiations on environmental services. Several, including two developing countries, submitted proposals on environmental services. The proposals share several common elements. Most recognise the potential benefits flowing from greater market openness in the environmental services sector and call for further liberalisation through the reduction of measures affecting trade in the sector. The need to facilitate the establishment of foreign firms (Mode 3) and the movement of key personnel (Mode 4) is also frequently mentioned. Several members highlight the fact that negotiations on environmental services should not impair members' ability to regulate. The importance of greater transparency of regulations in the sector is often raised as is, to a lesser extent, the transfer of technology and know-how (Table 4.2 lists the key elements of the proposals in more detail).

The guidelines and procedures for the negotiations adopted by the WTO Council for Trade in Services, and later reaffirmed in paragraph 15 of the Doha Ministerial Declaration, set the request-offer approach as the main method for negotiating specific market access commitments in services. It was agreed that members should submit initial requests by 30 June 2002 and initial offers by 31 March 2003. The agreement of 1 August 2004 reaffirmed members' commitment to progress in the services negotiations and called on them to table new or revised offers by May 2005.

As part of this second phase of the negotiations, members have been exchanging initial requests and offers. While requests are addressed bilaterally to negotiating partners (and it is therefore not possible to know their exact number or content), offers are traditionally circulated multilaterally (because of the MFN rule) and several are publicly available. So far, 48 members have submitted initial overall offers.[8] Of these, 12 have been derestricted by the members concerned and are publicly available on the WTO Web site.[9] Another 13 are available via national or other Web sites.[10] Of the 25 offers that are publicly available, 11 offer to make new commitments on environmental services.

7. Paragraph 31: "With a view to enhancing the mutual supportiveness of trade and environment, we agree to negotiations, without prejudging their outcome, on:…(iii) the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services."

8. Argentina; Australia; Bahrain; Bolivia; Brazil; Bulgaria; Canada; Chile; China; Colombia; Costa Rica; Czech Republic; Dominican Republic; European Communities and its Member States; Fiji; Gabon; Guatemala; Hong Kong, China; Iceland; India; Israel; Japan; Jordan; Kenya; Korea; Liechtenstein; Macao, China; Mexico; Mauritius; New Zealand; Norway; Panama; Paraguay; Peru; Poland; Singapore; Slovak Republic; Slovenia; Sri Lanka; St Kitts and Nevis; Senegal; Switzerland; Suriname; Chinese Taipei; Thailand; Turkey; United States; Uruguay.

9. Australia; Canada; Chile; the European Communities and its Member States; Iceland; Japan; Liechtenstein; New Zealand; Norway; Slovenia, Turkey; United States.

10. Argentina; Bulgaria; Colombia; Hong Kong, China; India; Israel; Mexico; Panama; Paraguay; Poland; Singapore; Switzerland; Uruguay.

Table 4.2. Main features of the negotiating proposals

Member	Benefits of liberalisation	Measures affecting trade	Modes of supply	Regulations	Transfer of technology	Other elements
Australia		There are several measures, *e.g.* limitations on the type of legal entity, general limitations on foreign investment and licensing requirements, that should be addressed in the negotiations	Members should eliminate limitations on commercial presence that cannot be justified	Government licensing and ownership regulations should be transparent and not unnecessarily restrictive		
Canada	Liberalisation can lead to several benefits, *e.g.* greater transparency, lower prices and greater availability, transfer of knowledge, and a healthier environment	Members should aim at eliminating measures affecting trade in the sector, such as investment and establishment measures, entry and stay of personnel and licensing requirements	Members should eliminate limitations on commercial presence and on the temporary movement of personnel	An important aspect is the regulatory framework in which this sector operates. The GATS reaffirms the right to regulate, but in a transparent manner The lack of transparency of regulatory regimes should be addressed		
Colombia	Commercial presence of foreign firms may be beneficial for developing countries (*e.g.* increased investment, technology transfer, and improved environment)		To strike a balance in the negotiations, commitments on Mode 4 need to be improved	Professional qualifications of foreigners should be taken into account (*e.g.* equivalent levels of education and experience)		Private participation would lead to more efficient management in the provision of the service and ensure wider coverage The level of development of the members should be taken into account
Cuba	With appropriate regulations, liberalisation can help the development of the sector in developing countries		Progress should be made in modes of supply of interest to developing countries	Members must be able to regulate, *e.g.* to preserve the national environment	Difficulties in accessing technology and know-how should be eliminated	Different levels of development should be taken into account, particularly through progressive liberalisation, differential treatment and capacity building

Member	Benefits of liberalisation	Measures affecting trade	Modes of supply	Regulations	Transfer of technology	Other elements
EC (2 proposals)	Liberalisation leads to a win-win scenario, *i.e.* transfer of technology, price and efficiency effects for domestic budgets and improved welfare, health and environment	Members should reduce measures affecting trade in the sector, *e.g.* monopoly issues, restrictions on foreign investment and the movement of key personnel, licensing, economic needs tests, residency and nationality requirements	It would be desirable to enhance commitments on Modes 1, 2 and 3 for all sub-sectors and eliminate relevant restrictions Discussions should aim at improving the temporary movement of natural persons for the provision of specific services			
Switzerland	Liberalisation can lead to several benefits, *e.g.* lower prices and greater availability, and transfer of know-how (particularly in the area of prevention)	Attempts should be made to reduce several measures affecting trade in the sector, *e.g.* general investment limitations, economic needs tests and licensing	Broader commitments on Mode 3, but also Modes 1 (where feasible) and 2, would facilitate trade in the sector. There must also be negotiations on Mode 4		The transfer of technology and know-how is key, because it leads to higher standards of public health and well-being worldwide	
United States	Liberalisation can lead to several benefits particularly for developing countries, *e.g.* less expensive, better quality services, increased availability, innovation, and improved health and environment	Negotiations should aim at reducing market access and national treatment measures Discussions should also address measures in related sectors such as professional services and business services (*e.g.* advertising)	Liberalisation would be most beneficial in the context of GATS Modes 3 and 4	Members must be able to regulate, *e.g.* ensure performance and quality controls, and that service providers are fully qualified and carry out their tasks in an environmentally sound manner The guidance described in the US submission on transparency would benefit this sector as well		

Note: This table does not include issues of classification, which were dealt with above.

Several members that have made submissions have *de facto* adopted a classification similar, though in some cases with differences, to the one proposed by the EC (Table 4.3). A number of submissions therefore relate to items added as part of the EC classification, such as protection of ambient air and climate, remediation and clean-up of soil and water, and noise and vibration abatement. No member, however, has proposed to make commitments on water distribution. Other members have offered to make new commitments using the WTO/CPC classifications and, in one case, this includes new commitments in all four categories of the Provisional CPC. Some members have also

proposed to remove market access and national treatment limitations to improve their current schedules.

Table 4.3. Classification used by members proposing new commitments on environmental services

EC classification*	WTO/120/Prov. CPC
Australia	Hong Kong, China
Japan	Iceland
Norway	Israel
Switzerland	Panama
United States	
New Zealand**	

Note: The table includes only publicly available offers.

*The EC classification has in some cases been adopted with variations.

**The commitments are limited to "consultancy related to the provision of environmental services".

Source: WTO members' offers.

Benefits of open markets for environmental services

Liberalising trade in environmental services can lead to significant environmental and economic benefits. In the case of environmental infrastructure services, gains can be made in particular through private companies' access to global capital markets. Since the provision of these services requires high levels of investment and expertise, the commercial presence of foreign enterprises may contribute to increased investment and thus to greater availability of these services to the benefit of the environment and the health of the population. This is likely to be most beneficial in emerging economies and developing countries where environmental problems are compelling and where domestic financial concerns may require even more careful balancing of environmental with other priorities. Liberalising these services can also improve the efficiency of utilities by introducing incentives to reduce wasteful costs and collect revenues.

Improved market access for non-infrastructure environmental services, including support services, could offer new market opportunities for firms in both developed and developing countries and also provide all countries, in particular developing countries, with greater access to these services while lowering their cost. The increased competition resulting from greater market access for foreign firms can lead to innovation and the provision of improved environmental services, thereby benefiting the environment (WTO, 2000b).

Liberalisation of trade in environmental services can also provide easier access to environmentally sound technology and know-how (Box 4.1). In particular, partnerships between firms in developed and developing countries are proving a valuable tool for helping firms in developing countries to acquire state-of-the-art technologies. For foreign firms, such partnerships facilitate activities in developing and emerging markets, where environmental and business conditions can be quite different from those at home (UNCTAD, 2003b).

Box 4.1. Trade in services as a channel for technology transfer

Trade in services is a potential vehicle for the transfer and dissemination of technology. Cross-border supply (Mode 1) can involve the passage of the technology embedded in the imported service from the innovating country to the receiving country, resulting in a passive technology spillover.

Potentially more important are the *active* knowledge spillovers (learning and adaptation of the embedded technology) that might diffuse from Modes 3 and 4. In particular, the establishment of a foreign commercial presence and the temporary presence of highly skilled foreign personnel may provide opportunities for person-to-person communication and learning by doing. This can occur through formal training and informal knowledge sharing. It could therefore facilitate the transfer and dissemination of technological knowledge and, even more importantly, non-codified (tacit) knowledge, typically pertaining to technical expertise and professional know-how. Additionally, as far as Mode 4 is concerned, interaction between domestic and foreign firms (backward and forward linkages) may favour technological diffusion (person-to-person communication and learning by doing through informal knowledge sharing or formal training).

Source: UNCTAD 2003a.

Stronger domestic capacity built via imports may also lead to the development of export capacity, enabling developing countries to become international providers of these services. Some developing countries may be able to compete in sub-regional or regional markets where experience with similar environmental problems is important. Moreover, they may be able to offer a range of products and services that are not only price-competitive, but also based on technology adapted to local conditions.

Other benefits can also be realised through greater liberalisation of environmental services. The increased availability and efficiency of these services can make importing countries more attractive destinations for foreign direct investment. Employment can also benefit in developing countries as they possess significant human capital. The expansion of the environmental services sector can provide employment opportunities for unskilled as well as skilled labour in these countries, as some environmental segments are labour-intensive such as solid-waste management and consulting. Enhanced access to environmental services can also contribute to the competitiveness of key industries. There is evidence that some of the fastest-growing industrial sectors in developing countries, such as steel or energy, would benefit from improved access to environmental services (OECD, 1997).

Recent OECD work has provided concrete examples of economic and environmental benefits accruing to a range of developing countries from liberalisation of their environmental services markets (OECD, 2001). The study provides over 60 examples of foreign private participation in the provision of environmental infrastructure services in developing countries in the past decades. The focus is on the services that represent the most immediate environmental services priorities for most developing countries; they are also the most demanding in terms of financial resources and represent bigger budgets than non-infrastructure services. In addition, much more information is readily available, owing to their status as basic services. There have been a number of "win-win" outcomes from trade and investment liberalisation of these services, in terms of roll-out of services to the population and industry, environmental quality improvements, participation by local firms and provision of local jobs.

Examples of export opportunities in environmental services for developing countries are also mounting. Cuba, for example, has supplied environment-related services in the form of studies, assessments and consultancies to various countries in Latin America (UNCTAD, 2003b). Similarly, enterprises in Brazil have undertaken initiatives to import environmentally sound technologies from foreign firms, build capacity and become international providers of environmental services (Box 4.2).

Box 4.2. Business opportunities for Brazil

Brazil was the first country in Latin America to implement a coherent package of environmental legislation. In addition, individual states developed legislation, the most advanced probably being the State of São Paulo, where a public company, CETESB (*Companhia de Tecnologia de Saneamento Ambienta*l), developed the capacity to absorb, adapt and modify environmentally sound technologies imported from developed countries. CETESB runs training activities aimed at upgrading the technical skills of its personnel, and it is responsible for approving large construction projects, after assessing their environmental impact. The company runs a number of projects of great importance to the country and the region. With the co-operation of the United States Environmental Protection Agency, and using funds made available by the World Bank, CETESB has started a pilot project with a group of private firms in the State of São Paulo aimed at replacing end-of-pipe technology (treatment of wastes and polluting streams) with cleaner technology (pollution and waste prevention). It has undertaken initiatives to import and adapt technology for cleaning up industrial sites to local conditions, for managing aquatic resources, and for incinerating industrial waste. It has also implemented a project to reduce air pollution from mobile sources in São Paulo. The results of these projects are relevant to other countries in the region that share the same problems of air contamination (especially in large cities), dependence on end-of-pipe technology, and limited capacity to deal with highly sophisticated technology.

CETESB has been providing consultancy services to other Latin American countries (Argentina, Uruguay, Paraguay and Mexico), has opened its training courses to technicians from foreign countries (including Portuguese-speaking African countries) and is thinking about developing a marketing strategy to sell its services to foreign countries. The income generated by these activities would represent a new source of financing for environmental initiatives in the State of São Paulo. Some private firms are also providing environmental services abroad. The technologies and services provided by these companies may be more appealing to neighbouring countries than those supplied by firms from developed countries because of knowledge of environmental problems specific to the region, cultural affinities, a similar language and greater understanding of the way in which business is carried out in the region. If Brazilian legislation becomes the basis for the development of environmental legislation in other MERCOSUR countries, export opportunities for both state-owned and private companies may increase dramatically.

Source: Zarrilli (2003), based on Rei and Lucon (2003).

Export opportunities exist for offering an integrated package of goods and services or providing multidisciplinary services. Municipalities can be serviced by a single company performing interrelated services (*e.g.* the collection, transport, disposal, recycling and conversion to energy of waste). In developing countries, some firms are pursuing this business strategy. In Malaysia, a private company whose main business is to operate wastewater plants is following the example of the British and French water companies, providing integrated water services domestically and to other countries in the Asia-Pacific region. Another Malaysian company, which operates engineered water treatment systems, has boosted its capabilities by starting a manufacturing facility. This has given the firm the capacity not only to design and operate its water treatment services, but also to manufacture them. The company is expanding its activities in Indonesia and Thailand

through acquisition and is moving to the specialised market of ultra-pure water[11] (Zarrilli, 2003).

Concerns and priorities for different kinds of environmental services

Environmental infrastructure services

Private sector participation

Historically, trade in environmental infrastructure services — including water, sewage and solid-waste management — has been limited because they were mainly provided by municipalities (although countries such as France have a long tradition of supply by private operators). Government provision was seen as necessary either to ensure socially equitable access to these services or because of their natural monopoly characteristics. The scope for competition in environmental network services has traditionally been limited as the existing infrastructure, *e.g.* sewage pipes, is often prohibitively expensive to duplicate.

Nevertheless, in recent years trade in environmental infrastructure services has increased, following changes in provision which have led to a stronger presence of the private sector. In emerging economies and developing countries, in particular, the drivers of decisions to permit private participation are to increase investment, improve infrastructure performance and introduce competition where feasible. Owing to the lack of domestic capacity and finance, when developing countries' governments decide to open these services to private participation, they often decide to encourage foreign participation.

Competition is possible for solid-waste management services, given that these do not have any constraints related to network duplication. Although these services have traditionally been performed by municipalities, private regulated provision does exist. Already, in both OECD and non-OECD countries, much of the waste generated by food retailers, shopping centres, restaurants and office buildings is collected by private waste collection and disposal service providers (see Chapter 5). Opportunities also exist to introduce competition in sewage treatment.

Even when competition *in* the market may not be feasible — *e.g.* local networks of sewers — it is possible to introduce competition *for* the market through government procurement and monopoly franchises. The procurement of environmental infrastructure services by the public sector would appear to be most relevant for the construction, operation and upgrading of public utilities such as water supply and wastewater treatment, as well as solid-waste collection and disposal (OECD, 2001). Many countries have also used innovative strategies to facilitate private participation in these services. Public-private partnerships (PPPs), such as concessions and build-operate-(own)-transfers have emerged as alternatives to privatisation, with ownership transferred through outright divesture (Box 4.3). A concession contract, for example, grants a private company, typically through competitive bidding, the exclusive right to provide a service for a specified period by using existing facilities and developing new ones. Thus, a concession agreement entails only a temporary transfer of the infrastructure assets (such as sewage

11. Ultra-pure water entails purity specifications so high that every possible measure is taken to avoid contamination (*e.g.* microbial). It is often used in the semiconductor and pharmaceutical industries.

pipes) to the private sector. At the end of the concession period, the assets are transferred back to the public authority (World Bank, 2004).

Box 4.3. Different forms of private sector participation in environmental services markets[1]

Operation, maintenance and services contract

The public sector remains the primary provider of the infrastructure and only contracts out portions of its operation to the private sector. The private sector carries out one or more specified tasks or services for periods from five to seven years. It must perform the service at the agreed costs and must typically meet performance standards set by the public sector. The contract is generally awarded through traditional competitive bidding procedures. The private sector is paid a predetermined fee for the service and does not have a relationship with the end users, all financial interactions being directly with the government. The public sector is responsible for funding any capital investments needed to expand or improve the system.

Concession

An operator (the concessionaire) is awarded full responsibility for the delivery of infrastructure services in a specified area, including all related operation, maintenance, fee collection and management activities. It is responsible, in addition to providing the service, for any capital investment required to build, upgrade or expand it, as well as for financing investments through tariffs paid by system users. The public sector establishes performance standards and ensures that the concessionaire meets them. The fixed infrastructure assets are entrusted to the concessionaire for the duration of the contract (25-30 years) but remain government property.

Build-operate-transfer (BOT) contract

Under a BOT, the operator finances, builds and operates a new infrastructure facility or system according to performance standards set by the government. The operation period is usually 10-20 years. The public sector retains ownership of the infrastructure facilities and becomes both the customer and the regulator of the service. The operator provides the capital to build the new facility. In return, the public sector agrees to purchase a minimum level of output to ensure that the operator recovers its costs during operation.

Joint venture

A joint venture is a company jointly owned by two or more corporate entities, any one of which can be a government-owned or private enterprise, in which the two (or more) companies assume co-responsibility for the delivery of infrastructure. The public- and private-sector partners can either hold shares in a new company or assume joint ownership of an existing company, which provides urban infrastructure services.

Community-based provision

Community-based provision starts when financial or institutional limitations prevent the government from providing adequate services to particular sectors of the population, forcing residents to find their own means of meeting their needs. Community-based providers might include individuals, families, or local micro-enterprises. Initial organisational and material costs are often provided by non-governmental organisations (NGOs), private charities, official development assistance (ODA), the government or the community itself. Maintenance costs are generated by local charges or revenues. Community based organisations often play a key role in organising poor residents into taking collective action and in representing their interests in negotiations with NGOs and governments.

1. These solutions are not mutually exclusive.

Source: OECD (2001).

Addressing concerns about liberalisation

These changes are having the effect of gradually bringing environmental infrastructure services into the realm of the market and exposing them to international trade. However, although the benefits of liberalisation can be very important in terms both of increased efficiency and of service access and affordability, past experience has shown that reforms must be appropriately designed and supported by a strong regulatory framework.

If a government decides to involve private firms, including foreign ones, in the provision of services previously provided solely by the public sector, it needs to shift from being the manager of these services to being their regulator. To achieve public policy objectives in the new environment, new regulatory tools and approaches are required (see below, including Box 4.4 for concrete examples). While these fall largely outside the scope of the GATS, they are important accompanying measures for successful liberalisation:

- *Regulating tariff pricing*. Unlike solid-waste management where market competition is feasible and trade liberalisation can lead to price decreases, private-sector involvement in environmental network services such as sewage collection can lead to higher fees for services supplied by the government, as prices fixed under governmental monopoly often do not cover the cost of providing the service. User fees are one of the most controversial aspects of private-sector involvement. Infrastructure network services are capital-intensive services and whatever the source somebody has to pay: if not users then taxpayers or aid donors. Cost-reflecting tariffs are needed to bring about the investment necessary to maintain, replace, modernise and expand facilities and services. User fees are also crucial for promoting conservation principles and new attitudes in user households and commercial enterprises. A decision to involve the private sector in providing these services does not mean the end of regulation in this fundamental regulatory sphere. Governments retain a key role in regulating utility prices in liberalised markets. The key challenge relates to setting rates that strike a socially acceptable balance between the interests of investors and consumers; attracting needed capital; and ensuring that tariffs are just and reasonable and contribute to universal service objectives. These goals are difficult to achieve simultaneously, and the optimal choice of regulatory mechanisms depends on several factors related to the stage of national development.

- *Regulating to achieve universal access.* In addition to introducing the cost-reflecting tariffs necessary to attract investment, governments may need to put in place policies that help to meet the needs of the population, often in poor peri-urban areas, that cannot afford to pay as much for infrastructure services as wealthier citizens. Allowing entry — particularly in segments where product competition is feasible, *e.g.* solid-waste management — can increase services for the poor, as competition introduces a range of price and quality options that make possible service to populations with lower income levels. Tools to induce the private sector to invest in coverage in low-income areas may also need to be an integral part of any reform programme. A common measure for extending access to service is to include network expansion obligations in contracts with private providers. Governments have also used various forms of subsidies directed at poorer groups of society, although effective targeting remains a challenge. Subsidies can also be used to create incentives for operators to extend access into otherwise unprofitable areas.

- *Regulating to meet service standards.* Government responsibility extends beyond ensuring the availability of service at an affordable price. Service standards in environmental infrastructure services have emerged as a major regulatory issue, not least because many functions of modern society critically depend on these services. Standards include type of service, service quality, service reliability and customer relations. A number of measures induce companies to meet standards, ranging from mandatory service obligations to market-based instruments. Under mandatory service obligations, the regulator sets standards which the companies must meet or face fines or even cancellation of the contract. These schemes entail broader social benefits by ensuring that consumers are protected through guaranteed standards of performance. Market-based instruments, on the other hand, aim at providing incentives to companies to meet targets by increasing efficiency. Particularly in developing countries where large shares of the population do not have access to services, flexible regulation are being introduced that provide the utility with strong incentives to seek creative approaches to meeting service standards, while ensuring that important public policy objectives, *e.g.* water quality, are not compromised.

- *Effective regulatory agencies and competition authorities.* The establishment of appropriate regulatory agencies and competition authorities designed to signal government's commitment to potential private investors and protect consumers from exploitation are essential to the reform process. In a natural monopoly situation, which is the case for water supply and sewage collection, private participation does not, for the most part, lead to a competitive market, but to the replacement of a public monopoly with a private one. Regulatory agencies and competition authorities therefore need to ensure that the interests of consumers are defended against potential abuses by a private enterprise operating in a non-competitive environment. The crucial tasks performed by these institutions — *e.g.* setting tariffs and quality standards, as well as ensuring enforcement — require considerable expertise in appraising the structure, behaviour and performance of markets. Regulatory agencies and competition authorities also need to be both largely independent from political influence and accountable for their actions.

- *Transparency and users' involvement.* There is evidence that even people with low incomes are willing to pay for environmental infrastructure services when the services are reliable and the cost of delivering them is reasonably transparent and understandable. Experience also suggests that people and businesses will pay more when they receive new or improved services. In the context of reform, this suggests that dissemination of detailed information about the improvement in services, and the capital investment needed to create these improvements, is essential for public acceptance of increases in overall prices. The new or improved services need to be clearly described and rate changes need to be phased in and accompanied by education and information programmes describing the changes and the reasons for them. Phasing in price increases allows people and businesses to adjust to price changes if the schedule of change is communicated in advance and people believe that it will actually be implemented (Gleick *et al.*, 2002). Making information available to consumers can mobilise them to play a role in monitoring the performance of service suppliers and the enforcement of regulation.

Box 4.4. Examples of some regulatory approaches and outcomes[1]

Tariff policy in the Chilean water and sewage sectors

Chile gradually introduced a new tariff formula in its water and sewage sectors from 1990 to 1995, when it reformed its publicly owned Santiago Metropolitan Sanitary Works Enterprise (*Empresa Metropolitana de Obras Sanitarias*, or EMOS) by means of a regulatory framework mimicking the design of a concession with a private utility. EMOS was still a state-owned company but started to operate under private law (privatisation ultimately occurred in 1999) and under the supervision of an independent regulatory agency. The tariff policy was designed both to signal to potential private investors that the government was committed not to expropriate their return on capital by under-pricing but would curtail the possibility of monopoly rents. Tariffs are calculated every five years to cover the long-run marginal cost[2] of a "model" or benchmark company and are then readjusted to permit a "reasonable" return on assets (allowing at least a 7% return on capital). The water tariff is also indexed to a price index. To reduce the risk of monopoly rents, the construction of the model company was a black box so that it would be difficult for the company to manipulate the information. The tariff has thus incentive properties similar to a price cap. If EMOS can be more efficient than the model, it earns additional profits, giving the company an incentive to maximise efficiency. At the end of the period, tariffs may be adjusted downward to force the company to share its gains with consumers. The reforms led to significant gains to the government through taxes and dividends, while consumers benefited from almost 100% coverage of expanding demand, better water pressure and fewer interruptions of service. Consumers also had to pay higher prices, but the effects were softened by direct subsidies. Employees gained from wages closer to market wages.

High tariffs in two water and sewage concessions in Argentina

In 1995 private participation was introduced in the water and sewage sector in the province of Tucuman, Argentina. A 30-year concession contract was awarded to a consortium composed of Compagnie Générale des Eaux and a local investor. Aggressive investment targets were set in the contract. These had a major impact on prices, which rose by up to 68%. In addition, the increase was spread across all consumers equally, with serious affordability implications for low-income households. This problem had not been foreseen and was not addressed early in the reform process. The new tariff became very unpopular and public disapproval turned to resentment following outbreaks of turbid water. A non-payment campaign was organised and an anti-privatisation local government was elected. The financial situation of the concessionaire further deteriorated and several attempts to renegotiate the contract failed. A social tariff was then proposed but public confidence had been lost and the case ended in international arbitration.

In May 1993, a 30-year concession contract was awarded to a private company to operate water and sewage services in Buenos Aires. Consumers already connected to the system initially benefited from a significant drop in tariffs and better quality and reliability of service. Expansion targets set by geographical area, with poor areas prioritised, resulted in large numbers of new households being connected. However, an unpopular decision to pass the cost of system expansion on to new consumers in the form of a hefty infrastructure charge led to public unrest and early contract renegotiation. This very high connection charge, unaffordable for the poor, was replaced by a bimonthly Universal Service and Environmental Improvement fee (SUMA), which was levied on all customers regardless of when they connected to the network. Connection charges were reduced to USD 120 for water or sewage, repayable over five years in interest-free instalments averaging USD 4 per month. In spite of the fact that the changes resulted in a decrease of 74% in average bills in poor areas, from USD 61 to USD 16, the rates remained unaffordable for the poor. In addition, the renegotiation saw a reduction in targets for expansion, again to the detriment of the poor, who are the primary residents of the unserved areas.

Providing incentives to extend water services in Senegal

After various reform efforts failed to improve water and sewage services, the government decided in 1996 to introduce private participation in the sector. A state-owned holding company, SONES (*Société National des Eaux du Sénégal*), was established to own the assets, carry out investments and regulate the water sector. SONES signed an "enhanced" affermage contract with the private company *Sénégalaise des Eaux* (SDE, a subsidiary of the French water company SAUR) to operate water utilities. Under a traditional affermage contract, the company bills all consumers and collects revenue at the tariff set by the government. It then receives a fixed fee (covering costs and a regulated profit) for the total volume of water sold and remits the difference between the revenue collected and the fee to the government. This does not create disincentives to serve poor households as the company receives the same remuneration for all consumers (*i.e.* the affermage fee is the same for each m^3 of water sold). The contract between SONES and SDE is said to be "enhanced" contract in that it incorporates some investment requirements for meeting targets on leakage and bill collection as well as incentives in the fee formula. A social programme was designed to expand service to low-income households. SDE receives a fee for each new connection in eligible poor households, through a fund financed by the government and donors. The fee includes a profit to give an incentive to install social connections. This programme was consistent with the social tariff established as part of the affermage contract. Additionally, with the help of donors and NGOs, the government financed the construction of "standpoints" (public water points) for low-income areas with no private connection. Eight years later, this reform had resulted in significantly better services. There has been a 20% increase in the amount of water supplied, and customer connections have increased by 35%. Exceeding its target requirements, SDE has installed a total of 89 000 new connections, 76% of which are social connections provided to poor households. According to the last Senegalese Household Survey (2001), drinking water is available (less than 15 minutes away) to more than 70% of households (almost 90% in Dakar).

Adapting standards to expand access to water and sewage to the poor in Manila

Manila introduced private participation in its water and sewage network in 1997 under two separate concessions. The two concessionaires have been encouraged to use innovative technology and third-party provision by contracts that do not contain strict standards for what constitutes a connection, do not disallow third-party provision and allow the concessionaire to add households served through means other than conventional utility connections for calculating compliance with coverage targets. Responding to the need for alternatives for reaching the poor, one of the concessionaires developed a system known as Bayan-Tubig (Water for the Community) for water delivery in densely populated, hard-to-reach slum areas. An underground water line carries water to the perimeter of a slum neighbourhood, and is then extended above ground, partially covered, attached to a wall, or lying on the surface. The line connects to a battery of meters from which homeowners make their own plastic connection, using small diameter pipes running from the main to households on the surface or along walls. Maintenance responsibility for the plastic pipes lies with the customers. Community-based organisations and NGOs play a role in intermediation and mapping the network. Estimates suggest that the Bayan-Tubig connections have reduced water connection costs for poor families by up to 25%. As even these reduced costs are sometimes a challenge, the concessionaire has also introduced interest-free repayment schemes over periods of six to 24 months. Introduced in early 1999, the programme had provided water connections to 19 000 poor households by the end of that year, and as of 2001 the figure had reached over 50 000. The other concessionaire served the poor equally unconventionally, arranging to sell bulk water to a steel tank manufacturing company which then installed small networks to serve poor communities.

1. Certain of the examples describe an experience that was not positive, in hopes of providing some guidance on pitfalls to be avoided if the benefits of liberalisation are to be realised and sustained.

2. The marginal cost is the change in total costs per unit change in output. Long-run marginal cost (LRMC) is estimated over the "long run", *i.e.* that time period over which all costs are variable. It therefore comprises changes in both capital and operating costs.

Source: Brocklehurst and Janssens, 2004; Estache *et al*., 2000; Haselip, 2004; PPIAF and WSP, 2001; Shirley *et al*., 2000; Zerah *et al*., 2001.

Another challenge relates to the need for policies to facilitate adjustment following private-sector involvement and increased competition in environmental infrastructure services. Private participation may lead to a reduction in employment in often over-staffed public utilities (but this can be mitigated by the creation of new employment resulting from an expansion of the network and service). In addition, in many developing countries, it is quite common to make a living from garbage collection and sorting. While large operators sometimes control the process, more often small-scale independent entrepreneurs make a living for their families in this way. They need to be seen as stakeholders in the new arrangements and as potential employees, as they generally have useful knowledge and experience. Governments can also grant adjustment assistance, such as retraining and relocation support. Such public support, of limited duration and in gradually declining amounts, can promote the transition to a more efficient environmental sector over the long term (OECD, 2001).

Experience has also shown that there is no universally appropriate model for reform. Every liberalisation programme must take account of each segment's features, as well as the country's economic, institutional, social and political characteristics. Furthermore, the elaboration of adequate regulatory instruments and the establishment of institutions can be costly and may require sophisticated skills, and thus present challenges that are likely to be most acute in emerging economies and developing countries. For these countries, provision of technical assistance and capacity building to support liberalisation are thus particularly important.

Environmental non-infrastructure and support services

Growing importance of these services

Environmental infrastructure services are still the primary need of many developing countries. However, several are now at the stage of economic and environmental development where they have begun to consider environmental non-infrastructure services. These services involve new approaches to resource use and generally reflect higher environmental awareness and standards. Unlike environmental infrastructure services, these services currently suffer from a knowledge gap, and it appears useful to provide GATS negotiators and policy makers with information on them: what kinds of activities are involved, who are the providers, who are the clients, and what kind of techniques are used.

Changes in regulatory approaches and participation in multilateral environmental agreements (MEAs) have also created demand, including in some developing countries, for a series of related environmental services that are necessary as direct inputs for delivering services in both environmental infrastructure and non-infrastructure services. These support services include engineering, analytical and monitoring, R&D, and consulting services (see OECD/Eurostat, 1999, for details). For example, engineering services are needed to plan a wastewater facility before it is built. Monitoring of air pollution emissions may be undertaken by specialised analysis and assessment firms.

Unlike environmental infrastructure services, environmental non-infrastructure and support services are often provided by small and medium-size enterprises (SMEs), although they may also be supplied by integrated environmental service companies, or by the environmental department of large professional firms in the case of support services. In addition, while, business-to-consumer activities are very important for environmental infrastructure services, environmental non-infrastructure and support services are largely

provided from business to business. This significantly decreases the risks of market failure for achieving social objectives for these services, though some regulatory spheres, such as service standards, remain very important.

Besides commercial presence and the presence of natural persons, which are the main modes of supply of environmental infrastructure services, cross-border supply and consumption abroad may also be involved at different stages in the provision of these other types of services. For example, in the case of air pollution control, air monitors are often set up by a service provider, but samples are collected by the client and then sent to the service provider's laboratory for analysis.

Characteristics of environmental non-infrastructure services[12]

Air pollution control

This category broadly refers to monitoring and control of emission of pollutants into the air, from both mobile and stationary sources. Operation of private air pollution control facilities by independent service providers is not yet commonplace, but monitoring of emissions and of ambient air conditions is. Techniques for monitoring emissions from stationary sources differ from those for monitoring mobile sources, and both differ from monitoring the quality of ambient air. As with many other services not based around infrastructure, the main private clients for air pollution services are point-source emitters of air pollutants, such as operators of fossil-fuelled electric-power generating stations, waste incinerators and petrochemical refineries.

In the case of stationary sources, technicians usually visit a facility, insert a sampling tube into the exhaust gases, and pump a sample of the gas through a filter, aqueous solution, or both. The filter or solution is then sent to a laboratory, which may be located on site or even in another country, for analysis. The monitoring of emissions from mobile sources, mostly cars and lorries, is typically a service that is closely tied to policing. A suspected vehicle is stopped, directed to the side of the road, and a device is applied to its tail pipe to measure emissions of carbon monoxide (CO) and unburned hydrocarbons. Governments are the main clients for this type of service. Monitoring of ambient air quality uses techniques similar to those used for point sources. Government agencies are major consumers of such services, but so are operators of large point-source emitters of pollutants, *e.g.* a facility that must obtain a permit limiting ambient concentrations of pollutants.

Noise and vibration abatement services

Noise can be a nuisance. It can also damage people's hearing and reduce worker productivity. Often it reflects poor design or fault in a system. Companies therefore have an interest in trying to keep the noise of their machinery and plants to a minimum, and to isolate it where it is unavoidable. (Many countries set limits on occupational exposure to noise.) Tracing a noise problem to its source is not always easy. The cause may be a loose bearing or a misaligned exhaust fan. Because intervention on the basis of a wrong guess can be costly, the monitoring and abatement of noise has become a specialised service.

12. This section draws on Chapter 5. The discussion is organised according to a modified version of the headings suggested by the OECD/Eurostat Informal Working Group of Experts (OECD/Eurostat, 1999). The main modification is the addition of a category for "nature and landscape protection services". Reference to these headings is without prejudice to the positions WTO members may take in current negotiations.

Nature and landscape protection services

This category of services refers to a diverse range of activities related to the protection and restoration of individual populations, species or ecosystems, and of the geographic features on which they depend. According to the Provisional CPC, it includes services related to the protection of ecological systems such as drylands, lakes, coastlines and coastal waters; services consisting of studies of the interrelationship of environment and climate (*e.g.* the greenhouse effect), including services related to the assessment of natural disasters and their abatement; and other landscape protection services.[13]

Governments are not the only clients of these services, and in fact may be less important than private firms. Golf courses are one growing client base for these services. In the United States, for example, the US Golf Association supports research to find ways to use native plants in golf courses so as to improve habitat for plant and wildlife while reducing irrigation and fertiliser costs. Interest in exploiting the biodiversity-promoting potential of golf courses is spreading to other countries, and is finding favour in developing countries interested in promoting eco-tourism. Not all services in this sub-sector pertain to problems on land. Many hotels and tourist resorts built along coasts near places of natural beauty understand the value to their businesses of restoring and protecting aquatic ecosystems both because tourists are drawn to them, and because a healthy and stable coastline provides better protection against storm damage.

Remediation and clean-up of soil, surface water and groundwater

The remediation of soil and of water normally involves two distinct types of services, although soil remediation often requires keeping toxic pollutants from leaching into groundwater aquifers. Demand for soil remediation services developed in OECD countries during the 1970s, typically as a response to concerns over health problems connected with past (often illegal) dumping of dangerous chemicals on the ground. Over the years, thousands of contaminated sites have been identified in various OECD countries, many of them less than a hectare in size. Owners of affected properties, whether or not they are themselves responsible for the contamination, are generally unable to sell the land until it has been cleaned or otherwise rendered harmless. They may also find themselves liable for any damage caused to other people or property. To help them, firms have emerged that able to come onto a property and decontaminate it, or at least ensure that the existing contamination does not spread.

Mine-site rehabilitation is another form of remediation service.[14] In OECD countries, companies engaged in the extraction of minerals and petroleum are required, or may be expected by shareholders, to restore land they have disturbed to something close to its original state. The heavier, earth-moving aspects of this work are typically carried out by the mining companies themselves. But the restoration of biodiversity and landscape requires specialist — and often local — knowledge, and services related to seed and plant selection and propagation are typically performed by outside contractors.

Water protection and remediation services have been driven by increases in the seaborne transport of crude oil and petroleum products, and government demands for

13. http://unstats.un.org/unsd/cr/registry/regcs.asp?Cl=9&Lg=1&Co=94060.

14. The different services classification systems leave room for interpretation about this kind of activity. Except for the fact that it can be considered "remediation", it might logically fall under another environmental services category, "nature and landscape protection services".

quicker and more effective responses to spills when they occur. Compared with soil remediation, cleaning up after oil spills employs rather simple technologies. Usually, long, floating barriers (called booms) are placed around the floating oil slick to contain it and prevent it from spreading. Once contained, some of the oil may be removed by "skimmers", either vacuum pumps connected to tanks, or floating disk-and-rope skimmers, to which the oil adheres. In other situations, absorbent materials, such as talc, straw and sawdust, are spread over the oil slick and then collected for processing. Service providers are typically companies that can be called at a moment's notice to fly a team to the site of an oil spill, usually with most of its chemicals, rafts, booms and other cleaning gear in tow.

Environmental protection services not elsewhere classified

This category covers certain other environmental services not included under any of the above headings. The Provisional CPC provides as examples monitoring, controlling and damage-assessment services relating to the deposition of acidifying compounds from the atmosphere ("acid rain") to soils, surface waters and buildings.[15] International conventions implemented in the past, including the 1979 Convention on Long-range Transboundary Air Pollution, have been important instruments for addressing the problems of acid precipitation and have spurred the development of related services.

The monitoring of emissions of acidifying compounds is performed using techniques that are similar to those employed in monitoring emissions of other gases from point sources; only the chemistry, and therefore the reagents needed, differ. Monitoring acid deposition involves, basically, setting up rainfall gauges and then measuring the precipitation's pH and analysing the concentration of different acids.

Formulation of liberalisation commitments

The GATS provides members with a range of choices when making specific commitments. This is particularly important in the area of environmental services, as these comprise a wide variety of services encompassing different needs and concerns. Flexibility is needed to carefully plan liberalisation, identify segments and modes of supply that are compatible with national and development goals, and put in place an appropriate regulatory framework. For example:

- Members are free to exclude a sub-sector or activity within that sub-sector.
- Members may make partial commitments in certain sub-sectors, activities within these sub-sectors and modes of supply, by limiting access or discriminating against foreign suppliers, to protect public policy objectives or provide a supportive environment to the domestic industry.
- Members may take a gradual approach by pre-committing certain sub-sectors for future liberalisation; this transition period allows time to undertake the steps necessary to strengthen these segments domestically and to introduce the necessary regulation.
- Developing countries may specify limitations in their schedules in order to strengthen their domestic capacity, including through access to technology and know-how. The GATS framework provides these countries with additional flexibility

15. http://unstats.un.org/unsd/cr/registry/regcs.asp?Cl=9&Lg=1&Co=94090.

to pursue such objectives, especially in Articles IV and XIX. However, care should be exercised in crafting these limitations to ensure that they do not ultimately deter trade and investment in environmental services, thereby retarding the development of domestic capacity.

- Members can maintain non-discriminatory domestic regulatory measures, such as licensing and qualification requirements, with no obligation to schedule them (as long as they also do not constitute market access measures). These measures fall within the scope of Article VI of the GATS.

Issues for consideration in the negotiations

Key issues for different kinds of environmental services

In current GATS discussions on environmental services, negotiators and policy makers must face several important issues. Clearly, there is a strong public service aspect to environmental services, particularly infrastructure services. Accordingly, governments may choose to provide these services through monopoly public utilities and they obviously retain the right to do so. The GATS leaves it entirely for members to decide whether they provide these services directly or indirectly (through public undertakings), or whether they entrust their provision to a third party (EC, 2003).

First, for all sectors, services provided to the public in the exercise of governmental authority, *i.e.* any service supplied neither on a commercial basis nor in competition with one or more service suppliers, are excluded from the agreement (Article I.3). Since there is no single model of public services — the concept varies according to sectors or segments, national traditions and legal conditions — the coverage of the carve-out will vary depending on the country and service concerned. With regard to the services covered by the agreement, each member maintains the right to determine the specific obligations that can be imposed on the operators. Members fully retain the possibility of excluding from their GATS commitments sectors (or sub-sectors) which they believe private-sector participation could threaten, such as the availability, quality or affordability of the services. Thus, members can maintain the service as a (public or private) monopoly: GATS negotiations have no influence on members' decisions to privatise certain undertakings (EC, 2003).

In addition, especially when private-sector participation is allowed, governments should be confident of their ability to regulate; this often requires several years of experience, including the regulation of foreign participation.[16] Scheduling commitments on environmental infrastructure services thus raises questions relating to the nature of these services. Nevertheless, the schedules of some WTO members provide useful ideas on how to make commitments on these services that take account of their characteristics.

16. The GATS explicitly recognises WTO members' sovereign right to regulate the supply of services within their territory in pursuance of public policy objectives. It should be noted, though, that whenever members make commitments in a given sector, they are obliged to administer their services regulation for that sector in a transparent and predictable manner (Article VI.5). In this context, the GATS calls upon members to develop disciplines for certain specific measures that affect trade in services, namely qualification requirements and procedures, technical standards and licensing requirements (Article VI.4). Such disciplines, which do not yet exist, would aim to ensure that those specific measures are based on objective and transparent criteria and that they do not unnecessarily hamper trade in services, having regard to the need to ensure service quality and other public policy objectives (EC, 2003).

One possibility could be to include in the commitments only services purchased by private industry. For example, US commitments on environmental services cover activities such as wastewater and solid- and hazardous-waste management that have been "contracted by private industry" (it is common for polluting manufacturing firms to have their own wastewater treatment system). The Swiss schedule states that "Nothing in this commitment should be construed to include public work function whether owned and operated by municipalities, cantons or federal government or contracted out by them."

Another approach would be to state clearly that the public sector has a primary role in supplying these services to the public and/or that policy decisions may be delegated to a decentralised level. For example, the schedule of Croatia indicates that, with respect to commercial presence, sewage services "are legally considered as municipal activities, provided primarily by entities owned by local authorities. Private operators may be allowed to provide those services on the basis of a concession granted by local authorities."

A similar, though horizontal, limitation can be found in the EC schedule, which indicates that "In all EC Member States services considered as public utilities at a national or local level may be subject to public monopolies or to exclusive rights granted to private operators." This limitation is complemented by a footnote explaining that "Public utilities exist in sectors such as related scientific and technical consulting services, R&D services on social sciences and humanities, technical testing and analysis services, environmental services, health services, transport services and services auxiliary to all modes of transport. Exclusive rights on such services are often granted to private operators, for instance operators with concessions from public authorities, subject to specific service obligations. Given that public utilities often also exist at the sub-central level, detailed and exhaustive sector-specific scheduling is not practical."

Another issue related to scheduling these services might arise from the government procurement carve-out. Recent discussions in the Working Party on GATS Rules reveal that there are uncertainties among members regarding the distinction between public-private partnerships (for concessions and BOTs) and government procurement (WTO, 1999). Pending the development of a multilateral set of definitions, these concerns can be addressed through the scheduling of adequate limitations (Cossy, 2003).

At the same time, consideration could be given to include environmental non-infrastructure and support services, which are becoming increasingly important from an economic and environmental standpoint, and entail fewer regulatory risks. With respect to these services, the key question for negotiators is whether it would be desirable to think of sectoral as opposed to horizontal commitments, especially on Mode 4 where existing commitments are mainly horizontal.

In the case of environmental support services, it is also important to ensure that any commitments in the environmental services sector are not undermined by the lack of complementary commitments in other sectors. As noted above, support services interact with both environmental infrastructure and non-infrastructure services. If, say, a commitment is made for air pollution control, it may turn out to be of marginal benefit if a corresponding commitment is not made for testing and analysis services. The above proposal for a "cluster" or "checklist" of environment-related services, which could be used as an *aide-mémoire* during the negotiations, could help minimise potential problems.

Measures affecting trade in environmental services

Governments must also have information about the full range of measures that prevent access to environmental markets of trading partners. The questions presented below offer a useful means of obtaining this information, which may not be readily available to negotiators, particularly from developing countries that may lack technical and negotiating capacity. This is particularly true for environmental services, which involve a wide variety of services and a large number of measures that potentially affect market access.

First, because most trade in environmental services takes place via Mode 3, both general and sector-specific foreign investment requirements are very important for international trade. These include conditions for approval of foreign investment and limitations on the level of foreign ownership, the type of legal entity required, the ownership of specific assets and the scope of operations of foreign companies. There may be additional licensing requirements for businesses and professionals motivated by consumer protection and public health and safety regulations. Typically, more specialised licensing requirements also apply to environmental services providers, *e.g.* for handling and disposal of hazardous substances or for specialised environmental data monitoring and analysis. Licensing requirements may be automatic and apply equally to foreign and local suppliers, or non-automatic and subject to approval (or quotas) for foreign businesses. These measures form part of countries' "right to regulate" and should not in themselves be regarded as barriers to trade in environmental services. However, they may become barriers if they discriminate between foreign and local companies, or if they are administered in an inefficient manner[17] (OECD, 2001).

Limitations on the movement of natural persons are also very important, particularly for environmental non-infrastructure and support services, which are typically provided by SMEs that need to bring in highly specialised professionals. Mode 4 restrictions can also be important for environmental infrastructure services, such as solid-waste management. For these services, however, restrictions on intra-corporate transferees may be more relevant, while for environment-related professional services, restrictions on contractual service suppliers can be important. Identifying and capturing export opportunities in these services will also require emphasis on efficient regulation and mutual recognition of qualifications.

Modes 1 and 2 can also be relevant, particularly for environmental non-infrastructure and support services; for example, plans or samples can be sent across borders or be collected by the clients. While Mode 2 is very difficult to regulate, restrictions on Mode 1 can affect trade in these services significantly. For instance, residency in the importing country may be required in order to supply that country's market on a cross-border basis. This can be a significant obstacle to trade for these types of environmental services.

Moreover, environmental services trade may be affected by measures which are largely beyond the scope of the GATS. For example, government procurement is an

17. In GATS terms, licensing and qualification requirements may have both a scheduling and a domestic regulatory element. The GATS does not explicitly require these measures to be included in schedules of commitments, unless they discriminate between local and foreign suppliers or, in the case of licences, if they are used to limit the number of service suppliers through numerical quotas, monopolies, exclusive supplier rights, economic needs tests, etc. (*i.e.* if they constitute national treatment or market access measures). When licensing and qualification requirements relate neither to market access nor to national treatment, they come under the scope of Article VI on domestic regulation.

important factor owing to the high share of environmental services procured by government entities. Local preferences and lack of transparency in procurement processes are among measures potentially affecting such trade. There is, accordingly, a need for services negotiators to be alert to such potential impediments and ensure proper co-ordination with officials in related policy fields (*e.g.* procuring agencies). This can help ensure that the various aspects of liberalising trade in environmental services are taken into account and that countries secure commercially meaningful and development-promoting commitments from their trading partners.

A key issue for many developing countries is the question of regulatory capacity — the human and institutional resources to devise, administer and enforce the required regulatory framework for successful liberalisation. This capacity will determine the nature and pace of liberalisation. Provision of technical and financial assistance to developing countries to build regulatory capacity is thus an important dimension of the GATS negotiations.

The checklists

Questions to raise with trading partners (and be prepared to answer) concerning the value of a request or offer

The checklists below can be used by WTO members when framing and assessing requests and offers in the area of environmental services. While they are primarily framed in request mode, "requesting" countries also need to be prepared to receive similar questions. The two-way policy interaction afforded by request-offer negotiations can underpin attempts to benchmark a country's approach to environmental services regulation against that of its main trading partners and identify means of achieving greater policy convergence or move in the direction of best regulatory practices. Such benchmarking, and the related need (in response to potential requests from trading partners) to identify more precisely what policies and measures can (and cannot) be addressed in the negotiations may also allow a useful policy dialogue between trade officials and regulators and officials in other government agencies, as well as with private stakeholders in business and civil society.

Questions that a country can use to inform the request-offer process include the following (they may also be usefully raised with trading partners; see Table 4.4 for a list of questions relating more specifically to environmental service-related measures that may be addressed under the GATS):

- What is the policy objective being pursued by the relevant regulatory measure?
- Is the objective different for environmental infrastructure services, where business-to- consumer activities are very important, as opposed to non-infrastructure services and support services which are largely supplied business to business?
- Is the measure periodically reviewed?
- Is the policy objective being fulfilled by the measure?
- Can the policy objective be equally achieved through other less-trade restrictive means?

Table 4.4. Negotiating checklists

GATS-related issues

Measures affecting cross-border supply (Mode 1)	• Can non-resident suppliers of environmental and environment-related services serve the market on a cross-border basis (*i.e.* without an established presence)? Is it necessary to channel those transactions through intermediaries? • What types of environmental services are allowed, or restricted, as regards cross-border supply? • Are there any restrictions on the electronic transmission of environmental and related services by non-established foreign service providers? • Is consumer access or connection to the Internet or other electronic networks available through monopoly or exclusively authorised providers? • Is the transfer of capital, payments and/or use of credit cards for such transactions permitted? Is it subject to authorisation? • If entry is restricted, what are the reasons given by the government? • Where and how clearly are such limits spelled out?
Measures governing commercial presence/ownership (Mode 3)	**Private participation** • Is there a government monopoly in the environmental services sector such that private investment is not permitted? If so, in which sub-sectors? • For environmental infrastructure services, how is private participation allowed (concessions, BOTs, etc.)? • How is it regulated at the central and local levels? What are the procedures and criteria used? Is preference given to any particular enterprise or group of enterprises? Is it a transparent process? **Foreign ownership** • In which segments is foreign ownership allowed in the provision of environmental services? • When laws restrict foreign shareholdings in local environmental companies, what is the maximum foreign equity permitted or the minimum local shareholding? **Screening laws** • Are proposed foreign investments in the environmental sector subject to screening by a specialised authority in the host country? • Are there economic needs tests for approval of foreign investment? If so, in which sub-sectors? Are the tests transparent? • Are there nationality or residency requirements for foreign establishment investment (*e.g.* to gain the right to practice environment-related professional services such as engineering)? • Which authorities are charged with the investment screening? • Which criteria apply in evaluating applications for approval? • Are investors offered rights of judicial review against unfavourable decisions by the screening authorities? Are clear administrative guidelines issued from which investors can reasonably predict the response of host country authorities to an investment proposal?
Measures governing commercial presence/ownership (Mode 3)	**Legal and joint venture requirements** • Are environmental firms required to establish locally through a particular legal form of establishment (*i.e.* subsidiary, branch, representative office)? • Are foreign established companies subject to specific performance requirements, including: *i)* licensing requirements and technology transfer rules; *ii)* remittance and foreign exchange restrictions limiting external financial transfers; and *iii)* local hiring and sourcing requirements? • Is entry of the foreign environmental firm conditional on substantial involvement of local participants in the ownership and management of the investment project (joint venture requirement)? • Is local control (*e.g.* 51% or more of the equity contribution) required over the (equity/contractual) joint venture? Does the law provide for a progressive increase in control over the venture? • Are there requirements regarding the composition of the board of directors? • What is the prescribed legal form of the joint undertaking (general partnership, professional corporation or limited liability company)?

Measures relating to licensing	• What laws and regulations discipline licensing of environmental activities? • What types of licences and regimes apply in different segments? What is the rationale for such licensing? • Who issues and monitors licences? • Are licences automatic or non-automatic? • Are licences open-ended or for a definite time? • What licensing procedures (*e.g.* application or bidding procedures) are applied? Under what circumstances are different procedures used? • What provisions apply to modification, termination and revocation of licences?
Measures governing the movement of natural persons (Mode 4)	• How are entry and work permits obtained? • Are there any restrictions on the movement of intra-corporate transferees? What about contractual service suppliers? For the latter, do the same restrictions apply to employees of firms and to independent professionals? • Do the restrictions apply to natural persons seeking long-term establishment or to individuals travelling for business purposes for short periods of time? • Is the entry of foreign experts subject to economic needs tests? Are such tests transparent? • Are there residency or nationality requirements with respect to certain categories of personnel employed by locally established environmental or environment-related firms? • Are equivalent professional qualifications for environmental support services obtained abroad recognised in the importing country? • Are prior experience or post-qualification experience requirements attached to the granting of visas?
• Preferential liberalisation measures	• Are there any preferential agreements affecting the supply of environmental and support services? Which measures are subject to preferential treatment? Do preferential measures also apply to the movement of natural persons? • What conditions must foreign suppliers of environmental support services fulfil to meet the requirements of existing mutual recognition agreements to which host country providers are party? • Does the importing country maintain preferential access arrangements for developing-country service providers?

Additional questions of relevance to negotiators

Effective access to environmental services markets involves the interplay of a wide range of measures. While the GATS provides important means to tackle many of the hurdles that potentially impede access to and presence in services markets, other policy measures (or their lack) not (currently) subject to negotiations under the GATS may still affect the value of liberalisation commitments. Table 4.5 lists a number of additional policy issues that may require the attention of negotiators on environmental services.

Table 4.5. Negotiating checklists

Other issues

Government procurement	• What procurement procedures are applied for environmental services (*e.g.* tendering)? Under what circumstances are different procedures used? • How are intended procurements publicised? • Are there registration, residence or other requirements for potential suppliers? • Is procurement subject to: *i)* local content; *ii)* technology transfer; *iii)* local employment; *iv)* investment or local presence in the importing country? • Do procuring entities grant price advantages to domestically owned companies over foreign companies? • Are there lists of approved suppliers? If so, what are the procedures for checking the capability of firms applying for inclusion on tenderers' lists? • What criteria are taken into account in the award of tenders? Are criteria for award of contracts made available in advance to potential suppliers? How are tenders received, registered and opened? • Are entities required to publish details of contracts awarded or notify unsuccessful tenderers? Are entities required to publish, or provide to unsuccessful bidders, pertinent reasons why their bid was rejected? • What, if any, are the procedures available for parties, domestic and foreign, to lodge complaints against the award of a contract? • Does the procurement regime distinguish between the procurement of environment-related goods and services? If so, what rules apply in cases of joint procurement involving both goods and services?
Regulatory measures[1]	• Which authorities are in charge of adopting and implementing regulation of environmental services? • Must the authorities follow detailed standards or rules in setting prices for environmental utilities? What is the price mechanism used (*e.g.* price cap or cost plus)? • What measures (at which level) and mechanisms are in place to ensure fulfilment of universal access to basic environmental services? In which sub-sectors? Are they objective and transparent? Are foreign service suppliers subject to conditions different from or additional to domestic suppliers in relation to public service obligations? • Which regulations are in place to ensure environmental service quality? Which technical standards apply? Are they transparent? Are alternative, more efficient ways to meet the standards considered? • How is uncompetitive behaviour, such as abuse of monopoly power, addressed? • Are these institutions independent from the government? How is accountability ensured? • Are price changes phased in and the public informed about the reasons for the changes? Are there any programmes in place to promote the participation of consumers and other stakeholders in regulation?
Temporary entry for services-related tools of the trade	• Are there any restrictions on the temporary entry of services-related tools of the trade (*e.g.* construction equipment, technical and training material or engineering software and design tools)? • Do restrictions apply to the temporary intra-firm transfer of service-related equipment? • Do restrictions on services-related tools of the trade apply to contractual service suppliers? • Do customs procedures exist in the importing country allowing for duty-free temporary admission of services-related tools of the trade?
Other relevant measures	• Are there subsidies for environmental services providers? In which segments?[2] • Are there intellectual property rights (IPR) laws or regulations which may inhibit the transfer of environmentally sound technology?

1. Some of these measures may be covered by the GATS if they represent market access or national treatment limitations, or if they fall under Article VI on domestic regulation — thus overlapping with measures relating to licensing in Table 4.4.

2. Subsidies may be covered by the GATS if they discriminate between foreign and national providers, that is, if they constitute national treatment measures.

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Chapter 5

Synergies between Trade in Environmental Services and Trade in Environmental Goods

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This chapter examines the synergies between trade in environmental services and trade in environmental goods. Environmental services are here defined as wastewater management services, solid-waste management services, sanitation and similar services and other environmental services. Services related to the collection, purification and distribution of water are also discussed. After describing each of the environmental services, the chapter identifies broad categories of goods used in their performance and notes that, for some goods, environmental services are driving growth in their markets. Case studies of business-to-business exports of environmental services, mainly from OECD countries to developing countries, are used to gain insight into the kinds of environmental goods used by service providers and how these goods are procured. The case studies provide qualitative evidence that many goods included on either the APEC or the OECD lists of environmental goods are used in the performance of environmental services. These include, in particular, items for holding, conveying, treating and filtering liquids, and instruments for monitoring and measuring. Many of these goods are procured from local suppliers, if not initially then over time as local demand for the associated services develops. The benefits to businesses that engage environmental services providers are many, allowing them to concentrate on their core activities and to shift some of the liability of meeting environmental regulations to other companies. Local employment is also generated. The general implication for developing economies is that the potential benefits of simultaneously liberalising trade in environmental services and in environmental goods are likely to be much greater than liberalising trade in only one or the other.

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Introduction

At the start of the 21st century, much of the world's population still lacks adequate sanitation or access to safe drinking water. Urban and suburban sprawl in developing and developed nations alike is putting pressure on air quality, water tables and biological diversity. Development of industrial and agricultural capacity — crucial for economic development and poverty reduction n many countries — poses similar environmental challenges.

Recent years have seen an increasing trend towards technology-led responses to these environmental challenges, mostly, but not only, in developed countries. This has created new markets for environmental goods and services to remedy and prevent problems related to hazardous waste, air pollution, noise, habitat degradation and unsustainable resource use. A key issue for policy makers is the role that global trade liberalisation can play in delivering solutions to these problems by building international markets for environmental goods and services. Perhaps even more important is the role that environmental goods and services can play in meeting the development needs of countries that are trying to emerge from poverty while protecting the environment on which the health and welfare of their population depends.

When WTO ministers, in paragraph 31(iii) of their 14 November 2001 Declaration, mandated negotiations on "the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services", they committed the international community to undertake further liberalisation of trade in environmental goods and services. These negotiations are currently taking place in separate WTO bodies: the Negotiating Group on Non-agricultural Market Access (NAMA) and the Special Session of the Council for Trade in Services. Meanwhile, the Committee on Trade and Environment in Special Session (CTE-SS) has been actively engaged in clarifying the concept of an environmental good for the purposes of the NAMA negotiations, and on monitoring developments relating to this mandate which are taking place in the other two negotiating groups. Yet the desirability of pursuing liberalisation of international trade in environmental services, in tandem with efforts to liberalise international trade in environmental products and clean technologies, remains as valid as ever. Environmental products, technologies and services are increasingly provided commercially on an integrated basis, whether "horizontally" by firms that bring together the range of materials and expertise required to undertake an entire project for a particular environmental medium (*e.g.* water, air, landscape), or "vertically" by firms that specialise in construction and engineering across several environmental media.

What are environmental services, who uses them, and how are they performed?

Traditionally, environmental services have been understood and defined quite narrowly in terms of facilities that provide water and waste treatment services, often by the public sector. However, over the last 15 years or so, a need has been felt to move beyond this stage, owing to a combination of new regulatory requirements for the management and control of pollution, growing public sensitivity to environmental problems, and trends in privatisation and liberalisation that have created private demand for environmental services and tied them more closely to the market. To develop a more comprehensive definition of the environment industry, the OECD, working with the Statistical Office of the European Communities (Eurostat), formed an Informal Working Group on the Environment Industry, which met several times during the mid-1990s. After

considering various definitions of the environment industry, the OECD/Eurostat Informal Working Group (OECD/Eurostat, 1999) agreed on the following:

> The environmental goods and services industry consists of activities which produce goods and services to measure, prevent, limit, minimise or correct environmental damage to water, air and soil, as well as problems related to waste, noise and eco-systems. This includes cleaner technologies, products and services that reduce environmental risk and minimise pollution and resource use.

Unlike computer and related services, for example, environmental services are not a set of similar activities (see Box 5.1). Thus, oil spill remediation services are very different from air pollution measurement and control services. Even within the same sub-sector there are important differences in technologies employed and skills required, for example, for the collection or mitigation of hazardous waste or of municipal or solid waste. Furthermore, under the WTO/GATS, some services fall into sectors other than those of the core environmental business activities defined above. For example, architects and engineers offering landscape conservation or biodiversity protection could be considered providers of environmental services. They have different skills, educational, licensing and technical requirements than the architects or engineers who design and build water and wastewater infrastructure projects.

Various proposals have been submitted to the WTO to try to address the most widely recognised problems, while preserving the mutually exclusive nature of the WTO's (1991) Services Sectoral Classification List (also known by its document reference number, W/120). The W/120 list for environmental services includes: sewage services; refuse disposal services; sanitation and similar services; and other environmental services. Some countries continue to use the W/120 CPC Provisional List. On the other hand, the EC has proposed a seven-part classification for core environmental services: water, wastewater management; solid- and hazardous-waste management; protection of ambient air and climate; remediation and cleanup of soil and water; noise and vibration abatement; protection of biodiversity and landscape; and a catchall category for other environmental and ancillary services. The EC has also proposed making certain closely associated services part of a special "cluster" or "checklist" that could be used as an *aide-mémoire* during sectoral negotiations and scheduled in the relevant GATS sectors separately from the "core" environmental services categories. The EC proposal in effect updates the classification to better reflect the types of services provided by modern environmental companies, and countries have used it, or an approximation thereof, in submitting their offers in the current negotiations. This chapter takes a similar approach.

The following paragraphs provide an overview of the various environmental services, the kinds of activities involved, the clients and the kinds of techniques used. In organising the discussion, the chapter adopts a modified version of the headings suggested by the OECD/Eurostat Informal Working Group of Experts (Box 5.1). The categories are consistent with, but not identical to, the EC classification. In addition, the chapter looks at "Services related to the collection, purification and distribution of water", which is not classified as an environmental service in either W/120 or the Provisional CPC, but which is often closely associated with other environmental services, notably in the OECD/Eurostat classification system and the one proposed by the EC.

Box 5.1. Formal classifications of environmental services

The Services Sectoral Classification List (WTO, 1991, also known as W/120), developed during the Uruguay Round of multilateral trade negotiations, is based largely on the United Nations' Provisional Central Product Classification (Provisional CPC) system. The environmental services sector was defined to comprise: "Sewage services" (corresponding to CPC Prov. 9401), "Refuse disposal services" (CPC Prov. 9402), "Sanitation and similar services" (CPC Prov. 9403), and "Other environmental services".[1] Even though the "other" category does not explicitly refer to any CPC items, it is generally presumed to comprise the remaining elements of the CPC environmental services category: cleaning of exhaust gases (CPC Prov. 9404), noise abatement services (CPC Prov. 9405), nature and landscape protection services (CPC Prov. 9406), and other environmental protection services not included elsewhere (CPC Prov. 9409). In 1998 the United Nations produced CPC Version 1.0, which introduced somewhat greater disaggregation into some of the sub-sectors of environmental services, while aggregating others. In March 2002 the UN's Statistical Commission issued a slightly revised version of the CPC (Version 1.1).

In the mid-1990s, many countries felt that, from an environmental policy perspective, the classification of environmental services in document W/120 was unduly limited because it did not include all the services that could benefit the environment. An OECD report summed up this concern: "the environment industry is evolving rapidly beyond its traditional focus on pollution control and remediation/cleanup activities to also incorporate a broader range of pollution management, cleaner technology and resource management activities" (1998, p. 9). An informal working group of experts from OECD countries, meeting under the auspices of the OECD and the Statistical Office of the European Communities, consequently developed a more comprehensive definition of the environment industry (OECD/Eurostat, 1999). Under the Pollution Management Group it identified ten environmental service sub-sectors:

- Air pollution control.
- Wastewater management.
- Solid-waste management (further divided into: *i)* hazardous-waste collection, treatment and disposal; *ii)* waste collection, treatment and disposal; and *iii)* waste recovery and recycling (excludes manufacture of new materials or products from waste and scrap).
- Remediation and cleanup of soil, surface water and groundwater.
- Noise and vibration abatement.
- Environmental R&D.
- Environmental contracting and engineering.
- Analytical services, data collection, analysis and assessment.
- Education, training, information.
- Other.

The OECD/Eurostat informal working group also identified ten "activities" (not differentiated according to goods or services) under the Resource Management Group. Among the activities identified was water supply, for which the services component was defined as "any activity that … designs, constructs or installs, manages or provides other services for water supply and delivery systems, both publicly and privately owned. It includes activities aiming to collect, purify and distribute potable water to household, industrial, commercial or other users."

In their submissions to the WTO's Council for Trade in Services, several OECD member countries have suggested alternative classifications that draw on elements of the OECD/Eurostat classification system. However, as R&D, contracting and engineering, and education, training and information services are generic categories mentioned elsewhere in W/120, they have tended to include the environmental parts of these services as part of an environmental services "cluster" rather than among the "core" list of environmental services.

1. Although the use of the Services Sectoral Classification List (W/120) is not mandatory, most WTO members have used it as a basis for scheduling their commitments.

Reference to these headings is without prejudice to the positions WTO members may take in the Special Session of the Council for Trade in Services. As the WTO's own Guidelines for Scheduling (S/L/92, 28 March 2001) underscore, commitments have been made — and can be made — according to the W/120 or CPC classification systems, or to members' own sectoral or sub-sectoral classification or definition, as long as they provide a "sufficiently detailed definition to avoid any ambiguity as to the scope of the commitment".[1]

Wastewater management services

The job of collecting and treating liquid wastes has existed since the dawn of civilisation. In ancient Greek legend, Hercules is said to have cleaned out the Augean stables by diverting water from two rivers through a wall he created in the cattle yard, flushing the waste out through a hole at the other end. Today, those charged with similar tasks usually use more sophisticated techniques.

Mention of the term "sewage services" typically evokes an image of municipal sewage treatment plants, and it is certainly true that the operation of large sewage systems remains one of the major markets for this sub-sector. But private businesses also require sewage services, as does anyone connected to a septic tank. Even in developed countries, many large hotels, resorts and non-incorporated residential communities either do not have access to, or for various other reasons, do not discharge their effluents into municipal sewage systems. Instead, they build, or have built for them, stand-alone sewage treatment works. Sometimes these plants are operated by the corporate clients, but they are increasingly operated by firms that specialise in that service, usually as part of an integrated system for treating industrial waste.

The other major category of wastewater treatment relates to wastes from mines, processing and manufacturing plants. Many large industrial facilities either choose not to, or are barred from, discharging liquid wastes directly into municipal sewage systems. Half a century ago, most plants generating large volumes of liquid waste were built near rivers or seas and simply discharged untreated effluents into these bodies of water. Nowadays, in most countries, they are required by law to minimise their effluent loading. Improvements in waste recycling have played a big role in reducing the volume and toxicity of industrial pollutants. But few industrial processes involving solvents or water have entirely eliminated waste streams. Pollution abatement, in short, remains a necessity.

The range of chemical compounds found in industrial wastewater effluents is enormous. Each process is unique. Treating the effluent from a Kraft paper mill, which contains numerous organic and sulphurous compounds, requires an entirely different set of technologies and chemicals than treating the effluent from a petrochemical refinery, which in turn bears little resemblance to the effluent from a factory that assembles electronic circuits. However, at their most basic levels, each process for treating liquid effluent usually involves some combination of chemically transforming, filtering and precipitating the target compounds.

Before a waste treatment facility is built, the effluent and receiving medium (usually a stream, lake or saltwater bay) is normally assessed. Although the character and volume of the waste can often be predicted without prior measurement, particularly if the discharging facility is similar to one that has already been built elsewhere, engineers still

1. www.wto.org/english/tratop_e/serv_e/guide1_e.htm.

need data on the physical and chemical characteristics of the receiving waters. This requires on-site measurements. Later, once the plant is running, it is necessary to monitor the waste stream and the downstream aquatic environment to ensure that the plant operates as intended and that the pressure exerted on the environment is within acceptable limits.

Waste treatment is increasingly integrated into industrial processes so as to recycle compounds that were formerly discharged, or to yield new, saleable products. According to Australia's Commonwealth Scientific and Industrial Research Organisation (CSIRO),[2] there are potentially six major products that could be produced from wastewater streams:

- Clean water (water mining from sewage and wastewater).
- Methanol and ethanol (transport fuels).
- Methane (as domestic and industrial fuel).
- Sugar-like compounds or polysaccharides.
- Proteins to make pharmaceuticals, fertilisers and feedstock.
- Glycols, such as hydraulic fluids, antifreeze and lubricants.

Solid and hazardous waste services

Measured by mass and volume, wastes generated by humans are not especially hazardous. They include food waste, packaging waste and waste from building sites. Such wastes are difficult to manage mainly because of their volume, and in the case of food because they can spoil and because they attract fauna (such as coyotes in North America, hyenas in Africa, and rats everywhere) that may pose a threat to health and safety. Some wastes collectively referred to as non-hazardous, such as discarded electronic appliances, may nonetheless contain hazardous elements (*e.g.* heavy metals). And disposal methods — incineration, for one — may turn relatively inert materials, like plastics, into compounds that are toxic or carcinogenic.

Homes and commercial entities generate the bulk of non-hazardous waste, collectively often referred to as municipal solid waste. The collection, transport, sorting and disposal of household waste has traditionally been performed in most municipalities either by the municipalities themselves or by companies working under contract to the municipalities. However, private, regulated provision of these services also exists. Already, in both OECD and non-OECD countries, much of the waste generated by food retailers, shopping centres, restaurants and office buildings is collected by private waste collection and disposal service providers. In the United States, private waste management firms sometimes sell services directly to households, with the result that houses in the same neighbourhood might be served by two or more waste management companies.

Hazardous waste is typically a product of activities that handle or produce dangerous chemicals, pathogens or radioactive material. Major producers of hazardous wastes in most countries include manufacturers of pesticides, manufacturers and users of organic solvents, hospitals and medical clinics, and nuclear power plants. Except for hospitals and medical clinics, most enterprises that handle or produce large volumes of hazardous waste

2. www.csiro.au/index.asp?type=mediaRelease&id=WhereTheresMuckTheresBrass.

are private businesses, and they are the main clients of private services that manage such waste streams.

One reason for the growth of private waste management services has been the demand for more innovative solutions to the disposal of waste than simply dumping or burning it. Another has been the advent of extended producer responsibility requirements. The people of Yorkshire, England, have an old saying, "Where there's muck there's brass" (translation: where there is waste there is money to be made). Companies in the business are constantly looking to identify new, positive properties of waste — in effect to turn liabilities into assets. Also, as scientific knowledge about the properties of non-hazardous waste accumulates, the line between non-hazardous and hazardous waste has blurred. Many types of non-hazardous waste are neither inert nor geochemically stable when exposed to the environment, and eventually undergo transformations that can impart hazardous properties that were not evident when the material was freshly generated (Twardowska *et al.*, 2004).[3] Yet many people involved in waste management are not aware of such time-delayed adverse environmental impacts.

Sanitation and similar services

The term "sanitation services" is sometimes confused with two other environmental services: wastewater treatment and the management of solid waste. Under most national and international service nomenclatures, however, it refers more specifically to such activities as street sweeping and the removal of snow from roads, as well as beach cleaning, drain unblocking and ice clearing.[4] In fact, street sweeping is perhaps a misnomer. Besides sweeping, the service usually also involves washing, scraping and removal of weeds. Street sweeping and snow and ice removal are services that are carried out typically by, or on behalf of, municipalities. But they are also used by private businesses. Typical clients are non-incorporated residential communities, operators of large hotels and resorts, and shopping centres and factory sites with extensive paved areas, such as parking lots.

Many technologies are used in street-cleaning services, and the choice depends largely on costs of equipment relative to labour. Sweeping and cleaning services that can be done with the use of hand carts and brooms, or other small equipment, are frequently performed by firms that provide other solid-waste management services. When the cleaning requires larger, mechanised equipment, it is often provided by firms that provide other road-related services. Some of the specialised equipment developed for this industry includes "gully machines" for clearing drains and cesspits, and "grab vehicles" for removing discarded objects.

Other environmental services

Air-pollution control

The corresponding Provisional CPC category for this service is "Cleaning services of exhaust gases" (code 94040), which seems narrower than the definition for this category of the United Nations Statistics Division (UNSD): "Emission monitoring and control

3. Some materials, like boiler ash, are used in common fill, such as in the construction of roads, where they are exposed to environmental conditions similar to those at disposal sites.

4. The Central Product Classification (CPC, 1997) refers to sweeping and snow removal services (94310) and "Other sanitation services" (94390).

services of pollutants into the air, whether from mobile or stationary sources, mostly caused by the burning of fossil fuels; concentration monitoring, control and reduction services of pollutants in ambient air, especially in urban areas".

Operation of private air pollution control facilities by independent service providers is not yet commonplace, although monitoring of emissions and of ambient air conditions is. Techniques for monitoring emissions from stationary sources differ from those for monitoring mobile sources, and both differ from monitoring the quality of ambient air. As for many other services not based around infrastructure, the main private clients for air pollution services are point-source emitters of air pollutants, which are often operators of fossil-fuelled electric power generating stations, waste incinerators, petrochemical refineries and other smokestack industries.

For stationary sources, monitoring may be performed according to an established schedule or continuously. In the former case, technicians visit a facility, insert a sampling tube into the exhaust gases, pump a sample of the gas through a filter or an aqueous solution, or both. The filter or solution is then sent to a laboratory, which may be located on site or even in another country, for analysis. Continuous monitoring usually requires highly specialised equipment that either automates the sampling and analysis process or measures the characteristics of the gas through less direct means, *e.g.* opacity as an indicator of concentrations of particulate matter.

The monitoring of emissions from mobile sources, chiefly cars and lorries, is typically closely tied to policing. A moving vehicle is stopped, directed to the side of the road, and a device is applied to its tail pipe to measure emissions of carbon monoxide (CO) and unburned hydrocarbons. Governments are the main clients for this type of service. In recent years, remote-sensing technologies have been developed that can trace pollutant emissions while vehicles are in motion. The technology works by directing laser beams of different wavelengths across a road; as a vehicle passes through the beams the changes in the light intensity transmitted indicate the concentrations of different gases. One vendor's system can measure emissions of up to four different gases and opacity (as an indicator of particulate matter from diesel engines) and photograph the license plate and the rear of the vehicle for which the measurements were taken.[5]

Monitoring of ambient air quality uses techniques similar to those used for point sources, with a few exceptions. First, because concentrations of pollutants are much lower than in exhaust gases, sampling periods have to be longer. Second, the gases of interest are not identical: some, like ozone, are formed in the atmosphere as a consequence of pollution. Third, whereas the sampling of point-source emissions requires only one or two monitoring devices, ambient air quality monitoring normally requires establishing a network of monitors at locations chosen to give representative results over time and under different wind conditions. Government agencies are major consumers of these types of services, but so are operators of large point-source emitters of pollutants, *i.e.* those that must limit the facility's contribution to increases in ambient concentrations of pollutants.

Besides commercial presence and the presence of natural persons, cross-border supply and consumption abroad may be involved in the provision of these types of services. For example, monitors are often set up by a service provider, but the samples are collected by the client and sent to the service provider's laboratory for analysis.

5. www.mustangdyne.com/pdfs/LT_corp-broch.pdf.

Noise and vibration abatement services

Noise can be a nuisance. It can also damage people's hearing and reduce worker productivity. Often it indicates poor design or a faulty system. Companies therefore have an interest in trying to keep the noise of their machinery and plants to a minimum and to isolate it where it is unavoidable. (Many countries also set limits on occupational exposure to noise.) If noise from their facilities is great enough, they may also have to worry about avoiding complaints from local residents.

Tracing a noise or vibration to its source is not always easy. A loose bearing or a misaligned exhaust fan may cause it, and these are not always easy to identify. Because intervention on the basis of a wrong guess can be costly, noise monitoring and abatement has developed into a specialised service.

Nature and landscape protection services

This category of services concerns a diverse range of activities related to the protection and restoration of individual populations, species or ecosystems, and the geographic features on which they depend. According to the UNSD, this category, which appears in the Provisional CPC (code 94060) but in subsequent versions of the CPC is subsumed under "Other environmental protection services n.e.c. [not elsewhere classified]" (code 9490), covers:

- Services related to the protection of ecological systems such as drylands, lakes, coastlines and coastal waters, including their respective fauna, flora and habitats.
- Services consisting of studies of the interrelationship between environment and climate (*e.g.* the greenhouse effect), including services related to the assessment of natural disasters and their abatement.
- Landscape protection services not elsewhere classified.

The UNSD excludes from this category "forest and damage assessment and abatement services", which are classified in Provisional CPC group 881 ("Services incidental to agriculture, hunting and forestry").[6]

Governments are not the only clients of these services, and in fact may be less important than private firms. Golf courses are a growing client base. In the United States, for example, the US Golf Association supports research to find ways to use native plants in golf courses to improve the habitat for plant and wildlife while reducing irrigation and fertiliser costs. Interest in exploiting the biodiversity-promoting potential of golf courses is already spreading to other countries, and is finding favour in developing countries that are interested in promoting eco-tourism.

Not all services in this sub-sector pertain to problems on land. Many hotels and tourist resorts are built along coasts, near places of natural beauty. Construction and dredging activities in the coastal zone usually entails some disruption, and perhaps alteration, of the inter-tidal area and deeper aquatic environments. In earlier times, these effects would

6. Under the Provisional CPC there are also separate headings for services related to botanical and zoological gardens (code 96331) and nature reserves, "including wildlife preservation services" (code 96332). According to the UNSD's explanatory notes (UN, 1998) to CPC Version 1.0, the latter subclass includes "supervision services of national parks and nature reserves", and "conservation and maintenance services of national parks and nature reserves".

have been ignored. Today, most large hotel chains understand the value to their business of restoring and protecting aquatic ecosystems, both because tourists are drawn to them, and because a healthy and stable coastline provides better protection against storm damage.

Remediation and clean-up of soil, surface water and groundwater

The remediation of soil and of water are normally two distinct types of services, though soil remediation may be required to keep toxic pollutants from leaching into groundwater aquifers. A common type of water remediation service is the cleaning up of an oil spill. Occasionally, a specialised firm will be engaged to remove nutrients or other pollutants from a standing body of water, such as a lake or a pond.

Demand for soil remediation services arose in OECD countries during the 1970s generally as a response to concerns over health problems connected with past (often illegal) dumping of dangerous chemicals on the ground or contamination caused by leaking storage vessels. Over the years, thousands of contaminated sites have been identified in OECD countries, many of them less than a hectare in size. Owners of affected properties, whether or not responsible for the contamination, are generally unable to sell the land until it has been cleaned or otherwise rendered harmless. They may also find themselves liable for any damage caused to other people or property. Numerous firms have appeared that decontaminate properties or at least ensure that the existing contamination does not spread.

Another form of remediation service is mine site rehabilitation.[7] In OECD countries, companies engaged in the extraction of minerals and petroleum are required to restore any land they have disturbed to something close to its original state. That means, in practical terms, carefully removing and storing top soil so that it can eventually be put back in place; refilling and regrading any open pits; and re-establishing a viable ecosystem, complete with local flora and fauna. Although such requirements are not yet universal, many mining and petroleum companies are expected by their shareholders to apply these standards wherever they operate.

The heavier, earth-moving aspects of this work are typically carried out by the mining companies themselves. But the restoration of biodiversity and landscape requires specialist and often local knowledge, so services related to seed and plant selection and propagation are typically performed by outside contractors.

When land restoration requirements were first introduced in OECD countries in the 1970s, the science and technology of ecosystem restoration was in its infancy. Scientists were usually brought in after the disturbance had taken place, and had to learn by doing. One of the lessons they acquired was the importance of undertaking thorough surveys of the local environment before mining or construction takes place, in order to determine the impact these activities will have on the environment and how to mitigate potential impacts. Today, companies that engage experts in biodiversity and landscape protection are well advised to involve them early in the process.

Water protection and remediation services have been driven by increases in the seaborne transport of crude oil and petroleum products, and the demands of governments

7. The different services classification systems leave room for interpretation for this kind of activity. Except for the fact that it can be considered "remediation", it might logically fall under the category "nature and landscape protection services".

for quicker and more effective responses to spills when they occur. Compared with soil remediation, cleaning up after oil spills employs rather simple technologies. Long, floating barriers (called booms) are usually placed around the floating oil slick in order to contain it and prevent it from spreading. Once contained, some of the oil may be removed by "skimmers", either vacuum pumps connected to tanks, or floating disk-and-rope skimmers, to which the oil adheres. In other situations, absorbent materials, such as talc, straw and sawdust, are spread over the oil slick and then collected for processing. Service providers are typically companies that can be called at a moment's notice to fly a team to the site of an oil spill, usually with most of its chemicals, rafts, booms and other cleaning gear in tow.

Environmental protection services not elsewhere classified

This category is a catchall for environmental services not covered under any of the above headings. The EC has suggested that it refers to "other environmental protection services" and "services related to environmental impact assessment". The UNSD provides as examples monitoring, controlling and damage assessment services relating to the deposition of acidifying compounds from the atmosphere ("acid rain") to soils, surface waters and buildings.[8]

In Europe and North America, the 1979 Convention on Long-range Transboundary Air Pollution[9] has been an important framework for efforts to address problems of acid precipitation and deposition, and has spurred the development of related services. Operators of industrial facilities, waste incinerators and coal- or oil-fired electric power plants are the main clients of monitoring and damage assessment services relating to acidifying deposition. Such facilities account for the bulk of acid precursors (sulphur dioxide, nitrogen oxides and hydrogen chloride) emitted to the atmosphere. Controlling acidification can involve either the generators of the acidifying compounds or owners of property affected by acid deposition.

Emissions of acidifying compounds are monitored using techniques similar to those employed in monitoring emissions of other gases from point sources; only the chemistry, and therefore the reagents needed, are different. Monitoring acid deposition basically involves setting up rainfall gauges and then measuring the precipitation's pH and analysing the concentration of different acids. These services may be provided by a wide range of firms, from small laboratories to large, integrated environmental services companies. As with protection of ambient air or climate, cross-border supply and consumption abroad may be involved at different stages in the provision of the service.

Services related to the collection, purification and distribution of water

According to Cossy (2005), neither the W/120 nor the Provisional CPC contains a distinct category for water-related services. Rather, certain sectors include water-related activities. As she explains:

> Nothing in the Secretariat's [W/120] list, however, refers to water distribution and the question does not appear to have been raised at the time it was established. The CPC Prov. only contains an entry for "distribution services on a fee or contract basis of … steam and hot water to household, industrial, commercial and other users" in a section

8. http://unstats.un.org/unsd/cr/registry/regcs.asp?Cl=9&Lg=1&Co=94090.

9. www.unece.org/env/lrtap/lrtap_h1.htm.

dealing with *Services incidental to energy distribution* (CPC 88700); this reference concerns activities related to heating systems, but does not cover drinking water. Moreover, the CPC Prov. explicitly excludes from the environmental services section (9401) the "collection, purification and distribution services of water", and classifies it in the subclass 18000, entitled "Natural water". This subclass is in the goods section, which means that, technically, distribution of drinking water does not appear to be included in the CPC Prov.

The CPC Version 1.0 rectified this omission, by creating a new category for "Water, except steam and hot water, distribution services through mains" (code 69210), which includes "distribution services of water" and "reading and maintenance of [water] meters". However, "Water distribution services through mains (on a fee or contract basis)", is classified under CPC Version 1.0 code 86223.

In their proposal in 2000, the EC suggested the creation of seven environmental sub-sectors, one of which it referred to as "Water for human use & wastewater management". The first part of this sub-sector includes "water collection, purification and distribution services through mains [*i.e.* large pipes], except steam and hot water" and is described as including services related to "potable water treatment, purification and distribution, including monitoring". In this regard, the category appears to be similar to the categories introduced in the CPC Version 1.0, except that it is more specific about the quality of water delivered, which must be for direct human use. It therefore excludes the provision of water as an input to a manufacturing process. To date, the EC is the only WTO member to propose including services relating to water for human use as an environmental service; some countries oppose the idea.

While much water treatment, purification and distribution through mains is undertaken by government-owned enterprises, private company involvement in the supply of water to individual clients is not as uncommon as might be imagined. Large, single-owner tourist resorts, commercial facilities, factories and corporate residential facilities located outside large metropolitan areas tend to procure dedicated sources of water. In many cases, only engineering and construction services are involved: once built, the water treatment facility is then operated by the client. But contracts involving separate ownership and operation of water supply facilities are starting to appear.

The techniques involved in the treatment (*i.e.* disinfection, pH control) and the purification (*i.e.* the reduction or removal of pollutants and suspended solids) of water depend on the characteristics of the water source and the quality that the supplier seeks to attain. Generally, water pumped from deep groundwater wells or sourced from rainwater-fed reservoirs does not require more than filtering and minimal treatment. By contrast, before water drawn from a river is fit for human or even industrial use, especially if the river is polluted (the normal situation for large cities), it can require treatment and purification as complex as any found in the most sophisticated chemical factories.

The service involved in the distribution of water through mains is mainly a logistical one, requiring the orchestration of various components of a network that may include storage tanks, valves, pumps and various monitoring equipment in order to ensure a reliable supply.

What goods are used in what services?

Some of the services described above share characteristics with consultancy and management services, and indeed the dividing line between consultancy services and

other environmental services is a fine one. But whereas consultancy services are usually performed by people with no more than pens, paper and portable computers, most other types of environmental services require goods.

Many of those goods are found on either or both of the environmental goods lists prepared by the Asia-Pacific Economic Co-operation (APEC), the OECD or both. These lists were prepared during the late 1990s for different reasons. APEC's list was intended to form the basis of an early voluntary sectoral liberalisation initiative among the group's member economies. The OECD's list was prepared as part of an exercise to gauge the volume of trade in goods that could potentially deliver environmental benefits and the height of tariffs applied to them. These two lists reflect representative examples of "environmental goods" as deemed appropriate in the context of each exercise (see Chapter 2).

In both exercises, but in particular APEC's, guiding criteria for deciding what goods to include on the lists were whether they: *i)* were used in the performance of one or more environmental services, or *ii)* were likely to be recommended to a client by a service provider. Not all goods used in the provision of environmental services were included in these lists. As explained in Chapter 2, in both the APEC and the OECD exercises, multiple-use goods were often excluded if the environmental use of the good in question accounted for only a small part of the market. Moreover, as techniques and technologies have evolved, new goods have come to be associated with environmental services.[10] Finally, the OECD list includes goods considered to be environmentally preferable because of their intrinsic characteristics in use, or because their disposal places a smaller burden on the environment.

Annex 5.A2 tallies all the goods found on the APEC and OECD product lists, ordered according to the 6-digit HS subheading assigned to them. Arrayed across the column headings are the seven environmental services discussed here, including services related to the collection, purification and distribution of water for human use. An "X" in a cell indicates that the good in question is used in the performance of the corresponding environmental service.

It is clear from the table that certain goods, or clusters of goods, are common to several services. These include (with HS subheadings in brackets):

- Chemicals: limestone flux, slaked (hydrated) lime, magnesium hydroxide and peroxide, and activated carbon (2521.00, 2522.20, 2816.10 and 3802.10).
- Catalysts (3815.00).
- Ion exchangers (3914.00).
- Erosion-control matting (ex outs[11] of 4601.20 and 5911.90).
- Laboratory refractory equipment (ex outs of 6903.10 through 6903.90).
- Laboratory ceramic and glassware (6909.19, 7017.10, 7017.20 and 7017.90).

10. Examples are biological oxidation systems, or biodetergents, which are used in the supply and pre-treatment of water, and in the remediation and cleanup of soil, surface water and groundwater.

11. The term "ex out" means that the good in question is described at a more detailed level (*i.e.* 8- or 10-digit level in national tariff schedules) than the 6-digit level.

- Pumps for liquids, whether or not fitted with a measuring device (8413); vacuum pumps and compressors (8414).
- Heat-exchange units and parts (8419.50 and .90).
- Solar cells (ex out of 8541.40) and photosensitive semiconductors.
- Surveying equipment (selected items between 9015.40 and 9015.90).
- Instruments used in monitoring (selected items between 9027.20 and 9032.20).
- Automated regulating or control instruments, other (9033.89).

The largest cluster of goods, by far, is laboratory equipment and glassware. Laboratory equipment, as a general category, is used in the provision of most environmental services, starting with the diagnostic phase and continuing after major capital works have been undertaken. Designing a wastewater treatment plant, for example, requires tests of the chemical and biological characteristics of both the raw effluent and the receiving river into which the treated effluent is discharged. Such tests are typically carried out locally, as most do not require overly sophisticated equipment or the skills of a PhD chemist. Some laboratory glassware (HS 7017.10), a centrifuge (HS 8421.19), a laboratory scale (HS 8423.81) and a few other assorted pieces of equipment and chemicals are often all that is needed. Analysing the composition of municipal solid waste, or the nature of soil contaminants prior to and following remediation, may require more sophisticated equipment and skills than measuring water and sewage (*e.g.* chromatographs and electrophoresis instruments, spectrometers and other instruments and apparatus for physical or chemical analysis, HS 9027), but the same basic glassware, centrifuges and laboratory scales are also required.

Instruments (selected items between HS 9027.20 and HS 9032.20) are used for the monitoring of all environmental services. Wastewater management service providers use instruments that measure such environmental variables as pH, temperature, dissolved oxygen, electrolytic conductivity and turbidity. Refuse disposal operations may use instruments for optical scanning and sorting of solid waste. Noise abatement services could not function without sound-level meters, and nature protection and landscape services could not function without surveying instruments. But instruments are not just for monitoring. For example, refuse collection vehicles now employ, in some places, GPS and route optimisation software systems similar to those used by express delivery services.

Catalysts also cut across several service sub-sectors. A catalyst is a substance that increases the rate of a reaction but remains chemically unchanged at the end of the reaction. Reaction initiators, reaction accelerators and catalytic preparations (HS 3815.00) refer to a broad range of compounds, usually made from nickel (or nickel compounds) or precious metals, such as platinum, palladium or rhodium, as the active substance. They are increasingly used in a wide range of industrial applications, not least for the reduction and control of environmentally harmful or dangerous substances. Catalysts are used, for example, to control odours during the treatment of sewage or malodorous industrial effluents (such as from pulp and paper mills), to remove hypochlorite (bleach) from chlorinated effluent streams, to suppress the formation of dioxins and furans during the combustion of municipal solid waste, and to strip toxic chemicals from contaminated soil.

Pumps, filters, valves and compressors are vital to any environmental service requiring the conveyance of fluids. In wastewater treatment, pumps move water, as well

as any chemicals in solution used in the treatment process, from one section of the treatment plant to another. Pumps are vital for cleaning up oil spills on water, and portable ones provide the power for sprays used for street cleaning. Different types of pumps are required for different purposes, however. Even in groundwater remediation, the choice of pump will depend on the depth to the groundwater table (Box 5.2).

Box 5.2. Choice of technology in soil and groundwater remediation

Groundwater pollution due to improper disposal of petroleum hydrocarbons or leaking storage tanks is a problem common to most countries, developed and developing alike. Remediation typically involves controlling or preventing contaminants from migrating off site.

Pump-and-treat (P&T) systems are the most commonly applied remediation technologies at most sites contaminated by petroleum products.[1] P&T systems typically use pneumatic groundwater extraction pumps, as opposed to electrical pumps, because of their intrinsic safety advantages and relatively lower costs of acquisition, installation, operation and maintenance. Above-ground diaphragm vacuum pumps can be used at sites where the groundwater table is within 5 metres of the ground surface. For sites with deeper groundwater tables, pumps with stronger suction heads may be needed, and down-hole, tube-well diaphragm pumps are usually preferred.

Typical P&T systems, especially those installed in remote locations, will also involve automated groundwater treatment systems. Among the major components of these systems are electrical control panels, control instruments, blowers, air diffusers, packing materials, oil interceptors and stripping towers.

1. Another widely used type of soil remediation system is soil vapour extraction (SVE). SVE is generally preferred if the organic compounds involved are volatile, the sub-surface is porous, and there is a risk of inhaling the vapour.

One reason for the commonality of certain goods across sub-sectors is that industries borrow from one another. Plants that convert waste to energy, for example, employ burners and pollution control systems originally designed for electric power generating plants. Landfills use leachate filtration systems that are also found in water treatment plants.

Other goods on the lists are less ubiquitous, but nonetheless important. Erosion control matting (ex outs of HS 4601.20 and HS 5911.90), for example, is vital to services involved in nature and landscape protection, especially during the critical period when new vegetation is being established on previously bare land. Similarly, service providers that treat wastewater may recommend its use to their clients, if the factories or power plants they are treating encounter problems in keeping discharge canals from washing away.

Services as market drivers

Many of the goods on the APEC and OECD lists have uses other than pollution prevention, pollution control or environmental remediation. Their use in the performance of environmental services is important, but in many cases will not be what drives the market for those goods. By contrast, some goods are quite closely associated with a

particular environmental service, so that growth in their consumption and trade is highly correlated with the expansion of that service.

There are several obvious examples. Booms or socks consisting of ground corncobs contained in a textile covering (HS 2302.10 ex) and pollution protection booms (HS 8907.90 ex) are used essentially to clean up oil spills. Similarly, trash compactors (HS 8479.89 ex) were created specifically for solid-waste management, the market for which is clearly driven by refuse disposal services.

Many types of air monitoring equipment (most of which fall under HS 9027) are used almost exclusively to measure either exhaust gases or ambient air quality. Examples include gas or smoke analysis apparatus (HS 9027.10), chromatographs and electrophoresis instruments (HS 9027.20), spectrometers, spectrophotometers and spectrographs using optical radiations (HS 9027.30), other instruments and apparatus using optical radiations (HS 9027.50), chemical analysis instruments and apparatus (HS 9027.80), and parts and accessories (HS 9027.90). A recent study undertaken by Business Communications Company, Inc. (Lindsey, 2003) found that the market for such equipment in the United States alone is expected to surpass USD 1.7 billion by 2007. Not all of these instruments are used by firms specialising in providing services for the protection of ambient air or climate — many are used by government inspectors — but service providers depend on them. Thus, as this service industry grows, so will sales of air monitoring equipment.

In the area of noise abatement, many of the goods involved may be purchased by specialists working for firms with a noise exposure problem, such as an industrial plant's occupational safety officers. But independent service providers are also major consumers. Examples most likely to be used in rendering the service would be: exposure meters, including sound-level meters (HS 9027.40), parts and accessories of apparatus of HS sub-headings 9027.20 to 9027.80 (HS 9027.40) and machines for balancing mechanical parts (HS 9031.10). Whether a company diagnoses a noise or vibration problem itself or follows the advice of a noise abatement service, it will often turn to certain goods to solve the problem, such as:

- HS 8708.92: silencers and exhaust pipes, [for] motor vehicles.
- HS 8409.91: parts suitable for use solely or principally with the engines of HS 8407 or 8408; suitable for use solely or principally with spark-ignition internal combustion piston engines (extended heading: industrial mufflers).
- HS 8409.99: parts suitable for use solely or principally with the engines of HS 8407 or 8408, other than aircraft engines or spark-ignition internal combustion piston engines (extended heading: industrial mufflers).

Case histories of environmental goods and services trade with developing countries

This section draws on case histories of services exported from an OECD country supplier to a private (*i.e.* non-governmental) entity in a developing country, as described in Annex 5.A1. Governments are also major consumers of environmental services, through a variety of contractual arrangements (OECD, 2001, p. 110). To avoid possible cases of public procurement, only case histories involving business-to-business trade were chosen. Because of the difficulty of obtaining information on contracts involving smaller companies, most of the case studies involve multinational corporations, either as

service suppliers or clients, and often as both. The range of examples therefore should not be assumed to be necessarily representative of the market as a whole.

Each case study provides a brief description of the nature of the service rendered and highlights the importance of any of the goods on the combined APEC and OECD product list (see Annex 5.A2) either to the service provider, or to the service provider's client following the provision of the service. The cases attempt to identify whether these goods were actually imported, brought in as temporary "tools of the trade", or purchased locally. If they were not brought in on a temporary basis, the cases mention whether any problems were encountered because of tariff or non-tariff barriers.

The market for environmental services

There would appear to be two forces driving businesses in developing countries to outsource environmental services. The first is environmental requirements, whether imposed by domestic or foreign governments or demanded by shareholders of the companies in order to uphold a high standard of corporate social responsibility. The second is the general tendency of manufacturing companies to contract for services that are not part of their core business.

As a series of national case studies carried out for the OECD, UNCTAD and UNDP have documented (see Chapter 1), developing countries are catching up with developed countries in the area of environmental protection. Over the last decade, many (especially the rapidly industrialising countries) have consolidated their previous, piecemeal environmental legislation, and increased their regulatory capacity.

In a number of developing countries, however, environmental laws are incomplete or are poorly monitored and enforced. For example, few explicitly require the remediation of soil and groundwater at contaminated sites. Nonetheless, remediation work is taking place, predominantly driven by general corporate mandates (especially if the firm is part of a multinational corporation), or specific concerns to reduce exposure to future liabilities or to protect a company's reputation. Multinational firms increasingly strive for a consistently high level of environmental responsibility and sustainability across all operations, regardless of the regulatory sophistication or commitment to enforcement in a particular country.

Many companies have decided that environmental services fall outside their core competencies, and are better left to professionals. Thus, in 2001, Hynix Semiconductor Inc. decided to divest itself of its water treatment facilities, and to turn that activity over to an independent service provider. Similarly, in Brazil, Arcelor, one of the world's leading steel manufacturers, decided to outsource all its utilities, including environmental services, to an independent service provider, in order to focus its investments on its core business and to reduce and contain costs, especially up-front investment.

Brazil provides an example of another, albeit less common, phenomenon: the diversification of industries from nearby sectors into the environmental sector. Bayer, one of the world's leading chemical manufacturers, has been conducting business in Brazil since the late 1800s. As an operator of chemical plants, it had gained considerable experience in handling a wide range of materials and transforming them through chemical, physical and even biological processes. It was a logical decision, therefore, to establish an Environmental Division specialising in the treatment of wastes. A half-owned subsidiary of that division, Tribel, now treats wastes in Brazil not only from the local Bayer chemical plant but from many other industrial plants as well.

The ability of some service providers to offer an integrated package of environmental technologies to address complex environmental problems may be spurring the move away from end-of-pipe solutions to those based on prevention. As Beatrice Chaytor[12] explains:

> The inclusion of cleaner technologies within the definition of environmental services may contribute to the dissemination of such technologies, through the provision of multidisciplinary services. In Malaysia, a private company operating privatised wastewater plants is following the example of British and French water companies, by providing integrated water services domestically and to other countries in the Asia-Pacific region. Another Malaysian company has expanded into manufacturing in order to complement its design of licensed and proprietary water treatment systems, enabling it to serve markets in Indonesia and Thailand. Although there is no evidence that such services caused direct environmental benefits, the implication of the inclusion of such experiences in empirical analyses of the effects from trade liberalisation seems to be that those benefits naturally follow from such liberalisation.

Goods associated with service contracts

The evidence provided in Annex 5.A1 confirms that many of the goods included on either the APEC or the OECD lists of environmental goods are used in the performance of environmental services. These include, in particular, items for holding, conveying, treating and filtering liquids: tanks, pumps, compressors, valves, chemicals and filters. Also appearing frequently on the lists of goods associated with the case histories are various instruments for monitoring and measuring. Carrying out environmental services such as wastewater treatment and soil and water remediation would simply not be possible otherwise. At the same time, the case histories show that environmental service providers often rely as well on specialty items designed specifically for that service. Passive sorbent collection devices (sorbers) — used to measure the movement of volatile gases in soils — are a case in point.

Several of the case studies provide evidence that there is often a progression in the way that service providers procure the goods they need. In almost all cases, any materials associated with "plumbing" (piping, valves and so forth) are purchased locally from the beginning, as are gravel, sand and similar bulk materials. As the service provider becomes more familiar with local suppliers, it will generally turn more and more to them for equipment and intermediate inputs, as long as the quality of those goods is sufficient for their needs. All else equal, there are advantages to procuring goods locally: delivery times may be shorter, transport costs lower, and after-sales service more reliable.

Consequently, as the market for equipment and inputs associated with environmental services expands, so usually does the number of local suppliers and the range and sophistication of the products they offer, not just to service providers operating in their own country, but also to buyers in other lands. Often, local suppliers are the result of joint ventures between foreign companies with specialised knowledge of the environment goods and services industry and local companies with complementary strengths.

For example, in a joint venture with Dongguan Hu Men Harbour Water Supply Company, Sino French Water Development (a 50-50 subsidiary of Ondeo and the New World Group based in Hong Kong, China) has established an equipment manufacturer

12. Beatrice Chaytor, "A primer on environmental goods and services: definitional challenges to the negotiation of further liberalisation", study commissioned by the Royal Society for the Protection of Birds, www.field.org.uk/PDF/RSPB.pdf.

which produces membrane-technology equipment for water treatment, including microfiltration units (capable of treating up to 50 000 m^3/day). Using ultra-filtration techniques from France and reverse osmosis techniques from the United States, it has additional equipment able to treat up to 45 000 m^3/day. This equipment was not used for the SCIP project discussed in Annex 5.A1, but has been used in other water plants in China and outside China.

The ability of local suppliers of environmental goods to meet the needs of environmental service providers varies, of course, according to the level of development of the local economy and the kinds of manufacturing in which it specialises. Most of the products necessary to treat and manage urban water and wastewater can already be purchased locally in rapidly industrialising countries such as Brazil, China or Korea. Similarly, above-ground diaphragm pumps, which are used for soil and water remediation in areas with shallow groundwater tables (see Box 5.2), are widely available in many developing countries.

However, some segments of the environmental services industry require equipment that is often difficult to find locally. The treatment of end-of-pipe industrial wastewater flows, for example, typically involves processes that are highly specialised (the market segments are narrow) and catered to by a limited number of global suppliers. Tube-well diaphragm pumps (required for remediation of soil and water in areas with groundwater tables) are another example of devices that often have to be imported. Similarly, the blowers for soil vapour extraction systems, because they need to be intrinsically safe, are usually imported, at least initially.

Import barriers

Obtaining information on actual customs duties paid for imported products is, naturally, a sensitive issue for businesses. For that reason, most of the information provided in the case studies included in Annex 5.A1 is quite general.

To the extent that the case studies mention tariff rates, the information is patchy. Some companies reported "no particular problems", others that tariffs on equipment were as high as 60%. Such tariffs raise the price of pollution control equipment, which ultimately has to be borne by the industrial clients, making their final goods less able to compete in the market. The information is simply too sparse to determine whether it is consistent with other information on tariffs applied to environmental goods. According to research carried out by the WTO, for example, the average *applied* tariff on environmental goods levied by developing countries is between 7% and 8%, and by least developed countries (LDCs) around 10% (Teh and Bora, 2004). (In developed countries the average is less than 2%.)

In some countries, including several examined for the purposes of this chapter, governments have at times been willing to waive import duties on equipment used for environmental purposes, or to provide rebates on duties after the equipment has been imported. However, because the administrative processes to obtain these waivers or rebates are often long and difficult, the net benefit to the importer may be substantially reduced. Other difficulties encountered included delays and problems associated with the payment of bribes when shipping goods through ports. Goods shipped by air have generally enjoyed smoother transit, and some companies ship by air wherever possible. However, unless the item is a high-value, low-weight good, the cost of shipping by air rather than sea can easily add 10% or more to the cost of importing it.

Concluding observations

Trade in environmental services is clearly responding to the demands of clients in developing countries. Those demands are being driven in some cases by tighter regulations and in others by corporate policy, especially in terms of corporate social responsibility.

Economies of scale

Businesses that engage outside experts to carry out environmental services reap many benefits. Outsourcing allows them to concentrate on their core activities and to shift some of the liability of meeting environmental regulations to other companies. Especially when the service involves treatment of water or wastes, the facilities can often be built to an optimal scale, which may be larger than what is required for a single client. The resulting economies of scale can help reduce costs and, because several clients can be served, introduce greater flexibility into the contractual arrangements. Keeping an open door to imports of environmental services and goods also helps ensure vigorous competition, which keeps down prices and helps make supply more reliable.

Increased access to the latest know-how

Specialist service providers generally have access to the latest know-how and technology for protecting the environment. That is not only good for communities in the vicinity of the sites where the service providers operate, but it also provides a conduit through which knowledge about pollution control and remediation can flow into the importing country. This effect is strengthened when local people are employed at the service provider's facility. In almost all of the case histories described in Annex 5.A1, the great majority of the staff providing the environmental service was hired locally.

Improved environment for investment

The case studies also suggest that the availability of environmental goods and services in a country or a region of a country removes a barrier to investment by companies whose stockholders require the application of high standards of environmental performance at their plants. This phenomenon is apparent in Brazil, for example, where the creation of a major waste treatment centre associated with Bayer's chemical complex has helped attract subsequent investments by other chemical companies and by companies engaged in the transport of materials, engineering, maintenance, computer science and cleaning services.[13]

Investment and commerce discount uncertainty, however, and place a value on predictability. One way for national governments to remove uncertainty in the area of trade and investment related to environmental goods and services is to make positive commitments for their liberalisation. For environmental goods, that means not just lowering tariffs but also binding tariffs at those low (or zero) rates. Currently, among members of the WTO, the average bound tariff rates on environmental goods included on the APEC and OECD lists are 30% for developing countries and over 50% for LDCs, *i.e.* considerably higher than the applied rates. Moreover, while the share of environmental good tariff lines bound by developing-country WTO members is around

13. www.bayer.com.br/ContentPI/home.nsf/.

80%, for LDCs it is around 50%. By comparison, for developed countries the share of tariff lines that are bound is close to 100%.

For environmental services, the current set of GATS negotiations offers WTO members an opportunity to achieve greater levels of liberalisation in an orderly and flexible manner. As Chapter 4 acknowledges, liberalising trade in environmental services, particularly services that require long-term investments in plant and equipment, may require new regulatory tools, including those relating to pricing and service standards. This is particularly necessary in the case of environmental services, as they involve a wide range of services and a large number of measures may affect access to them. Identifying and removing barriers to commercial presence (Mode 3) and movement of natural persons (Mode 4) are clearly important to achieving the full benefits of liberalisation in this area.

Finally, there would appear to be potential benefits for trade in environmental goods resulting from the WTO negotiations on trade facilitation. In particular, improving customs procedures could address several of the non-tariff barriers mentioned in the case studies.

The main point of this chapter, however, is that the potential benefits of simultaneously liberalising trade in environmental services *and* in environmental goods are likely to be much greater than liberalising trade in either one or the other. These benefits include, naturally, improving the environmental performance of local industries, and thereby increasing a country's attractiveness for foreign direct investment; increasing the availability of these services, for the benefit of the environment and the health of the population; and reducing costs and spurring innovation. But they also include increasing local capacity to produce goods and provide environmental services, capacity that, with multilateral liberalisation, can be translated into increased export opportunities.

Annex 5.A1

Case histories of EG&S trade with developing countries

Some of the following information was obtained from private service providers and should be treated as indicative. The market for technologies using micro-electronics is particularly dynamic, and the processes and the techniques are continuously being adapted. Financial data may be modified by currency exchange rate fluctuations. Consequently, the origin of imported equipment and the share provided by local markets may change over time.

Goods appearing on the APEC list are indicated with a pyramid (▲) and goods appearing on the OECD list are indicated with a round dot (●).

Multi-service contracts

Multi-service contract supplying Arcelor's Vega do Sul plant, Brazil

The client

In the southern Brazilian State of Santa Catarina on the island of San Francisco, Arcelor, the world's largest steel maker, is completing construction of a new steel plant. The Vega do Sul plant, which became operational at the end of the first half of 2003, produces annually some 880 000 tonnes of pickled, cold-rolled and galvanized steel.[14] Built at a cost of USD 420 million, it employs 300 people and is credited with generating indirectly an additional 250 jobs. Final completion of the project is expected in 2005. The steel laminated by Vega do Sul is supplied to manufacturers of automotive vehicles, household appliances, pipes and the building industry in Brazil and throughout the MERCOSUR region.

Arcelor decided to outsource all the utilities supplied to the Vega do Sul (water, energy, waste) in order to:

- Address growing pressure associated with environmental legislation.
- Reduce and contain costs.
- Focus investments on its core business.
- Maximise quality, safety and environmental compliance.

Arcelor entrusted the investment, the construction and the exploitation of a multi-utility power station to an external industrial partner. The financial and contractual

14. The plant can be expanded to 1.4 million tonnes.

agreements allow Arcelor to de-consolidate the utilities and environmental service assets from other industrial assets of the Vega do Sul plant.

The service supplier

The group Veolia Environnement (VE) was selected to supply these services. VE operates in 84 countries, and some 55% of its sales turnover (EUR 29 billion in 2003) is generated outside of its home country, France. For the Vega do Sul contract, VE created a new company, SPC CLE Brazil. VE holds 100% of the capital of SPC CLE Brazil: 50% by Veolia Water, 25% by Onyx (VE's solid-waste management subsidiary). and 25% by Dalkia (its energy subsidiary). The company's annual revenue is estimated at USD 15 million.[15]

The contract

The contract, signed in 2002, envisages the design, the construction and the complete outsourcing of the utility services for a period of 15 years. The contract is of the BOO (build, own and operate) type, and does not require the customer to invest any capital. The scope of the contract includes transformation and distribution of electrical power, the distribution of natural gas, and production and distribution of industrial gases (nitrogen and hydrogen) and of compressed air, solid-waste management, wastewater management, and the provision of water (process water, water for fire fighting, demineralised water, hot water, cooling water and potable water).

For solid-waste management, Veolia Environnement provides on-site collection and organises external treatment of some 3 000 tonnes of waste a year. Treatment includes the recycling of some waste categories, the incineration of waste oils in a cement factory, and the burying of other waste categories in specialised landfills. For the other utility and environmental services it provides, VE operates all the on-line equipment with about 60 employees, most of them recruited locally. For the procurement and financing of equipment used to produce industrial gases, it teamed up with Air Products Brazil. For the procurement of other equipment, engineering and construction it turned to USF Brazil, ABB Brazil and JPE Brazil.

Goods associated with the service contract

As a general rule, about 65% of VE's investment is spent locally in Brazil and 35% is spent on imports from Europe and the United States. The great majority of products and equipment (an estimated 75% of the total investment) for the Vega do Sul facility were purchased in Brazil. These included demineralisation modules, measurement instrumentation (for example HS 9026.10 and 9028.30), part of the instruments used for process control, and all the following products and heavy equipment:

- Various active chemicals from HS Chapters 25 and 28•.
- Tanks (HS 7309.00• and 7310.10•).
- Pumps for liquids (HS 8413.60▲• to 8413.70▲•).
- Compressors (HS 8414.30• to 8414.90•).
- Filters (HS 8421.21▲• to 8421.29▲•).

15. www.veoliaenvironnement-finance.com/.

- Valves and fittings (HS 8481.10• to 8481.80•).

Veolia Environnement estimates that approximately 25% (in value terms) of the equipment used in installations relating to water were imported. These imports, 70% from Europe and 30% from the United States, included:

- Technologies for the treatment of used water flows, notably, technologies for vacuum evaporation, technologies for treating biological and mineral oils and technologies for treating specific industrial wastewater microflux. Most of these specialised technologies were provided by Veolia Water Systems.
- Electrical instruments, command and control instruments, monitoring instruments. Several categories of instruments, presenting specific technical features or adapted to specific operating constraints, cannot be sourced on the Brazilian market. As an example, imports include contacts for high-tension electrical current (HS 9032.89▲•), which are provided by ABB. These types of contacts are currently manufactured only in Norway.

For waste treatment, all capital equipment required by Veolia Environnement (notably, two pump trucks for liquid wastes) was purchased locally. The share of equipment imported to provide industrial gases accounted for more than 50% of the investment required for on-site industrial gas production facilities. This relatively high share is explained by the fact that technologies required for on-site industrial gas production are patent-protected and only proposed by the major international suppliers, such as Air Products & Chemicals and Air Liquide.

Import barriers

The customs tariffs on some equipment imported by Veolia Environment for the Vega do Sul plant were 25% or higher. A customs tariff exemption procedure can be activated if the importer is able to prove that the goods cannot be purchased in Brazil. Veolia Environment activated this procedure and benefited from a tariff waiver on most of the equipment imported for Vega do Sul. Nevertheless, the administrative process to obtain this result was extremely long and difficult.

Multi-service contract supplying local industrial clients in Belford Roxo, Brazil

The clients

The city of Belford Roxo, located 40 kilometres from Rio de Janeiro, is one of the poorest in Brazil, and a large proportion of its estimated 600 000 inhabitants are children. It is also home to many of Brazil's heavy industries. Companies in the area manufacture or assemble, among other goods, chemicals (especially petrochemicals and pharmaceutical products), automobiles, steel and telecommunication equipment. This concentration of industries generates huge volumes of solid and liquid wastes. Many of these wastes are now treated at a central facility operated by *Tratamento de Resíduos Industriais de Belford Roxo S.A.*, or Tribel for short.

The service supplier

In 1956 Bayer, one of the world's leading chemical manufacturers, bought an old sulphuric acid and phosphate factory in the city of Belford Roxo, Brazil, and re-

established it as *Bayer do Brasil Indústrias Químicas S.A.* (Chemical Industries). Today, Belford Roxo is one of Bayer's largest production sites in Latin America.

In the 1980s, Bayer began installing systems for treating both its solid and its liquid wastes. An effluent treatment plant was installed in 1984, followed by a landfill in 1985, and an industrial waste incinerator in 1992. Anticipating the growing demand for managing wastes from industrial facilities in the area (some of which are located in an industrial park established by Bayer in 1997), and that economies of scale were likely, Bayer built its facilities with considerable spare capacity. In August 2001, Bayer transferred the facilities to Tribel, a 50-50 joint venture between the Environmental Division of Bayer and the French company Tredi (now part of the Séché Environnement group), and started contracting with various nearby industries to treat their waste.

Certified to ISO 9002 and ISO 14001 standards (2000 revisions), Tribel's 60-hectare facility comprises:

- An accredited *toxicology laboratory* for waste and effluent analysis, employing around ten scientists.
- A *water purification plant* with two lines and an aggregate capacity of 150 m^3/hour. Physical and chemical treatment includes equalisation, pH adjustment and sedimentation phases, while the biological treatment stage consists of degrading organic substances through the action of micro-organisms in the activated sludge. The resulting sludge is piped to Tribel's industrial landfill, and some of the treated wastewater is recycled through the incinerator's gas treatment system.
- A 22-hectare Class 1 *landfill* with an available annual capacity of around 1.5 million m^3. Solid wastes are dumped on the landfill area, which is protected by a layer of compacted clay over the earth and lined with a high-resistance polyethylene sheet that can withstand physical, chemical and biological attack. Shafts have been sunk around the site to monitor underground water, which is collected and analysed on a regular basis. Leachate is pumped to the wastewater treatment plant.
- An *incinerator* with a capacity to handle 10 000 tonnes a year. Equipped with a rotating kiln, a static oven, an after-combustion chamber and an off-gas treatment system, the plant is capable of completely destroying inorganic residues, and is one of only two in Brazil able to incinerate polychlorinated biphenyls (PCB) in a way that does not damage the environment. The facility is Brazil's first central toxic waste treatment complex and accounts for around 10% of domestic installed capacity.

Currently, 1 000 clients send one or more of their waste streams to the Tribel site. Some 15% of the waste incinerated by Tribel comes from Bayer's own production; the rest comes from other companies.

Goods associated with the service contract

Only general information on goods used in the construction and operation of Tribel's facilities is provided on its Web site (www.tribel.com.br). However, judging from the description of its facilities, it appears that many goods from the combined APEC and OECD list have been or are being used, such as:

- Tanks (HS 7309.00● and 7310.10●).
- Pumps (HS 8413.60▲● to 8413.70▲●).

- Waste incinerators (HS 8417.80▲•).
- Filtering or purifying machinery and apparatus (HS 8421.21▲•, 8421.29▲• and 8421.39▲•).
- Measuring and monitoring equipment for use in laboratories (various subheadings under HS headings 9015, 9022, 9025, 9026, 9027, 9028, 9030, 9031, 9032 and 9033▲●).

Water and wastewater treatment

Water and wastewater treatment for Hynix Semiconductors, Korea

The client

Hynix Semiconductor Inc. (formerly Hyundai Electronics Industries) is a global leader in the production of semiconductors and has become the world's third largest producer of DRAM (dynamic random access memory) chips. Hynix produces DRAM chips at four sites in Korea, as well as computer screens and liquid crystals. As semiconductor production requires ultra-pure water to clean components that are very sensitive to the deposition of impurities, it is essential for Hynix to have access to a constant supply of high-quality, ultra-pure water. Moreover, since the industry recycles most of its wastewater in the production cycle, effective wastewater treatment is also a critical issue. In order to focus on its core business, Hynix decided in 2001 to transfer the risk of managing its water to a specialised supplier of services. This involved selling the existing water treatment plants and drawing up a long-term contract for their operation.

The service supplier

Hynix chose Veolia Water, a subsidiary of the Veolia Environment group, to operate the plants. Veolia Water, one of the world's leading companies in services and technologies related to water, was already established in Korea at the time. In 2000, for example, Veolia acquired the water treatment units of Hyundai Petrochemical's petrochemical complex, and was selected by two large cities to build and operate wastewater treatment plants.

The contract

In 2001 Veolia Water, in association with Korean financial organisations, acquired all of the industrial water treatment and generating stations belonging to Hynix. A second company was set up to operate the facilities. This fully owned subsidiary of Veolia Water contracted to ensure the installation, operation and management of water at all four of Hynix's sites for a period of 12 years. Approximately 150 Hynix employees were transferred to the Veolia Water subsidiary. Veolia Water's 20 manufacturing units produce each day 83 500 m^3 of ultra-pure water, and treat 45 500 m^3 of wastewater, recycling between 60% and 95% of the water that flows through the manufacturing plants.

The contract specifies that Veolia Water will guarantee levels of performance and reliability of service (quality of provided water, delivered quantity, continuity of the service, etc.). For example, Veolia Water's required level of performance in the treatment of wastewater exceeds Korea's environmental regulations for the discharge of wastewater. Penalties are envisaged in the event of non-observance of the criteria.

Goods associated with the service contract

Almost all of the "plumbing" equipment for the plants was purchased in Korea, including:

- Tanks (HS 7309.00• and 7310.10•).
- Pumps (HS 8413.60▲• to 8413.70▲•).
- Compressors (HS 8414.30 to 8414.90).
- Valves (HS 8481.10• to 8481.80•), except special valves and fittings for ultra-pure water distribution and regulation.

Production of ultra-pure water

The installations purchased by Veolia Water were already equipped, mostly with Japanese processes. It is expected that the equipment will have to be entirely replaced at least once during the life of the contract, as advances in the technologies for producing ultra-pure water are constantly evolving (the normal product cycle is approximately six years), and customers ask for upgrades regularly. Currently, Veolia Water uses several processes to produce ultra-pure water at the Hynix sites, including membrane-based filtration (micro-filtration) and resin-based demineralisation through ion exchangers (HS 3914.00•). Demineralisation is gradually being replaced by cleaner processes, such as units using thin-cell continuous deionisation (CEDI), an electronically controlled process that reduces the need for chemicals. This patented technology was provided by US Filter (a former subsidiary of Veolia Water, sold to Siemens in 2004).

Most of these processes are not protected by patents, but they do require very precise engineering for process design. This is provided for the Hynix sites by Europe-based teams of engineers from Veolia Water. The equipment, highly specialised, is then purchased on the world market. It are available from a limited number of suppliers and there is currently no local producer. Approximately 50% (in value terms) of the equipment used to produce ultra-pure water at the Hynix sites has had to be imported. About two-thirds of the imports have come from factories located in Europe and the rest from the United States.

Treatment of residual water and the recycling of process water

The treatment of wastewater also requires highly specialised techniques. It generally involves the use of equipment assembled on skids. For the wastewater treatment units deployed at the Hynix sites, the rate of importation (over 50% in value terms) has been comparable, or even higher, than that for the units for producing ultra-pure water. Recycling requires less imported equipment, but more imports of engineering services provided by staff (based in Europe) employed by Veolia Water. Veolia's re-engineering made it possible to increase the rate of water recycling compared with the recycling rate achieved by the original operator of the facilities.

Consumable items

Some two-thirds of consumable items used at the plants have had to be imported. About half have come from Europe (mainly Germany and France), and the rest from other regions (the United States and Asian countries). The suppliers have been industrial groups such as Dow Chemical and Filmtech (for membranes), Pal (for filtration

cartridges), Nalco and Betz-Dearborn. Veolia Water, which has other clients in Korea, is a major buyer of equipment and consumable items, which allows it to obtain more favourable conditions than other, smaller industrial enterprises.

Instrumentation

Nearly 100% of the control and monitoring instruments integrated in the water facilities at the Hynix sites is imported. Roughly one-third comes from factories located in Europe, one-third from the United States and one-third from Japan. On the combined APEC-OECD list of environmental goods, Veolia Water identified the following categories of instruments as being imported:

- Hydrometers and similar floating instruments, barometers, hygrometers, and psychrometers (HS 9025.80▲•).
- Instruments and apparatus for measuring or checking the flow or level of liquid (HS 9026.10▲•).
- Instruments and apparatus for measuring or checking pressure (HS 9026.20▲•).
- Electricity meters (HS 9028.30▲).
- Automatic regulating or controlling instruments, other (HS 9032.89▲•).

The manufacture of semiconductors requires advanced technology for the management of process water, and only a limited number of companies supply the necessary highly specialised equipment. It is thus probable that the share of imports will remain high in the near future. The second industrial facility managed by Veolia in Korea, that of Hyundai Petrochemicals, requires, for example, imports of products for implementing modules used in reverse osmosis.

Barriers to imports

Veolia Water's Korean subsidiary functions like a local enterprise in Korea, and therefore paid normal customs duties.

Water and wastewater treatment at Shanghai Chemical Industry Park

The client

Shanghai Chemical Industry Park (SCIP), located north of Hangzhou Bay, is one of the largest industrial projects included in China's Tenth Five-year Plan. Within its total planning area of 29.4 km^2, SCIP intends to be one of the leading sites for the production of petrochemicals in Asia. Companies such as BP, BASF, Bayer, Huntsman, Air Products & Chemicals, Vopak, Air Liquide and Praxair, as well as Chinese groups, have already started projects there worth a total investment of over USD 8 billion. Shanghai Chemical Industry Park Development Co., Ltd. (SCIPDC) is responsible for development and construction of Shanghai Chemical Industry Park, and provides industries located in the park with public utilities, logistics and environmental protection services.

The service provider

Ondeo, a subsidiary of the Suez group, was chosen by SCIPDC as its partner for water services. Ondeo is a leading water specialist, supplying water and wastewater services to 115 million people and 60 000 industrial customers in 130 countries, and has

built some 10 000 water treatment plants. Over the last 20 years, its engineering services division, Ondeo Degrémont, has built 118 water plants in China alone. Ondeo has ten long-term water contracts in China.

The contract

A joint venture was formed between Sino French Water Development Co. Ltd. (a 50-50 subsidiary of Ondeo and the New World Group based in Hong Kong, China) and SCIPDC. Ondeo Industrial Solutions, a wholly owned Ondeo subsidiary (created in 2002 by drawing together Ondeo's know-how and technical expertise in industrial water treatment), is the operating branch of this joint venture.

For water supply, SCIP projects include the operation of a 200 000 m^3/day industrial water plant and a 7 000 m^3/day domestic water plant. For wastewater treatment, SCIP projects include designing, financing and managing installations and services for the park's industrial effluents. The duration of the wastewater contract is 50 years. Total investment is expected to reach EUR 50 million for an effluent treatment volume of 50 000 m^3/day. Both water and wastewater plants, located on a "utilities island", which integrates the supply of water, co-generation and industrial gas services, became operational at the end of 2004.

Goods associated with the service contract

Because Ondeo has been operating in China for 30 years, its knowledge of Chinese suppliers is quite good. A growing number of western manufacturers are now establishing joint ventures in China, so the imported share of its equipment is shrinking. For the SCIP contract, several categories of industrial products have been sourced entirely from Chinese suppliers. These categories include heavy products and instrumentation, such as:

- Chemicals (HS Chapters 25 and 28•).
- Tanks (HS 7309.00• and 7310.10•).
- Valves (HS 8481.10• to 8481.80•).
- Various types of monitoring instruments:
  - Photogrammetric surveying instruments and appliances (HS 9015.40▲).
  - Apparatus based on the use of x-rays or of alpha, beta or gamma radiations (HS 9022.29▲).
  - Thermometers and pyrometers (HS 9025.11▲•).
  - Liquid supply, production and calibrating metres (HS 9028.20▲•).
  - Instruments and apparatus for measuring or detecting ionising radiations (HS 9030.10▲•).
  - Cathode-ray oscilloscopes and cathode-ray oscillographs (HS 9030.20▲).
  - Multimeters (HS 9030.31▲).
  - Other instruments and apparatus for measuring electrical quantities (HS 9030.89▲).
  - Thermostats (HS 9032.10▲•).
  - Manostats (HS 9032.20▲•).

- Hydraulic and pneumatic instruments and apparatus (HS 9032.81▲•).

Product categories that are partly sourced from local suppliers include heavy equipment, such as pumps (80% local), compressors and filters (70 % local), as well as several categories of instruments.

Sino French Water Development Co. identified the following industrial product imports from the combined APEC-OECD list of environmental goods:

- Pumps (HS 8413.60▲• and 8413.70▲•): 20% imported.
- Compressors (HS 8414.30• to 8414.90•): 30% imported.
- Filters (HS 8421.21▲• and 8421.29▲•): 30% imported.
- Several categories of instruments (on average 50% imported), including:
  - Hydrometers and similar floating instruments, barometers, hygrometers and psychrometers (HS 9025.80▲•).
  - Instruments and apparatus for measuring or checking the flow or level of liquid (HS 9026.10▲•).
  - Instruments and apparatus for measuring or checking pressure (HS 9026.20▲•).
  - Chromatographs and electrophoresis instruments (HS 9027.20▲•).
  - Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared) (HS 9027.30▲•).
  - Exposure meters [including sound-level meters] (HS 9027.40▲•).
  - Gas meters (HS 9028.10▲•).
  - Electricity meters (HS 9028.30▲).
  - Automatic regulating or controlling instruments, other (HS 9032.89▲•).

Sino French Water Development Co. has indicated that it did not use ion exchangers (HS 3914.00•) or catalysts (HS 3815.00•) for the SCIP project but, if this type of equipment were needed, the import share would be around 50%.

Trade barriers

Regular custom tariffs apply to goods imported for the SCIP project. (There have been no tariff reductions or exemptions.) Otherwise, Sino French Water Development Co. has not encountered any other obstacles, such as delays caused by slow customs clearance.

Other examples

A French company, Veolia Water Systems, developed and is now operating a water and wastewater recovery system for a DaimlerChrysler truck manufacturing plant in Saltillo, Mexico. The plant requires more than 1 800 m^3 of treated water a day and is forbidden to discharge any wastewater into the local river. The contract involves pumping water from deep, on-site wells; producing drinking and process water; treating sewage (which is reused in irrigation); and treating industrial wastewater (which is reused in the plant). The incoming well water is filtered and purified using a reverse-osmosis system,

which is then used in the manufacturing processes. Some 70% of the plant's wastewater is treated and reused in the plant.

Solid-waste management services

In Chile, industrial and construction solid waste was for years disposed of in residential dumping grounds, clandestine dumping grounds or simply thrown down the drain.[16] In 1997, the industrial solid waste unit of the "Point Source Emissions Control Programme" (*Programa de Control de Emisiones de Fuentes Fijas*, PROCEFF) of the Metropolitan Environmental Health Service (*Servicio de Salud Metropolitano del Ambiente*, SESMA) began to regulate this waste. This coincided with the inauguration of the first authorised waste treatment company, Hidronor, which is owned by the Belgian group, Machiels, and Bravo Energy Chile S.A., whose parent company is based in California. Bravo Energy Chile S.A., through its fully permitted, state-of-the-art treatment plant facility (located in Santiago), is currently providing industrial waste treatment and disposal services and environmental consulting for a wide range of clients.[17] Because its first facility was built before the Chile-US Free Trade Agreement, it had to pay duty on equipment purchased from abroad. It is believed that tariffs were of the order of 10%.

Air pollution and sound-level monitoring

Air pollution and sound-level monitoring for a Jordanian cement manufacturer

The client

For reasons of confidentiality, the service provider (a Canadian consulting firm) has asked that its client's name not be disclosed, but described it as a large multinational firm engaged in the production of cement and aggregates. The client owns and operates two cement plants in Jordan and supplies customers throughout the Middle East.

In order to reduce production costs (by some USD 6 million a year), the client recently proposed to substitute 180 000 tonnes a year of pulverised petroleum coke (petcoke) for some of the heavy fuel oil it used in its plants. The plant sites needed to be modified, using both new and existing equipment, to accommodate new facilities for crushing, milling and storing the petcoke, and new burners for incinerating petcoke in the kilns. The plants would require approximately 190 000 tonnes a year of raw petcoke, transported in covered trucks (25-30 tonnes/truck) from the Syrian border. In addition, around 110 000 tonnes/year of pulverised petcoke would be hauled from one of the company's plants to the other, using 12-15 specialised trucks ("capsules"), each with a capacity of 20 to 25 tonnes.

The client had applied to the Jordanian government for an environmental permit, but non-governmental organisations (NGOs) opposed the application, arguing that burning petcoke would further degrade the ambient air in the vicinity of the two cement plants. The NGOs claimed that the plants were emitting too much dust, NO_X and SO_2, and that these emissions were negatively affecting public health. Moreover, owing to misperceptions about the environmental impact of the plants' operation, local land

16. See the report by the US & Foreign Commercial Service of the US Department of State (2001) at http://strategis.gc.ca/epic/internet/inimr-ri.nsf/en/gr-79378e.html.

17. www.bravoenergy.com/page7.html.

owners complained that prices for their properties were depressed compared with prices for comparable land elsewhere in the region.

In order to obtain an unbiased, independent assessment of the situation, the Jordanian government ordered an environmental assessment and audit by an international consultant able to collect most of the environmental data on its own. The Jordanian authority did not want to rely on local equipment, data or even local staff to complete the job.

The service provider

The Canadian company engaged by the client is an employee-owned scientific and research-oriented consulting firm specialising in evaluations, assessments and quantitative data analysis. Over the past 25 years it has worked in more than 50 countries, for both public- and private-sector clients. The company's associate in Jordan provided technical and logistical support for the project.

The contract

The contract entailed preparing a comprehensive environmental impact assessment (EIA) for the proposed changes in the client's production processes, and conducting an environmental audit of all ongoing activities at both of the client's cement plants in Jordan. This involved drawing up and carrying out a detailed monitoring programme for air pollutants (PM_{10}, $PM_{2.5}$, SO_2 and NO_X) and noise, using its own equipment or equipment leased or rented from other providers.

Goods associated with the service contract

The products involved in the site investigation included:

- Filter assemblies (HS 8421.39▲•).
- Particulate samplers (ex HS 9027.10▲•).
- Pre-weighed and prepared particulate filters (ex HS 9027.10▲•).
- NO_X absorbers (ex HS 9027.10▲•).
- SO_2 absorbers (ex HS 9027.10▲•).
- Sound-level meters (HS 9027.80▲•).

The particulate samplers, power pack, spare batteries and associated equipment were shipped as checked luggage brought into Jordan by the air quality monitoring engineer from the service provider's Canadian office. The particulate filters were supplied by Maxxam Laboratories of Mississauga, Ontario, and the absorbers by the Maxxam Laboratories' facility in Calgary, Alberta. Noise monitoring equipment was rented through another agency in Canada and transported to Jordan in the engineer's hand-carried luggage.

Import issues

Because the equipment used to perform the job was to remain in Jordan only temporarily, no import duties were due. However, affirmations that the equipment was to be so used were required.

Before departing for Jordan, the service provider made inquiries through its Jordanian associate regarding import restrictions and was informed that personnel should bring appropriate letters, operating manuals and other relevant documentation to demonstrate that the equipment to be used for the job was necessary and would be removed from Jordan when the work was completed. A letter specifying the equipment, date of purchase and value was submitted to the Jordanian customs agency prior to the engineer's arrival in Amman. Upon arrival at Amman airport, however, all of the equipment was impounded by the customs service, pending clearance. The service provider's local associate had to work with local authorities for three days and deposit JOD 750 (equivalent to USD 1 070 at the time) as a security deposit to ensure that the equipment would be taken back to Canada. How the security deposit was calculated was never disclosed.

After using the equipment for six months in Jordan, the service provider decided to return the equipment, and it was packed with the check-in luggage of the firm's director, who was in Amman making a final presentation of the report. The firm's director had to spend three hours at the airport customs office prior to check-in to get clearance to take the equipment out. That was in February 2004. As of mid-July 2005, the JOD 750 security deposit had not been returned.

Noise and vibration abatement services

Solving a noise and vibration problem at a Caribbean smelter

The client

In the early 1990s, a large smelter situated in a Caribbean country needed professional help to investigate ventilation noise and a vibration problem associated with an exhaust duct serving one of its furnaces. It turned to Hatch, a Canadian company specialising in such services.

The service provider

Hatch has been exporting sound-level monitoring services for more than 20 years. In Trinidad in the late 1970s, for example, it assisted in ensuring that a plant did not bother people living in the neighbourhood.

Goods associated with the service contract

The agent took an octave-band sound-level meter and several accelerometers into the country as "tools of the trade". The solution turned out to require a modification of some ducts. The work was carried out locally and successfully.

Import barriers

It took a day or two after the agent arrived for a community noise monitor to clear customs. His octave-band sound-level meter came in with him, and perhaps required some paperwork.

Nature and landscape protection services

A co-operative programme between the United States Golf Association (USGA) and Audubon International (an environmental NGO) is promoting ecologically sound land management and the conservation of natural resources on golf courses.[18] Already, nearly 2 000 golf courses around the world have joined the programme, among them three in Costa Rica,[19] three in the Philippines[20] and one in Singapore[21] fulfil requirements in all six of the programme's categories, including the one relating to "wildlife and habitat management". This requirement emphasises maintaining the best possible habitat for wildlife on the non-playing areas of golf courses.

Remediation and cleanup of soil, surface water and groundwater

Remediation and cleanup of soil at a former cosmetics plant in Indonesia

The client

For business confidentiality reasons, the client of this case study asked not to be identified. The company has fairly recently ceased production in Indonesia, but still sells its products (health and beauty aids) to retail outlets in the country.

The service provider

Environmental Resources Management (ERM) is an environmental consultancy employing 2 500 staff at 100 offices in 37 countries. Gross revenues for 2003 totalled USD 348 million, making it the second largest pure environmental services firm in the world after US Filter. The company provides a full range of environmental consulting services, including strategic management planning; development impact assessment and planning; risk and liability management; facility permitting, compliance, and technical support; and contaminated-site management.

The company's Jakarta office employs 15 people, including 12 technical consultants, all but one Indonesian. The company works primarily for clients in the oil and gas industry, but serves many other industries as well.

The contract

The client retained ERM to take over pollution monitoring duties at a production facility which the client sold during the period of the work as part of its decision to close down manufacturing operations in Indonesia. The extent of the site is moderate, but it is potentially contaminated by particularly dangerous hydrocarbons that could pose a

18. www.audubоninternational.org/programs/acss/golf.htm and www.usga.org/turf/environmental_programs/audubon_sanctuary_program/audubon_sanctuary_program.html.

19. Garra de Leon Golf Course, Conchal Beach, Santa Cruz, Guanacaste; Hacienda Pinilla, Guancaste; and Parque Valle del Sol, Santa Ana.

20. Forest Hills Golf and Country Club, Las Piñas City; Manila Southwoods Golf and Country Club, Carmona; and Santa Elena Golf Club, Makiti.

21. National Service Resort and Country Club.

serious threat to groundwater supplies serving nearby communities, which use the supplies for washing and bathing, if not for drinking.

Although the Indonesian government has developed regulations regarding the cleanup of contaminated sites, the regulations are vague, subject to interpretation and not rigorously enforced. Few companies go to the trouble of assessing contamination at their sites in Indonesia, but ERM's client is concerned about the threat to the local groundwater, and as a company that still sells its products in the country, it is concerned to protect its good reputation.

The work, which began in 2002, involved ERM taking over the operation of three groundwater monitoring wells on the site. The company found the construction of the wells unsatisfactory and installed three more wells, using specialised, low-flow positive-displacement bladder pumps that can sample at several levels of the water table. ERM also re-equipped the original wells with diffusion bags filled with distilled water. The bags are left in place for about two weeks, during which time the (potentially) contaminated groundwater seeps through the porous bag linings. They are subsequently removed for analysis.

Another phase of the project could involve the implementation of a soil gas survey to determine particular hot spots of hydrocarbon contamination. This activity is contingent upon the approval of the new site owner, which is not the client for the job but controls access to the site. The soil-gas survey would involve the installation of passive sorbent collection devices (sorbers) at numerous locations, including inside buildings, which could create disruption.

Goods associated with the service contract

The products involved with the site investigation included the following:

- Low-flow, positive-displacement bladder pumps.
- Diffusion bags (62 units) containing distilled water (HS 2851.00•).
- Textile products for the construction of the new wells (HS 5911.90▲).
- Filters (HS 8421.29▲•).
- Passive sorbent collection devices (sorbers).
- Bottles for samples (HS 7017.10▲).

The pumps were rented from a company in Australia. The filters and textile products were purchased from Australian suppliers, and the diffusion bags and sorbers were purchased from W.L. Gore, a US supplier which also analysed the sorber contents. Otherwise, sample analysis was conducted by an environmental laboratory in Sydney, Australia.

Import issues

ERM paid import duties of about USD 100 on the entire shipment of diffusion bags and sorbers, worth around USD 1 200 after shipment and insurance costs. A second lot of the bags will likely be required if the soil-gas survey moves forward as originally planned. ERM is finding that Malaysia is increasing its capacity to provide some of the basic environmental goods that were used in this project. Some of the goods that initially

had to be sourced from Australian suppliers are now becoming available from Malaysia at lower prices.

ENSR-Brazil

The client

Petróleo Brasileiro (Petrobras) is a Brazilian company engaged in oil, gas and energy exploration, production, refining and retailing. The Brazilian government owns 32% of Petrobras and 56% of its voting shares. The company — the largest in Brazil, with annual revenues in excess of USD 5 billion — operates 16 refineries, more than 20 000 miles of pipeline, and more than 5 000 gas stations, and has proven reserves of 11.6 billion barrels of oil equivalent. Its subsidiary, Petrobras Distribuidora, is Brazil's leading retailer of oil products and fuel alcohol.

Although Brazil's regulatory framework requiring oil and gas companies and other industrial companies to address pollution is becoming more stringent, Petrobras is already cleaning up its sites on a voluntary basis.

The service provider

ENSR International is an environmental consulting and engineering firm generating more than USD 170 million a year in gross revenue. The privately held company (in 2000, it completed a management-led buyout from the German energy services giant RWE) provides a wide range of environmental services. The company employs about 1 400 people at approximately 70 offices in 17 countries, including a number of developing countries in Latin America and Asia. In Brazil, the company employs a multidisciplinary team of 35 engineers, geologists, biologists, oceanographers and technicians, and it has undertaken numerous offshore and onshore projects for large oil and gas companies like Petrobras, as well as for manufacturing companies.

The contract

In early part of the current decade, ENSR contracted with Petrobras on a time and materials basis to conduct site investigations at Petrobras service stations and, where necessary, to undertake follow-up remediation activities. The sites to be investigated were distributed broadly throughout Brazil, from Rio de Janeiro in the south to the Amazon Basin in the north. Altogether, ENSR conducted a total of about 120 site investigations and undertook about 30 remedial actions. Single investigations were performed for an average price of about USD 5 000, while remediation projects cost an average of about USD 30 000, with jobs ranging from the very small, involving pump-and-treat work, to jobs exceeding USD 100 000.

Goods associated with the service contract

To undertake the site investigations and cleanups, ENSR relied on a broad range of remediation technologies, including pump and treat, air sparging, bioslurping, soil vapour extraction and chemical oxidation. To implement these technologies and to characterise sites, the company uses the following types of products:

- Activated carbon (HS 3802.10•).
- Pumps (HS 8413.60▲• to 8413.70▲•).

- Filters (HS 8421.21▲• to 8422.20▲•).
- Valves and fittings (HS 8481.10• to 8481.80•).
- Instrumentation (HS 9015.40▲ to 9031.90▲).
- Pigs (*i.e.* devices for inline inspection of buried pipelines).
- Oil-water separators.

Because of the lack of local sources, ENSR must import most of these items, generally from suppliers in the United States, Canada and Europe. A company spokesperson attributes the lack of local suppliers of environmental equipment to the lack of a sufficient market to sustain the necessary production infrastructure. Some equipment, such as oil-water separators, can be obtained locally, but even then, not in every case. Pumps in particular are sourced from outside Brazil. All assembly of systems, including electric control panels, is performed by local contractors.

Import barriers

When purchasing equipment through in-country representatives of US, Canadian and German companies, ENSR pays a mark-up of up to 100% for the products compared with their original prices. When ENSR project managers use their own agents to purchase equipment directly from foreign suppliers they pay a 60% import duty. The trade-off, however, is the lack of after-sales services such as instrument calibration and system maintenance.

Another barrier to trade in Brazil is the withholding tax, of up to 25%, on funds spent for services, such as laboratory analysis, procured outside the country. This withholding tax is in addition to any import duties or mark-ups associated with the purchase of equipment.

Environmental impact assessment

Environmental impact assessment for an Indian hazardous-waste site

The client

For reasons of confidentiality, the service provider (a Canadian consulting firm) has asked that the name of its client not be disclosed, but described it as an industry association with a significant membership of large and medium-sized companies based in India. The association's 800 members include large automobile makers, pharmaceutical companies, foundries, petroleum refineries, metal platers, chemical makers and textile dyeing and processing firms. The association is seeking to develop an integrated hazardous-waste management facility for its member organisations.

The service provider

The service provider is the same Canadian consulting firm described above. It has a subsidiary in India, and it employs all local staff, although it regularly deploys Canada-based staff to assist in project management and technical support.

The contract

The client retained the services of the Canadian consulting firm to prepare a comprehensive environmental impact assessment (EIA), including carrying out detailed site assessments and collecting baseline data, in order to select a suitable site for the facility. The data were also to be used to develop an environmental management plan and to inform the design stage.

The consulting firm drew up a detailed monitoring programme for surface water and groundwater, as well as for the assessment of air quality and noise, and then carried out the monitoring, using its own equipment. However, considering the shipping distance and the relatively high costs of shipping, it initially decided to use only its own sound-level meters, which were substantially more sophisticated than those locally available. The service provider did, however, decide to lease other equipment and technical support locally in India.

Goods associated with the service contract

The following equipment from the combined APEC and OECD product list was involved with the site investigation:

- Sample bottles (HS 7017.10▲).
- Filter assemblies (HS 8421.39▲•).
- Particulate samplers with appropriate filters, vacuum pumps and accessories (ex HS 9027.10▲•).
- NO_X absorbers (ex HS 9027.10▲•).
- SO_2 absorbers (ex HS 9027.10▲•).
- Sound-level meters (HS 9027.80▲•).

In addition, the consultants used drills and core samplers for testing the soil and sub-soil. All the material was locally sourced except the sound-level meters, which were initially brought into India from Canada in the project manager's hand-carried luggage.

Import issues

The project manager carried appropriate letters to indicate that the sound-level meters used for the assessment work were the property of the Canadian company and would be returned once the testing was complete. This equipment had been previously used and was substantially lower in value than the original purchase price. However, upon arrival at the New Delhi airport, the customs officials demanded that 100% duty be paid to take the equipment into the country. Once the equipment was re-exported (returned to Canada), the duty was to be claimed by the Canadian company by filling out the appropriate forms.

The company's project manager expected that it would take a substantial amount of time to get the refund. (Box 5.3 provides a perspective on non-tariff barriers to trade in environmental goods and services in India.) Bearing that probability in mind, and considering that a 100% duty was being demanded, even though the sound-level meters were old, he decided not to pay the duty, and instead to take his chances with less sophisticated equipment available for rent locally. The project manager left the sound-

level meters that he had brought with him from Canada under bond with the customs authority at New Delhi airport and picked them up on his return journey.

Box 5.3. Non-tariff barriers to imports of environmental goods and services in India

In early 2003, the US-Asia Environmental Partnership (USAEP) office in New Delhi released a report on non-tariff barriers to trade in environmental goods with India. A summary of some of these findings, submitted to Environmental Business International by a USAEP official in New Delhi, is provided here:

Processing delays and government purchasing practices: The major share (75%) of India's market for environmental technologies is through government procurement. The time taken for a proposal to materialise into an actual sale is so lengthy that, by the time the sale takes place, the imported technology is often obsolete, and the supplier may be wrongly accused of trying to supply obsolete technology.

Certification requirements: Raising financing for infrastructure projects, such as waste-to-energy, water and wastewater treatment projects, poses great problems, because the imported technology has to be tested and certified by local agencies. Only in a few cases is international approval recognised. The Ministry of Environment and Forests (MOEF) sits once every three months. A company that has worked on several waste-to-energy projects, for which gas turbines had to be imported, reported that the MOEF took months to give clearance on this type of equipment.

Service tax: Professional services firms pay a service tax on services provided, a problem also observed in countries such as Brazil.

Annex 5.A2

Goods from the Combined APEC and OECD Product Lists Used in the Performance of Environmental Services

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*								Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services					
			Seven-sector environmental service classification[1]								
			WWM	SHM		APC	N/V	BIO	R/C	Other	
2201.00	Water, incl. natural or artificial mineral water		X					X	X		X
2207.10	Ethanol					X			X		
2302.10	Bran, sharps and other residues, whether or not in the form of pellets, derived from the sifting, milling or other working of corn	Booms or socks consisting of ground corn cobs contained in a textile covering							X		
2521.00	Limestone flux					X		X	X		
2522.20	Slaked (hydrated) lime					X		X	X		X
2801.10	Chlorine		X								X
2801.10	Hydrogen peroxide		X								X
2814.10	Anhydrous ammonia		X								X
2815.11	Sodium hydroxide solid		X								X
2815.12	Sodium hydroxide in aqueous solution		X								X
2816.10	Magnesium hydroxide and peroxide		X			X			X		X
2818.30	Aluminium hydroxide		X								
2820.10	Manganese dioxide		X			X					
2820.90	Manganese oxides (other)		X								
2824.10	Lead monoxide		X								
2832.10	Sodium sulphites		X								X
2832.20	Other sulphites		X								X
2835.10	Phosphinates and phosphonates		X								
2835.21	Phosphates of triammonium		X								
2835.22	Phosphates of monosodium or disodium		X								X
2835.23	Phosphates of trisodium		X								
2835.24	Phosphates of potassium		X								X
2835.25	Calcium hydrogenorthophosphate		X								X
2835.26	Other phosphates of calcium		X								X
2835.29	Other phosphates (excl. polyphosphates)		X								X
2851.00	Distilled and conductivity water										X
2905.11	Methanol					X					
3209.10	Paints and varnishes, in aqueous medium, acrylic or vinyl					X					
3209.90	Other paints and varnishes, in aqueous medium					X					
3802.10	Activated carbon		X			X			X		X
3802.90	Activated earths					X					
3815.00	Catalysts		X	X		X			X		X
3906.90	Flocculating agents		X								X
3914.00	Ion exchangers (polymer)		X						X		X
3920.20	Polypropylene sheeting, etc.			X					X		
3924.90	Household & toilet articles of plastic		X								

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*							Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services				
			Seven-sector environmental service classification[1]							
			WWM	SHM		APC	N/V	BIO	R/C	Other
3926.90	Other articles of plastics and articles of other materials of headings 3901 to 3914; other	1. Bio-film medium that consists of woven fabric sheets that facilitate the growth of bio-organisms.	X						X	
3926.90	Other articles of plastics and articles of other materials of headings 3901 to 3914; other	2. Rotating biological contactor consisting of stacks of large (HDPE) plates that facilitate the growth of bio-organisms.	X						X	
4601.20	Mats, matting, and screens of vegetable materials	1. Erosion control matting (biodegradable)	X					X	X	
5603.14	Non-wovens, whether or not impregnated, coated, covered or laminated: of manmade filaments; weighing more than 150 g/m2	Fabric of polyethylene, polypropylene, or nylon for filtering wastewater.	X						X	
5801.90	Woven pile & chenille fabrics of other textile materials		X							
5911.90	Textile products and articles, for technical uses, specified in note 7 to this chapter; other	Environmental protection cloth	X					X		
6810.99	Other articles of cement, concrete		X	X						X
6902.10	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight, singly or together, more than 50% of the elements Mg, Ca or Cr, expressed as MgO, CaO or Cr_2O_3	Industrial incineration		X						
6902.20	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; containing by weight more than 50% of alumina (Al_2O_3), of silica (SiO_2) or of a mixture or compound	Industrial incineration		X						
6902.90	Refractory bricks, blocks, tiles and similar refractory ceramic constructional goods, other than those of siliceous fossil meals or similar siliceous earths; other	Industrial incineration		X						

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*								Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services					
			Seven-sector environmental service classification[1]								
			WWM	SHM		APC	N/V	BIO	R/C	Other	
6903.10	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of graphite or other carbon or of a mixture of these products	Laboratory refractory equipment	X	X		X		X	X		X
6903.20	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; containing by weight more than 50% of a	Laboratory refractory equipment	X	X		X		X	X		X
6903.90	Other refractory ceramic goods (for example, retorts, crucibles, muffles, nozzles, plugs, supports, cupels, tubes, pipes, sheaths and rods), other than those of siliceous fossil meal or of similar siliceous earths; other	Laboratory refractory equipment	X	X		X		X	X		X
6909.19	Ceramic wares for laboratory, chemical or other technical uses; other	Laboratory equipment	X	X		X		X	X		X
7008.00	Multiple walled insulating units of glass					X					
7017.10	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of fused quartz or other fused silica		X	X		X		X	X		X
7017.20	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; of other glass having a linear coefficient of expansion not exceeding 5 x 10 -6 per Kelvin within a temperature range of 0 °C to 300 °C		X	X		X		X	X		X
7017.90	Laboratory, hygienic or pharmaceutical glassware, whether or not graduated or calibrated; other		X	X		X		X	X		X
7019.90	Other glass fibre products					X					
7309.00	Tanks, vats, etc., > 300 litres		X								X
7310.10	Tanks, drums, etc., >50 litres <300 litres		X								
7310.21	Cans < 50 litres, closed by soldering or crimping		X								
7310.29	Other cans < 50 litres		X								
7325.10	Articles of cast iron		X								X
7806.00	Other articles of lead		X	X							X

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*							Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services				
			Seven-sector environmental service classification[1]							
			WWM	SHM		APC	N/V	BIO	R/C	Other
8404.10	Auxiliary plant for use with boilers of heading 8402 or 8403 (for example, economisers, super-heaters, soot removers, gas recoverers)			X		X			X	
8404.20	Condensers for steam or other vapour power units			X		X				
8405.10	Producer gas or water gas generators, with or without their purifier; acetylene gas generators and similar water process gas generator, with or without their purifiers	Include only those with purifiers.		X		X				
8409.91	Parts suitable for use solely or principally with the engines of heading 8407 or 8408; suitable for use solely or principally with spark-ignition internal combustion piston engines.	Industrial mufflers					X			
8409.99	Parts for diesel or semi-diesel engines						X			
8409.99	Parts suitable for use solely or principally with the engines of heading . 8407 or 8408; other	Industrial mufflers				X	X			
8410.00	Hydraulic turbines 00		X			X				X
8410.11	Hydraulic turbines and water wheels of a power not exceeding 1 000 kW					X				
8410.12	Hydraulic turbines and water wheels of a power exceeding 1 000 kW but not exceeding 10 000 kW					**X**				
8410.13	Hydraulic turbines and water wheels of a power exceeding 10 000 kW					**X**				
8410.90	Hydraulic turbines and water wheels; parts, including regulators					**X**				
8413.20	Root control equipment		**X**							**X**
8413.50	Positive displacement pumps, hand operated [centrifugal pumps]		**X**							**X**
8413.60	Pumps for liquids, whether or not fitted with a measuring device; other rotary positive displacement pumps	Submersible mixer pump to circulate water in wastewater treatment process; sewage pumps, screw type	**X**							
8413.70	Pumps for liquids, whether or not fitted with a measuring device; other centrifugal pumps	Centrifugal pumps lined to prevent corrosion; centrifugal sewage pumps	**X**							
8413.81	Pumps for liquids, whether or not fitted with a measuring device; other pumps	Wind turbine pump				**X**				
8414.10	Vacuum pumps		**X**	**X**		**X**			**X**	**X**
8414.30	Compressors of a kind used in refrigerating equipment		**X**	**X**		**X**			**X**	
8414.40	Air compressors mounted on a wheeled chassis for towing				**X**	**X**			**X**	

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*							Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services				
			Seven-sector environmental service classification[1]							
			WWM	SHM		APC	N/V	BIO	R/C	Other
8414.59	Fans (and blowers) other than table, floor, window, ceiling or roof fans with a self contained electric motor of an output not exceeding 125W				X	X				
8414.80	Other air or gas compressors or hoods		X	X		X				
8414.80	Air or vacuum pumps, air or other gas compressors and fans; ventilating or recycling hoods incorporating a fan, whether or not fitted with filters; other		X	X		X				
8414.90	Parts for air or gas compressors, fans or hoods		X	X		X				
8417.80	Industrial or laboratory furnaces and ovens, including incinerators, non-electric; other than bakery ovens and furnaces for treatment of ores	Waste incinerators		X						
8417.90	Parts of Industrial or Laboratory Furnaces and Ovens, Including Incinerators, Non-electric	Parts of waste incinerators		X						
8419.11	Instantaneous gas water heaters					X				
8419.19	Other instantaneous or storage water heaters, non-electric	Solar water heaters				X				
8419.40	Distilling or rectifying plant									X
8419.50	Heat exchange units		X	X		X				
8419.60	Machinery for liquefying air or other gases					X				
8419.89	Other machinery for treatment of materials by change of temperature					X				
8419.90	Parts for heat exchange equipment		X	X		X				
8421.19	Centrifuges, including centrifugal dryers, other than cream separators and clothes-dryers		X	X		X				X
8421.21	Filtering or purifying machinery and apparatus for liquids: for filtering or purifying water		X							X
8421.29	Filtering or purifying machinery and apparatus for liquids; other		X						X	X
8421.39	Filtering or purifying machinery and apparatus for gases; other			X		X				
8421.91	Parts of centrifuges		X							
8421.91	Parts of centrifuges, including centrifugal dryers	Centrifuges, accessories & parts; except clothes dryers and clothes dryer furniture	X	X		X				X
8421.99	Parts of filtering or purifying machinery and apparatus for liquids or gases			X		X				

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*								Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services					
			Seven-sector environmental service classification[1]								
			WWM	SHM		APC	N/V	BIO	R/C	Other	
8422.20	Machinery for cleaning or drying bottles or other containers			X							
8423.81	Weighing machines capacity <30 kg		X								
8423.82	Weighing machines capacity >30 kg <500 kg		X								
8423.89	Weighing machines		X								
8424.90	Parts for sprayers for powders or liquids					X					
8428.33	Other continuous-action elevators and conveyors, for goods or materials; other, belt type	Belt-type above ground conveyor used to transfer solids or slurries between plants	X	X							
8436.80	Other agricultural, horticultural, forestry, poultry-keeping or bee-keeping machinery	Hot water weed killing system	X					X			
8462.91	Machine tools for working metal, other than punching or notching and combined punching and shearing; hydraulic presses	Shredders/balers for metals; hydraulic		X							
8472.90	Other office machines	Paper shredders		X							
8474.10	Sorting, screening, separating or washing machines	Machines of a kind for use in screening and washing coal		X		X					
8474.10	Sorting, screening, separating or washing machines	Waste foundry sand reclamation equipment		X							
8474.32	Machines for mixing mineral substances with bitumen	Asphalt recycle equipment		X							
8474.39	Other mixing or kneading machines for earth, stone, sand, etc.			X							
8479.82	Mixing, kneading, crushing, grinding, screening, sifting, homogenising emulsifying or stirring machines	Agitator for wastewater treatment	X								
8479.82	Mixing, kneading, crushing, grinding, screening, sifting, homogenizing emulsifying or stirring machines	Other than kneading machinery		X							
8479.89	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Trash compactors		X	X						
8479.89	Machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Radioactive waste press		X							
8479.90	Parts of machines and mechanical appliances having individual functions, not elsewhere specified or included in this chapter, other	Parts of trash compactors		X	X						
8481.10	Valves, pressure reducing		X								X
8481.30	Valves, check		X								X
8481.40	Valves, safety		X								X

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*								Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services					
			Seven-sector environmental service classification[1]								
			WWM	SHM		APC	N/V	BIO	R/C	Other	
8481.80	Other taps, cocks, valves, etc.		X								X
8502.31	Generating sets, electric, wind-powered					X					
8505.90	Electromagnets; other, including parts	Electromagnet		X							
8514.10	Industrial or laboratory furnaces and ovens; electric, resistance heated	Waste incinerators or other waste treatment apparatus		X							
8514.20	Industrial or laboratory furnaces and ovens; electric, induction or dielectric	Waste incinerators or other waste treatment apparatus		X							
8514.30	Industrial or laboratory furnaces and ovens, electric, other	Waste incinerators or other waste treatment apparatus		X							
8514.90	Parts of industrial or laboratory electric furnaces and ovens or other laboratory induction or dielectric heating equipment	Parts of waste incinerators		X							
8516.29	Other electric space heating and soil heating apparatus			X					X		
8539.31	Fluorescent lamps, hot cathode					X					
8541.40	Photosensitive semiconductor devices, including photovoltaic cells whether or not assembled in modules or made up into panels; light emitting diodes	Solar cells				X		X	X		
8543.89	Electrical machines and apparatus, having individual functions, not specified or included elsewhere in this chapter; other	Ozone production system	X								X
8708.92	Silencers and exhaust pipes, motor vehicles						X				
8907.10	Inflatable rafts	Inflatable oil spill recovery barges							X		
8907.90	Other floating structures	Pollution protection booms							X		
9013.20	Lasers			X							
9015.40	Photogrammetric surveying instruments and appliances		X	X		X	X	X	X		X
9015.80	Other surveying, hydrographic, oceanographic, hydrological, meteorological or geophysical instruments and appliances, excluding compasses		X	X		X	X	X	X		X
9015.90	Parts and accessories of surveying, hydrological, meteorological, or geophysical instruments and appliances, excluding compasses	Photogrammetric instruments; parts and accessories for articles of subheading 9015.40	X	X		X	X	X	X		X

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*								Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services					
			Seven-sector environmental service classification[1]								
			WWM	SHM		APC	N/V	BIO	R/C	Other	
9022.29	Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses		X	X		X	X	X	X		X
9022.90	Apparatus based on the use of X-rays or of alpha, beta or gamma radiations for other than medical, surgical, dental or veterinary uses	Parts and accessories for goods of subheading 9022.29	X	X		X	X	X	X		X
9025.11	Thermometers and pyrometers, not combined with other instruments: liquid-filled, for direct reading		X								X
9025.19	Thermometers and pyrometers, not combined with other instruments: other than liquid-filled, for direct reading		X			X					X
9025.80	Hydrometers and similar floating instruments, thermometers pyrometers, barometers, hygrometers, and psychrometers, recording or not, and any combination of these instruments		X			X					X
9025.90	Parts and accessories for hydrometers and similar floating instruments, thermometers pyrometers, barometers, hygrometers, and psychrometers, recording or not, and any combination of these instruments		X								X
9026.10	Instruments and apparatus for measuring or checking the flow or level of liquid		X								X
9026.20	Instruments and apparatus for measuring or checking pressure		X								X
9026.80	Other instruments and apparatus		X	X		X	X	X	X		X
9026.90	Parts and accessories for articles of subheading 9026		X								X
9027.10	Gas or smoke analysis apparatus					X					
9027.20	Chromatographs and electrophoresis instruments		X	X			X	X	X	X	
9027.30	Spectrometers, spectrophotometers and spectrographs using optical radiations (ultraviolet, visible, infrared)		X	X			X	X	X	X	
9027.40	Exposure meters [including sound-level meters]		X	X			X	X	X	X	
9027.50	Other instruments and apparatus using optical radiations (ultraviolet, visible, infrared)		X	X			X	X	X	X	
9027.80	Other instruments and apparatus for physical or chemical analysis		X	X			X	X	X	X	X

HS sub-heading	Description of product	Additional product specification (if applicable)	*Four-sector environmental service classification*								Water supply
			Sewage	Refuse disposal	Sanitation	Other environmental services					
			Seven-sector environmental service classification[1]								
			WWM	SHM		APC	N/V	BIO	R/C	Other	
9027.90	Microtomes; parts and accessories		X	X			X	X	X	X	
9028.10	Gas meters			X		X					
9028.10	Gas supply, production and calibrating meters					X					
9028.20	Liquid supply, production and calibrating meters		X	X							X
9028.30	Electricity meters					X					
9028.90	Parts and accessories for articles of subheading 9028		X	X		X					X
9030.10	Instruments and apparatus for measuring or detecting ionising radiations			X		X			X		
9030.20	Cathode-ray oscilloscopes and cathode-ray oscillographs		X	X			X	X	X	X	
9030.31	Multimeters		X	X			X	X	X	X	
9030.39	Other instruments and apparatus, for measuring or checking voltage, current, resistance or power, without a recording device		X	X			X	X	X	X	
9030.83	Other instruments and apparatus for measuring or checking electrical quantities, with a recording device		X	X			X	X	X	X	
9030.89	Other instruments and apparatus for measuring or checking electrical quantities		X	X			X	X	X	X	
9030.90	Parts and accessories (for nominated articles of HS 9030)		X	X			X	X	X	X	
9031.10	Machines for balancing mechanical parts		X	X			X	X	X	X	
9031.20	Test benches		X	X			X	X	X	X	
9031.30	Profile projectors		X	X			X	X	X	X	
9031.49	Other optical instruments		X	X			X	X	X	X	
9031.80	Other measuring or checking instruments, appliances and machines, not elsewhere specified in this chapter		X	X			X	X	X	X	
9031.90	Parts and accessories (for nominated articles of subheading 9031)		X	X			X	X	X	X	
9032.10	Thermostats		X	X				X	X	X	
9032.20	Manostats		X	X					X	X	
9032.81	Hydraulic and pneumatic instruments and apparatus		X	X				X	X	X	X
9032.89	Automatic regulating or controlling instruments, other		X	X			X	X	X	X	X
9032.90	Parts and accessories		X	X			X	X	X	X	
9033.00	Parts and accessories (not specified or included elsewhere in this chapter) for machines, appliances, instruments or apparatus of Ch. 90		X	X			X	X	X	X	
9603.10	Brooms, hand			X	X						
9603.50	Brushes as parts of machines, appliances			X	X						
9603.90	Hand-operated mechanical floor sweepers, not motorised			X	X						

WWM = Waste-water management.

SHM = Management of solid or hazardous waste.

APC = Air-pollution control.

N/V = Noise and vibration abatement.

BIO = Nature and landscape protection services.

R/C = Remediation and clean-up of soil, surface water and groundwater.

PWT = Services related to the collection, purification or distribution of water.

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