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Identifying Complementary Measures to  
Ensure the Maximum Realisation of Benefits  
from the Liberalisation of Trade in  
Environmental Goods and Services

Case Study: Chile

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## **Joint Working Party on Trade and Environment**

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SERVICES**

**CASE STUDY: CHILE**

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by

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## ABSTRACT

This paper analyses the major determinants of change in the Chilean market for environmental goods and services and how they have affected trade in environmental goods and services with a particular focus on water services and air pollution control. The study reveals that the domestic market in Chile still largely focuses on end-of-pipe technology. In order to improve an access to and use of environmentally sound technology, a holistic approach by linking technology transfer to investment and to licensing of IPR is needed. In order to build domestic capacity on the supply side, the study also drew a conclusion that an evaluation of Chile's comparative and competitive advantage and a long term strategy is needed.

*Key words: environmental goods and services, environmental technologies, trade liberalization, trade and environment, water services, air pollution control, Chile*

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## ABBREVIATIONS

|                  |  |
|------------------|--|
| CDM              | Clean Development Mechanism (Kyoto Protocol)                           |
| CEIA             | Canadian Environment Industry Association                              |
| CER              | Certified emission reduction   |
| CNPL             | National Clean Production Council                                      |
| CP+L             | Cleaner Production Centre  |
| CODELCO          | National Copper Corporation  |
| CONADE           | National Ecology Commission  |
| CONAMA           | National Environment Commission  |
| ECLAC            | United Nations Economic Commission for Latin America and the Caribbean |
| EG&S             | Environmental goods and services                                       |
| ENAMI            | National Mining Enterprise   |
| ENAP             | National Petroleum Enterprise  |
| EPA              | US Environmental Protection Agency                                     |
| EST              | Environmentally sound technology                                       |
| FDI              | Foreign direct investment  |
| FSC              | Forest Stewardship Council   |
| FTA              | Free-trade agreement   |
| GHG              | Greenhouse gas   |
| INTEC            | National Technology Research Corporation                               |
| IPR              | Intellectual property rights   |
| PM <sub>10</sub> | Particulate matter up to 10 microns                                    |
| PPDA             | Air Pollution Clean-up and Prevention Plan (Metropolitan Region)       |
| R&D              | Research and development   |
| SEIA             | System of Environmental Impact Assessment                              |
| SISS             | Superintendence of Sanitation Services                                 |
| SMEs             | Small and medium-sized enterprises                                     |
| TSP              | Total suspended particulates   |
| VOCs             | Volatile organic compounds   |
| WTO              | World Trade Organization   |

## **IDENTIFYING COMPLEMENTARY MEASURES TO ENSURE THE MAXIMUM REALISATION OF BENEFITS FROM THE LIBERALISATION OF TRADE IN ENVIRONMENTAL GOODS AND SERVICES**

### **CASE STUDY: CHILE**

#### **Introduction**

In 1999, the Chilean environmental market was valued at about USD 810 million and was expected to grow 8-10% a year. Estimates for the major environmental technologies were: water and wastewater, USD 270 million; air pollution control, USD 320 million; solid waste management, USD 80 million; industrial wastewater treatment, USD 60 million; consulting and engineering services, USD 60 million; and hazardous and medical waste management, USD 20 million (USDC, 2000).

A key determinant of growth in the market for environmental goods and services (EG&S) was environmental regulation, starting in the early 1990s with the introduction of environmental framework legislation and the System of Environmental Impact Assessment (SEIA), as well as regulations on air pollution in the capital, Santiago. Since then, environmental regulation regarding various media has been shaping the increasing national demand for EG&S and creating new market opportunities for companies in the sector. Unilateral trade liberalisation, the establishment of favourable conditions for foreign direct investment (FDI), the conclusion of several free-trade agreements (FTAs), privatisation of water utilities and the country's economic and political stability have resulted in better market access for EG&S imports. These factors have also facilitated expansion of the market for EG&S through direct imports and the flow of FDI to the environmental sector. Increasing international competition, and the need to comply with international standards and commitments, put pressure on Chilean industry to take up the environmental challenge, apply environmental technologies and management, and, in some cases, exploit the market opportunities opening in the EG&S sector.

This paper analyses the major determinants of change in the Chilean market for EG&S and how they have affected trade in EG&S. It focuses on water services and air pollution control because they are national environmental priorities, they are important to the Chilean environmental market and they offer good examples of how environmental and trade policies have influenced market development.

The study was carried out using the OECD/Eurostat definition and classification of EG&S.<sup>1</sup>

#### **Main determinants of Chilean EG&S market**

##### ***Drivers on the demand side***

This section gives an overview of the major factors shaping the Chilean EG&S market in air pollution control and water services. It covers the main elements behind shifts in demand, including the evolution of environmental policy since 1990, environmental expenditure and investment, and national regulatory

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<sup>1</sup> See OECD (2001).

mechanisms. It also covers the drivers of supply shifts, including unilateral trade liberalisation, FTAs and other co-operation accords.

### *National factors*

#### Development of environmental policy

It is commonly agreed that Chile's current environmental policies and institutions were made possible by the advent of democracy in 1990. Nevertheless, three articles in the constitution of 1980 concerning environmental governance also aided the establishment of environmental institutions and policy making. One guarantees the right to live in a pollution-free environment, another links property rights with social and environmental priorities and the third establishes the right of appeal in cases of non-compliance with the first two provisions.

Thus environmental institutions can be traced back to 1984, when the National Ecology Commission (CONADE) was formed. Its main objectives were to identify major environmental problems, formulate environmental policies to address them, and co-ordinate related public-sector work. As its financial and technical resources were insufficient, however, and its approach to environmental problems reactive rather than proactive, it made little progress.

The environment has been of greater concern to the democratic administrations that have governed Chile since 1990. That year, to address the widespread problem of air pollution in the Metropolitan Region of Santiago, the government established a Special Commission for Pollution Control in the Metropolitan Region. Between 1992 and 1994, the two main pillars of current environmental policy in Chile were erected: CONADE became the National Environment Commission (CONAMA), and the General Environmental Framework Law (Law 19.300) was drafted and adopted. All other environmental legislation must conform with this law. Among other provisions, it sets out the legal basis for CONAMA and establishes such environmental management instruments as the SEIA, environmental quality and emission standards and pollution prevention and control plans.

Thus, the driving force behind growth in demand for EG&S has been legislation, mostly based on a command-and-control approach. In the years since the framework law's enactment, however, this approach has been cautiously complemented with other instruments, such as market-based measures. About 20 initiatives to introduce such measures have been taken, of which three have been implemented: an emission offset trading programme for particulate matter in Santiago, individual transferable fishing quotas and eco-labelling for ozone-friendly products and organic agriculture (Borregaard and Leal, 2000).

International issues have also influenced the development of Chilean environmental policy. For example, Chile has ratified the Montreal Protocol and Kyoto Protocol. Competition in external markets and the completion of several FTAs have been other important international agents for change. In addition, since 1999, various manufacturing sectors have entered into ten voluntary cleaner production agreements, adopting specific, time-bound environmental objectives in areas such as water and air pollution and solid-waste management.

#### Environmental expenditure

The environmental regulations introduced in the 1990s resulted in increased environmental expenditure by both the public and private sectors. The framework law and application of the SEIA have been the main elements influencing environmental expenditure since 1994 (Brzovic, 2002).

An assortment of information on environmental expenditure by the government exists, but no general agreement concerning the total has been reached. By some estimates it grew around fiftyfold between 1990



and 2000, while a more reasonable reckoning is that during this period it grew by a factor of at least 2.5 (Brzovic, 2002). More specifically, from 1998 to 2001 environmental expenditure by the central government probably grew at an average annual rate of 7.1% (Table 1). Although government environmental expenditure rose from USD 255 million in 1998 to USD 312 million in 2001, its share of GDP stayed at around 0.4-0.5%.

Another significant source of environmental expenditure comes from state firms. Between 1998 and 1999 the National Copper Corporation (CODELCO), National Mining Enterprise (ENAMI), National Petroleum Enterprise (ENAP) and a group of wastewater management enterprises spent a combined total of USD 605 million (Table 2). CODELCO accounted for about 55% of this sum, principally for pollution control and tailings management. The group of sanitation enterprises accounted for around 28%, mostly for sewerage connections and wastewater treatment plants.

Concerning private firms' environmental expenditure, no official figures exist but clearly the SEIA is a key impetus for spending related to new projects, especially since 1997. Between 1993 and 2004, 7 651 projects with an approximate investment value of USD 75.77 billion were submitted to the SEIA. The average environmental assessment accounts for the equivalent of around 1% of project costs, which means Chilean firms have spent about USD 651 million on EIAs (SEIA, 2004). In terms of investment, mining projects account for 31% of projects submitted to the SEIA. Other important sectors are energy (15%), property development (13%), industry (11%), forestry (7%), water services (4%) and transport (4%). A further significant source of environmental expenditure in the private sector stems from compliance with regulations concerning air and water pollution, especially related to emission standards and clean-up plans. The Securities and Insurance Supervisor (SVS) estimated that, in 2001, private-sector environmental expenditure totalled USD 120 million, equivalent to roughly 1% of GDP. This figure was higher than some had expected; nevertheless, the National Clean Production Council (CNPL) has maintained that total private-sector environmental expenditure is probably higher still, since the SVS figure covers only listed firms. The National Statistics Institute calculates that over 1995-99 roughly 55% of manufacturing firms in Chile implemented pollution reduction measures, an estimate that seems to support those of the SVS and CNPL.

#### Air regulations

The Metropolitan Region, home to some 40% of the population, has had an air pollution problem at least since the 1980s. Restrictions on car use began in 1986 and the particulates emission trading programme for stationary sources in 1992, yet the air of Santiago remained polluted: in 1996 the Metropolitan Region was declared an air-pollution "saturated zone"<sup>2</sup> for particulates (PM<sub>10</sub> and TSP), ozone (O<sub>3</sub>) and carbon monoxide (CO). It was also declared a "latent zone" for nitrogen dioxide (NO<sub>2</sub>). This prompted the authorities in 1997 to implement an air clean-up plan for PM<sub>10</sub>, O<sub>3</sub> and CO, and a prevention plan for NO<sub>2</sub>, with the objective of achieving accepted levels of air pollution by 2011. So far, the plan has involved emission reduction measures for industry, public transport, private transport, construction and green area management, among other measures. In addition, the areas around six mining complexes in various regions have been declared saturated for sulphur dioxide (SO<sub>2</sub>), PM<sub>10</sub>, or both, leading the authorities to put air clean-up plans into effect there as well.

*Driving restrictions and promotion of catalytic converters.* The restrictions on car use adopted in Santiago in 1986 were initially applied only during periods of severe pollution. In 1992, to improve regulation of passenger-car emissions, the restrictions were made permanent for all cars not equipped with catalytic converters. That year, unleaded gasoline became available, the first car with a catalytic converter

<sup>2</sup> In Chilean law, an area in which one or more standards are exceeded is called a saturated zone and one where the level of pollution is at 80-100% of the maximum allowed is a latent zone.

was sold, and the government issued a decree requiring all new cars entering Santiago to be equipped with catalytic converters (Bauner, 2003). Since 2002, even cars with catalytic converters have been subject to usage restrictions when pollution is bad. Although many in Chile have criticised car-use restrictions as an ineffective and inequitable way to combat air pollution, the measures have contributed to an increase in the share of the car fleet equipped with catalytic converters, from virtually nil in 1994 to 53% in 1998 and an expected 77% in 2010.

*Emission offsets trading.*<sup>3</sup> The emission offsets trading programme was established by Supreme Decree No. 4 (DS 4) in March 1992 as a cost-effective way to control emissions of total suspended particulates (TSP) from industrial boilers and furnaces in Santiago. Existing sources were assigned daily emission capacity rights in perpetuity, and all sources must have enough capacity rights to offset their maximum emission level for any given day.<sup>4</sup> The emission level is based on the source's size and fuel type, which are assessed during annual inspections. If the source's estimated maximum emission level is greater than its capacity rights, the source is categorised as a buyer; if smaller, as a seller. New sources (and expansion at existing sources) are not allocated emission capacity rights but must buy enough to offset their maximum emission level.

Montero *et al.* (2001) maintain that this programme has done well in environmental terms. They note that by 1997 the environmental goal of the programme had been achieved and that the overall maximum TSP emission level was below the total of emission capacity rights allotted at the beginning of the programme. They argue, however, that another factor helps explain the relatively good performance of industry in Santiago. As the offset programme was linked to critical pollution events, participating sources that were among those considered responsible for 50% of total emissions from stationary sources could be forced to stop operating during an emergency and those responsible for 30% of total emissions could be shut down during a pre-emergency. Such events were sufficiently frequent that, from a business perspective, being dropped from the list of most-polluting industries would likely have been deemed a good reason to take TSP emission reduction measures. If this is correct, the changes that industrial firms made were an economic response to critical pollution episodes and not to the economic incentives provided by the offsets programme.

*Metropolitan Region Air Pollution Clean-up and Prevention Plan (PPDA).* The PPDA, developed in 1997, consisted of more than 100 measures and instruments aimed at long-term emission reduction in the Santiago basin. Its cost to the government was estimated at USD 350 million (Pizarro and Vasconi, 2001). The plan also involved measures to be applied only during pollution pre-emergencies, emergencies and other critical events. Although the plan was aimed at reducing emissions from a range of sources — stationary, mobile and others — the emphasis was on industry and on public and private transport. Table 3 shows reductions for stationary and mobile sources between 1997 and 2000.

In 2001, a review of the PPDA by Chilean and international experts concluded that although emission reductions had been achieved between 1998 and 2000, much work remained and considerable investment was still needed to attain the long-term objectives set in 1997. Only stationary sources (mainly in industry) and certain other sources (mostly fuel distributors) had been able to significantly reduce their emissions. Stationary sources had been reducing emissions since 1997, and by 2000 were already complying with the 2005 targets for PM<sub>10</sub> and SO<sub>2</sub> in addition to cutting CO emissions by 32% and volatile organic compounds (VOCs) by 9% (though their NO<sub>x</sub> emissions had grown by 2%). As with the offset programme for TPS, most observers suggest that industry's good emission performance in Santiago is due more to voluntary changes than to pressure to meet the PPDA requirements. Nevertheless, the Federation of Chilean Industry

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<sup>3</sup> This section is mainly based on Montero *et al.*(2001).

<sup>4</sup> The emission capacity rights were allocated uniformly, based on a rate derived from an aggregate emission reduction goal of about 80%.

(SOFOFA) estimates that industry investments of USD 30 million between 1998 and 2000 were related to air pollution emission abatement, including conversion to natural gas and installation of control equipment.

Despite significant investment directed at reducing vehicle emissions between 1997 and 2000, emissions from mobile sources grew over the period: by 17% for PM<sub>10</sub>, 12% for NO<sub>x</sub> and 29% for SO<sub>2</sub>. In 1998, the public sector invested some USD 33 million to improve fuel quality (CONAMA, 1999).

In 2002, the PPDA was modified, with some measures added, others changed and special emphasis placed on the transport sector. In addition, Santiago's new urban transport plan aims at reducing emissions while providing better public transport. Among other measures, it involves redesigning public transport routes, increasing emission monitoring for vehicles without catalytic converters, extending the underground rail system, phasing out leaded petrol, paving 200 km of unpaved roads, renewing the public bus fleet and improving fuels. Moreover, a draft emission trading law now before the National Congress could cover not only air pollution but also water-related issues and apply across the country. CONAMA would like to use an instrument based on this law to achieve the 2011 emission targets of the PPDA, notably by strengthening the emission offsets trading programme.

*Air clean-up plans for copper smelters.* Between 1992 and 1998, the areas around five state copper smelter complexes were declared saturated zones for PM<sub>10</sub>, SO<sub>2</sub> or arsenic. Air clean-up plans were put into effect for each area, and are generally considered to have been successful. The exception is the Potrerillos smelter at El Salvador in Region II: instead of achieving air quality standards, CODELCO decided to relocate the local population 3 km away from the smelter. According to the Chilean Copper Commission (COCHILCO), as of 2000 some USD 1.2 billion had been spent on implementing the clean-up plans, with Chuquicamata, also in Region II, accounting for 56% of that sum (Table 4). Most of the plans involved investment related to three objectives for smelter management: increasing sulphur capture, expanding converters' fusion capacity and recovering more slag from furnaces. They also entailed greater investment in monitoring equipment and information services. A review of the plan for the Hernán Videla Lira smelter at Paipote in Region III found that increased sulphur capture, using new acid plants and a gas-management system, accounted for 46% of the total invested there; equipment to increase fusion capacity represented 31% and slag recovery 17% (CONAMA, 2003).

## Water regulations

*The water services industry.* Water services essentially comprise drinking water supply, sewerage connection and sewage treatment. This industry in Chile has undergone dramatic change since the late 1980s. The state owned, ran and enforced regulations in the sector until 1989, when Law 18.902 established the Superintendence of Sanitation Services (SISS) as the regulatory agency, and a decree, DFL 382, formulated the General Sanitation Services Law. From a service provided fully by the state, the sector was transformed into a system based on 13 independent firms. At first the state continued as owner and operator, but in the late 1990s private resources were injected into the sector. Between 1998 and 2000, five of the 13 firms were partly privatised: ESVAL, EMOS (later Aguas Andinas), ESSAL, ESSEL and ESSBIO. To continue financing sanitation objectives over 2000-10, especially as regards sewage treatment, in 2001 the state opted for a different form of private involvement, granting 30-year concessions to private firms that agreed to make required investments. It is expected that, to achieve 100% coverage for rural drinking water and urban sewage treatment by 2010, some USD 1.4 billion will be needed. Also during this period a concession plan for flood-water management is likely, with around USD 1.7 billion expected to be required.

*Industrial wastewater treatment.* Since 1993, environmental laws have required most industrial installations to treat effluent before discharging it into waterways or sewage systems. A survey by SISS before this regulation took effect indicated that 38% of industrial firms operating in Chile had primary

treatment systems, and 9.2% had more advanced treatment systems. Companies have been slow to comply with the regulation. SISS estimated in 1996 that 1 780 industrial firms required some kind of effluent treatment. By September 2004, more than 400 industrial firms had established authorised effluent treatment plants ([www.siss.cl](http://www.siss.cl)).

Since the early 1990s, the General Directorate of the Maritime Territory and Merchant Marine (DIRECTEMAR) has actively monitored industrial discharges in coastal areas. Companies operating in these areas must conduct a study to determine the carrying capacity of the immediate environment and adapt their operating procedures accordingly. The sectors most affected by these rules are chemicals, petrochemicals, fishmeal processing and salmon farming. The mining industry is also working on ways to reduce its effluent (ITA, 2000), and, as mining complexes are typically located in areas where water is scarce, the industry is exploring ways to reuse its wastewater (Box 1).

While the wastewater technologies and services subsector is still relatively small, it will continue to grow as clean-up plans in the most-polluted areas are implemented and new standards go into effect. A study by the Chilean Engineers Professional Association found that, to comply with current regulations, industry needs to invest about USD 4.5 billion in wastewater treatment facilities and that the best prospects involve water reuse technology in the mining industry (ITA, 2000).

**Box 1: The case of Altonorte: water treatment and transport**

In March 2003, the Altonorte copper smelter north of the city of Antofagasta, one of the driest places on earth, completed a USD 170 million expansion. The expansion, which increased the smelter's annual copper production capacity from 160 000 tonnes to 290 000 tonnes, was made possible by the introduction in April 2002 of a new water treatment process in Antofagasta, on the coast almost 40 km away, and a system that transported water to the plant at 600 metres above sea level. The project seems to be benefiting both the environment and the economy. The USD 6 million wastewater treatment and transmission project was managed by Cascal, an Anglo-Dutch company. Essentially it involves providing extra treatment for part of Antofagasta's wastewater, all of which formerly was discharged into coastal waters, and transporting it north via a special pipeline and pumping stations for use at the smelter, where it is stored in reservoirs until needed ([www.water-technology.net/projects/copper](http://www.water-technology.net/projects/copper)).

*International influences*

Multilateral environmental agreements and trade

*Kyoto Protocol.* Chile was a latecomer in terms of setting up the necessary institutions to participate in the world carbon market, and only in 2003 did it develop the National Designated Authority for participation in the Clean Development Mechanism (CDM) of the Kyoto Protocol. In June 2003, the Chacabuquito run-of-river hydropower project, high in the Chilean Andes, was the first project in the developing world to have its greenhouse gas (GHG) emission reductions verified for CDM purposes (FIC, 2003). The 26 MW plant near the town of Los Andes will be credited with 1 million tonnes' worth of certified emission reductions (CERs) under the World Bank Prototype Carbon Fund, and the power company involved, Hidroeléctrica Guardia Vieja S.A., will receive USD 3.5 million in return over ten years. In addition, Japan's Mitsubishi Corporation made a separate purchase from Chacabuquito of 100 000 tonnes of CO<sub>2</sub> emission reductions (about 10 000 tonnes per year for ten years), at an expected price on the CDM market of around USD 7 million (FIC, 2003).

Chilean environmental authorities say that Chile offers very good opportunities for low-cost GHG emission reductions and that they expect the country to account eventually for a significant proportion of CDM projects worldwide. Apart from Chacabuquito, three other CDM projects are now under way, each covering ten years. Agrosuper, an important agroindustrial firm, is reducing methane emissions from its pig farms and will sell about 4 million CERs for USD 25 million. Nestlé changed the fuel it uses in its Chilean plants from coal to natural gas and will sell around 100 000 CERs for USD 400 000. Watt's, a

major food firm, introduced a cogeneration plant and increased energy efficiency, permitting it to sell some 100 000 CERs for USD 400 000. These are among more than 30 projects that Chile expects will represent CDM credits worth some USD 150 million over 2003-08. Most of the projects are in the energy sector; they include cogeneration plants, hydropower projects and wind farms. Other possibilities involve transport, waste management, agriculture and green building developments.

*Montreal Protocol.* Chile was one of the first countries to sign the Montreal Protocol in 1988 and to ratify its amendments. In 1994 it launched its Country Programme for Ozone Layer Protection, and subsequent measures had good results in terms of reducing consumption of ozone-depleting substances (ODS). The programme was divided into two phases. The pilot phase, from 1995 to 1997, eliminated 118.4 tonnes of ODS a year in 11 conversion projects at a total cost of USD 1.19 million (Canales and Leiva, 1999). The current phase, which started in 1998, allocates grant resources through auctions. The eight auctions organised thus far, involving more than 20 firms, have resulted in the elimination of 370 tonnes of ODS at a cost of about USD 13 million, of which USD 2.6 million was provided by the Multilateral Fund for the Implementation of the Montreal Protocol and USD 10.4 million by private firms.<sup>5</sup>

Under the Montreal Protocol, Chile is expected to be consuming no more than 428 tonnes of chlorofluorocarbons (CFCs) a year by 2005; projections indicate that its actual consumption, assuming all current projects are fully implemented, will be around 298 tonnes. The terms of the protocol also mean Chile should be consuming no more than 125 tonnes of CFCs by 2007 and is expected to end its imports of CFCs by 2010 and of methyl bromide by 2015.<sup>6</sup>

*Competition in international markets.* Many observers in economic, industrial and environmental circles in Chile see international competitiveness as a key driver of environmental investment in Chilean industry. As Chile's Foreign Investment Committee has put it (FIC, 2001), Chile has recognised that investment related to environmental sustainability is a key aspect of being able to compete and make headway in international markets — that sustainability, in other words, is “a powerful business driver”. For example, Chilean industry's choice of environmental quality standards, such as ISO 14001 and the Forest Stewardship Council (FSC) standards, has largely been influenced by firms' determination to retain access to foreign markets.

Borregaard and Dufey (2002) analyse the role of FDI in introducing environmental management and technology to Chile. In the mining sector, for instance, foreign companies were the first to carry out EIAs and seek ISO 14001 certification. The foreign-owned Chagres smelter has for years recorded the country's lowest emissions per unit of output.

Chile's strong export orientation and trade liberalisation, and the elimination of many non-tariff measures, have given the country one of the world's most open economies. Matus and Rossi (2002) see Chile's export strategy as positioning Chile as a reliable supplier of high-quality goods and services produced according to international environmental standards. To precisely this end, in 1999 the General Directorate for International Economic Affairs (DIRECON) established a Trade and Sustainable Development Department. Given the trade agreements signed by Chile since the mid-1990s (described in more detail below), environmental considerations in the production of trade-related goods and services can be expected to be increasingly emphasised.

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<sup>5</sup> The figure for private firms is not official; it was derived from a telephone conversation with Mr. Canobio of the CONAMA Ozone Unit.

<sup>6</sup> See [www.conama.cl/portal/1255/article-28561.html](http://www.conama.cl/portal/1255/article-28561.html).

## Complementary measures

*Voluntary cleaner production agreements.* Since 1999, the government has promoted the implementation of voluntary cleaner production agreements to facilitate sector-wide improvement of environmental, production, health and safety conditions. The agreements are concluded between representatives of government and industry who together define the objectives, targets and actions needed. Though they are voluntary, once signed the commitments must be honoured. As of January 2003, ten such agreements had been reached, involving more than 1 200 firms, in the following branches of industry: chemicals (containers), chemicals (liquid waste), construction, pig farming, pulp, sawmills, mining (copper smelters), salmon farming, scallop farming and vegetable growing. Rough expenditure figures are available only for smelters, where investment has amounted to about USD 5 million, basically for technology to deal with air pollution and solid waste (CNPL, 2003a).

*Environmental standards and certification.* Several certification initiatives have been developed in Chile in recent years. Programmes relating to natural resource sectors have tended to expand more rapidly than those covering manufacturing. Although their validity was initially challenged, such initiatives have gradually gained recognition. Chile is also progressing in terms of ISO 14001 certification in industry. By December 2004, some 109 firms had achieved ISO 14001 certification,<sup>7</sup> with forestry, fruit growing, winemaking and mining predominating. Other environmental management standards with a strong presence in Chile are the FSC and the more recent national programme CERTFOR,<sup>8</sup> which is recognized by the Programme for the Endorsement of Forest Certification Schemes (PEFC). Although several Chilean organic certification bodies have emerged, most certification of organic farms — whose number and acreage are expanding rapidly — is still carried out by foreign organisations, particularly from Switzerland, Germany and Argentina.

## ***Drivers on the supply side***

### *Unilateral trade liberalisation and FDI promotion*

Since the mid-1970s, Chile has had a strong export orientation and pursued a trade liberalisation strategy that included eliminating many non-tariff measures, carrying out large-scale structural reform to attract foreign capital, and privatising state-owned companies. Chile's approach for penetrating international markets is based on unilateral elimination of trade barriers, bilateral and regional liberalisation over the past decade, and active participation in multilateral trade negotiations.

In negotiations within the World Trade Organization (WTO) on environmental goods, Chile opposes tariff differentiation, a position consistent with its strategy of giving generally equal treatment to all economic sectors: it applies a uniform 6% tariff on most imports. Chile also participates in the work of the WTO's Special Sessions of the Council for Trade in Services under the General Agreement on Trade in Services, where it has made commitments in sectors including insurance, financial services, telecommunications, travel and tourism, and engineering and consultancy. For environmental services, however, it has neither made specific commitments nor offered any negotiating position (RIDES, 2002; WTO services database).

Chile has eliminated most restrictions on FDI<sup>9</sup> and established a favourable tax regime for foreign investment. The country has signed more than 50 bilateral investment agreements, and several of its

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<sup>7</sup> ProChile, personal communication.

<sup>8</sup> See [www.certfor.org](http://www.certfor.org).

<sup>9</sup> The Foreign Investment Statute, promulgated by decree (DL 600), establishes clear rules based on constitutional principles, such as non-discrimination, neutrality and equal treatment for national and foreign investors (FIC, 2001).

bilateral trade agreements<sup>10</sup> envisage further concessions for FDI and services. The resulting inflow of FDI, often from large multinational companies, has raised the quality of environmental management and technology.<sup>11</sup> Meanwhile, increasing international competition and the need to comply with international standards and commitments has led Chilean producers to improve their environmental performance, thus creating new market opportunities for companies in the EG&S sector.

#### *Free-trade agreements*

Several FTAs signed by Chile, such as those with Canada (1997) and the United States (2003), as well as the broader Chile-EU Association Agreement (2003), have an environmental dimension, though they do not oblige the parties to harmonise their environmental standards. In environmental side agreements with Canada and the United States, each country agrees to enforce its own legislation and regulations in a sustainable development framework, while preserving the right to define its own environmental protection, policies and priorities. It is important to note that enforcement is a significant issue, given the sometimes uneven application of environmental legislation, much of which long predates the current environmental policy framework (Dufey and Blanco, 2003). Thus, addressing the environmental aspects of these trade agreements gives an additional boost to Chile's environmental market.

These agreements also contain provisions on co-operation that include environmental aspects and make explicit mention of technology transfer. The resulting environmental co-operation projects can also affect the Chilean EG&S market. For example, in the framework of its environmental co-operation agreement with Canada, Chile has begun reviewing and systematising its environmental legislation, and carrying out joint projects on several environmental issues, including improvement of the regulatory framework regarding air and water, promotion of clean technology, environmental management in the mining sector and the development of environmental information systems. Under the environmental co-operation agreement with the United States, eight joint projects have been identified, some with potential relevance for markets in water services and air pollution management. The co-operation chapter of the Chile-EU Association Agreement also includes aspects relevant to Chile's EG&S market, such as promotion of information and exchanges of technology and experiences, including on environmental standards, models and education.<sup>12</sup>

#### *Other international co-operation*

International co-operation more generally is also an important driver for the Chilean EG&S market. The Japan International Cooperation Agency (JICA), in particular, has played a key role in the development of the Chilean EG&S market. For example, from 1995 through 2002 it financed the establishment and operation of the National Environment Centre (CENMA), which provides technical assistance to support the formulation and implementation of environmental regulation. JICA's aid included funds, technical assistance, training and equipment (CENMA, 1998). JICA also provided a grant of about USD 2 million for the new air-quality measurement system in the Metropolitan Region.

Several other bilateral donors have made important contributions to the development of the market for EG&S in Chile. For example, since 1991 Germany's development co-operation agency, GTZ, has helped the Chilean Government improve air quality, first in the early 1990s with support for an initial clean-air plan focusing mainly on end-of-pipe technology, and in 1998 with aid for implementation of the PPDA. GTZ also assists the Chilean Economic Development Agency (CORFO), the CNPL, the National

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<sup>10</sup> In addition to the agreements discussed below, these include pacts with the regional trade blocs Mercosur (1996) and Caricom (1998) and with Mexico (1998).

<sup>11</sup> See, for example, Borregaard *et al.* (1998) regarding the mining sector.

<sup>12</sup> For more information (in Spanish) on all these agreements, see [www.direcon.cl](http://www.direcon.cl).

Technology Research Corporation (INTEC) and other stakeholders to promote the introduction of clean technology in Chile. In the Promotion of Environmental Technology Project, GTZ helped set up the national Cleaner Production Centre (CP+L) in 1998, and through the centre it also promotes initiatives towards energy efficiency. In addition, with the German development bank, Kreditanstalt für Wiederaufbau, GTZ provides long-term financial support for the introduction of cleaner technology through a credit line established by CORFO in 2001. GTZ also funds a project by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC) to assess needs and opportunities for small and medium-sized enterprises (SMEs) in Chile's EG&S market.<sup>13</sup> The German agency is also helping public and private organisations increase their use of energy from renewable sources.

In addition, Chile and the US Environmental Protection Agency (EPA) have concluded co-operation agreements for technical assistance and training in inspection organisations, ministry environmental departments and consulting firms. The EPA has also given CONAMA technical assistance in environmental standard setting. Moreover, in 1993-96, the US Agency for International Development set up its first Environmental Pollution Prevention Project (EP3) in Chile to demonstrate the benefits of pollution prevention (USDC, 2000). Although some of these projects were so far ahead of their time that Chile lacked the institutional framework to deal with the issues concerned, such initiatives sensitised stakeholders who could absorb the lessons and disseminate them more widely.<sup>14</sup>

A further example of international co-operation in this area is a USD 200 million programme, funded in equal parts by Chile and the Inter-American Development Bank, which includes a subprogramme seeking to improve producers' environmental performance (Urzúa, 2001). The subprogramme on "environmental management in the productive sector", managed by the CNPL, is in its second phase, which involves additional funding of USD 34 million over 2001-05 to increase producers' competitiveness and environmental performance through the introduction of cleaner technology (CNPL, 2003b).

### **Effects on trade in EG&S**

This section looks at how environmental and trade policies have affected Chile's trade in EG&S. It first analyses the evolution of Chilean demand for EG&S imports and the role of trade liberalisation efforts, identifying limits to such imports from a trade viewpoint and as regards the absorption rate. It then examines the development of the country's EG&S exports, the role of trade policies, trade-related limits and market inefficiencies.

Chile exported USD 438 million worth of environmental goods in 2001, representing about 2.4% of total Chilean exports; the corresponding figures for imports were USD 995 million and 6.1%.<sup>15</sup> Although Chile accounted for less than 1% of world exports of environmental goods in 2000, it is the 15<sup>th</sup> largest developing country exporter of such goods (Dufey, 2003). Methanol accounts for 85% of Chilean environmental goods exports.

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<sup>13</sup> The situation of Chilean SMEs is discussed further below.

<sup>14</sup> Personal communication from Nicola Borregaard, former director of Chile's Environmental Research and Planning Centre (CIPMA), the institution in charge of the implementation of some of these projects, October 2003.

<sup>15</sup> These estimates are calculated using the OECD classification of EG&S, which excludes cleaner fuels such as natural gas. Because of problems with distinguishing environmental goods at the level of six-digit HS codes and the fact that many such codes cover "multiple-use" products, these figures may be very inflated and should be interpreted with caution. Nevertheless, they provide useful information about Chilean trade patterns. For more information about these estimation problems, see OECD (2001).



## ***EG&S imports***

### *Main trends and critical factors facilitating imports*

Local production of EG&S remains modest, though it is growing in response to demand within Chile. Most of the national market is still supplied by imports, as in most smaller developing countries. Water and wastewater equipment makes up the bulk of Chile's EG&S imports. Most engineering and construction in the water services industry is done locally but much of the equipment is imported. Demand for air pollution control technology, still concentrated on end-of-pipe solutions, is largely met by local production (USDC, 2000).

Environmental technology from the United States often starts from an advantageous position in Chile because many Chilean regulations and standards are modelled on US ones. The Chilean EG&S market is very competitive, however, so products and investments from French, Spanish, UK, German, Canadian and Japanese companies are also significant. Recent estimates indicate that the United States provides about 45% of Chile's environmental technology imports, Europe 35% and Asia 20%. Latin American firms, notably from Argentina and Colombia, are also active in the market (USDC, 2000).

Table 5 shows Chile's imports of environmental goods between 1997 and 2001. Wastewater management was the largest sector in 2001, accounting for 40% (USD 302 million). Wastewater management imports peaked in 1998, the drop thereafter being due to an economic crisis triggered by the worldwide economic slowdown of late 1997. That crisis resulted in a reduction of all types of investment in Chile, including environmental. More recently, wastewater management imports have steadily recovered, though in 2001 they were still below the peak. The main products imported are screens and strainers, pumps and related equipment, and chemical recovery systems.<sup>16</sup>

Air pollution control imports accounted for 20% of total EG&S imports in 2001 (USD 152 million). Unlike wastewater management imports, air pollution control imports have declined — a trend accentuated by the economic slowdown of the late 1990s — and shown very little sign of recovery. Given the PPDA objectives for 2004, however, and the fact that Santiago is far from the only city in Chile with air pollution problems (some have been declared saturated), actions to improve air quality could be expected and would trigger new demand. Most imports in this sector involve end-of-pipe technology: air handling equipment, catalytic converters, incinerators, separators, precipitators and the like.

Regarding imports of wastewater management equipment, government measures to increase the percentage of the population with access to safe drinking water and sewage treatment have been a critical factor, and the privatisation that started in the second half of the 1990s played a key role in the increase of imports to achieve the government's goals. Investment in Chile by UK, French and Spanish companies in this sector has contributed to demand for wastewater management goods and related products. For example, Agbar of Spain and Lyonnaise des Eaux of France bought a controlling stake in Chile's largest water company, Aguas Andinas (formerly EMOS), and announced plans for three new sewage treatment plants, among other projects. The first, the El Trebal plant, which cost USD 220 million, began operations in 2002. The second, the USD 315 million La Farfana plant, Latin America's largest wastewater treatment facility and among the top five worldwide, started operating in October 2003. Their combined capacity can handle wastewater output equivalent to that of five million people or 72% of the Metropolitan Region's population. A third plant, Los Nogales, which has not yet gone to tender, will require an investment of USD 210 million and is expected to be in operation by 2009.

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<sup>16</sup> <http://unstats.un.org/unsd/comtrade>

Investment by foreign companies goes beyond the water utilities themselves, since regulation has created new market niches for overseas suppliers. The managing director of Thames Water in Chile noted, for example, the increasing demand for meters: "They mostly have to be imported and there is a strong argument for at least assembling them here" (FIC, 2001:60). Similarly, foreign firms that provide environmental services find that, to be profitable, it is advantageous to pair consulting services with equipment sales; or a single, horizontally integrated company may offer a range of environmental goods. Many emerging companies take on the sales and equipment representation for multinational firms dealing not only in goods related to water services but also in air and waste management products (Leal, 2003).

Among other sectors that have played a significant role in the growth of FDI inflows and direct imports related to the environment, special mention must be made of the mining sector, especially with regard to air pollution. Canadian, US, Australian and UK companies adhering to the high standards in force in their home countries have pioneered the introduction of cleaner technology, sought ISO 14001 certification for their Chilean units and launched environmental education programmes for their employees and their communities (FIC, 2001). The state-owned mining company CODELCO, for its part, has spent over USD 700 million in recent years on environmental investments and programmes, primarily for air pollution (especially SO<sub>2</sub> emission abatement). For example, CODELCO signed a contract with Lurgi Umwelt GmbH of Germany to install a USD 100 million sulphuric acid plant at the Potrerillos complex. The first phase of the project, operating since 1999, captures 73% of SO<sub>2</sub> emissions and has cut arsenic emissions by 60%. Two additional phases are expected to lead to further reductions (USDC, 2000).

In addition, recent environmental regulations such as the requirement of an EIA for all new projects have increased demand for environmental consulting services.<sup>17</sup> Such services scarcely existed in Chile when the regulations took effect, so many foreign consultancy firms opened offices in Chile around that time. The regulations also created a market for related environmental technology (USDC, 2000).

Finally, some highly qualified managers are establishing SMEs to supply equipment and tools to other Chilean firms (Leal, 2003). Such companies remain very few and quite specialised, however; most domestic demand is still met by foreign technology.

#### *Main import limits and problems with absorption*

With hardly any barriers to imports or FDI, foreign firms operating in Chile face the same conditions as local firms, and though Chile's tariff rate is 6%, many products from countries with which Chile has trade agreements enter with reduced or zero duty. Duty on capital goods purchased for use in export production may be deferred for seven years or, in some cases, waived. Thus, it seems likely that most restrictions facing EG&S imports stem from inefficiencies in the national market affecting local and imported products to the same extent (although no systematic assessment has been made, either of Chilean restrictions or of technology absorption problems). In some cases, however, government procurement practices, tax inefficiencies, aid conditions and some cultural factors may create barriers to trade.

#### *Trade restrictions*

##### Government procurement

Law 19.886, enacted in mid-2003, established new rules for government procurement, increasing the efficiency of the process and enhancing transparency by requiring all public tenders to be published on the Internet. Nevertheless, in the water services sector certain restrictions on foreign participation exist despite

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<sup>17</sup> For example, EIA legislation passed in 1997 was expected to boost Chilean demand for consulting services by some 50% annually for the first several years.

Chile's far-reaching privatisation of water utilities (RIDES, 2003). For instance, no more than 55% of a water company's shares can be privately held; employees can own up to 10% and pension funds another 10%, and 45% has to remain in government hands. To make private participation more attractive for investors, the government gives administrative control (four out of seven directors) to the holder of the remaining 35%.

In the mining sector, CODELCO requires at least 25% of new project engineering to be provided by Chilean firms (Katz, 2001). This provision represents significant discrimination against foreign competitors, especially since CODELCO has long been and will continue to be a major player in the environmental market.

On the other hand, the relative lack of capacity in Chile with regard, for example, to regulation favours foreign investors. The large international water companies are skilled at negotiating, while many developing-country governments are relatively inexperienced at it. RIDES (2003) argues, regarding the EMOS privatisation, that while the intent was for the public sector to retain control of the utility while using the private sector to raise capital, in practice the opposite happened. Efficiencies associated with private involvement come at the expense of public control, given that the Chilean state guarantees, for example, a profit margin of 33%. Furthermore, the authors argue that since the government has to rely on international private companies for the provision of water services, it is unlikely to enforce regulations out of fear of upsetting the companies. The situation is further complicated by the fact that the contents of contracts between local authorities and water companies are generally confidential, so broader public participation and potential opposition are seldom possible.

#### Intellectual property rights and licences

An adequate intellectual property rights (IPR) system is required to attract FDI and foster technology diffusion. Although Chile has amended its IPR system and it is considered generally compatible with international norms, the level of patent protection remains deficient. Chile has made several commitments in this area under the FTA with the United States, however, and as most of them are "WTO plus", IPR protection will likely be enhanced in the near future.

Barriers to EG&S trade may arise where patented or patentable technical knowledge is adopted as a standard for an industry through government regulation. Chile's environmental standards are generally not technology-based, however, and thus not likely to imply bias towards specific suppliers, foreign or domestic (Borregaard, 2002).

On the other hand, Chile does have fiscal measures regarding patenting and licensing that can distort trade,<sup>18</sup> notably a 40% tax on acquisitions of foreign patents, which makes it more profitable for Chilean firms to import a whole technology than to buy the patent and produce the good locally. Similarly, a 25% tax on engineering services results in equipment being imported already assembled, and handicaps Chilean engineering firms compared with those from countries with a lower tax.

#### Cultural factors

Although Chile's regulations on FDI do not require minimum local ownership or staffing, technically sound and well-connected local staff can be a considerable asset in marketing products and services locally. As setting up a local unit can involve considerable investment, the identification of a local agent or distributor to represent a company's products or services is common practice. Foreign companies look for

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<sup>18</sup> See Borregaard *et al.* (2003), quoting Gonzalo Hurtado, general manager of Manantial S.A., at a workshop titled "Towards a Definition of Environmental Goods and Services" in Santiago on 18 June 2002.

association with local partners to gain access to up-to-date information on new projects and bids and to establish a network of contacts and trained human resources. The USDC (2000) describes how US companies have successfully entered the Chilean market by teaming up with local firms, deriving competitive advantage from qualified Chilean personnel and equipment that is well received in the local market.

#### Tied aid

International co-operation programmes often require equipment transfer, which can constitute a trade barrier. The USDC (2000) cites an example of international donor agencies, particularly Japanese and European, supporting the development of air pollution monitoring systems in Chile that gave Japanese and European equipment companies a market advantage. Even the technical assistance that the US EPA gave CONAMA for environmental standard development, mentioned above, can be seen as helping US equipment manufacturers.

#### Tax discrimination

For certain types of environmental services, foreign firms (like local ones) may face competition in bidding from local universities, which have a cost advantage because they are exempt from the 18% VAT, have their own laboratories and incorporate salaries in the institution's annual budget (USDC, 2000).

#### *Absorption problems*

Take-up of clean technology in Chile has been slow (Urzúa, 2001). Inefficiencies in the capital and labour markets affect Chilean technology absorption capacity, as does poor enforcement of environmental regulations.

Although Chile has a well-developed capital market, especially in relation to other Latin American countries, many companies, especially SMEs, have trouble obtaining credit. A study by the Canadian Environment Industry Association (CEIA), cited by Leal (2003), found that SMEs' limited access to credit in Santiago was a key reason for smaller firms' relatively poor environmental performance.<sup>19</sup> For example, by 1999 many large factories in Santiago had switched to natural gas to control air pollution emissions but few smaller pollution sources had done so. In addition to financing problems, the SMEs lacked the bigger sources' economies of scale and access to price discounts for large purchases (Montero *et al.*, 2000).

For similar reasons, SMEs tend to take a reactive approach to pollution control, focusing on short-term and ad hoc end-of-pipe solutions rather than adoption of cleaner or environmentally sound technology (EST). SMEs in Chile operate in a highly competitive, unregulated market, often with unskilled labour. Most are unlikely to be willing or able (or effectively required) to control pollution and environmental damage unless they perceive clear economic benefits (Schaper, 2001).

Another barrier to the take-up of new technologies is a lack of staff with the skills to use or adapt them. Prior training is considered a condition for technology absorption (Urzúa, 2001). In 2000, Chile had 24 companies, with a total of 910 employees, offering services related to clean technology or EST, mainly addressing a limited number of environmental issues. The CEIA study suggested that the lack of skilled staff in Chile is one reason for the predominance of end-of-pipe solutions, especially in critical situations. For SMEs in particular, financial constraints and their influence on company priorities also underlie the tendency towards reactive environmental management. A further effect of the shortage of skilled staff is a

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<sup>19</sup> SMEs, including micro companies, constitute 99% of Chilean enterprises by number, and in 1997 accounted for 24% of total sales, 48% of employment and 4.8% of total exports (Schaper, 2001).

lack of trust in cleaner technology, the benefits of which are not well understood. This situation is exacerbated by difficulties with access to information about environmental regulations and about the subsidies and other financial assistance available (Leal, 2003). Overall, however, this situation is likely to improve, since most academic institutions in Chile now offer courses, degrees and postgraduate studies related to environmental management, policy and technology. In addition, INTEC and the CP+L, which is now part of Fundación Chile, have offered training in “Environmental Management and Audit and Cleaner Production”.

Insufficient enforcement is also a significant problem. As Bauner (2003) observes, responsiveness to environmental issues is rather recent in Chile, the capacity of its environmental institutions is still weak, and effective enforcement mechanisms are fragmented and often lacking, partly because of government resource constraints. In addition, sometimes the government overlooks SMEs’ infringement of environmental regulations because of the financial difficulties common to smaller firms. Given Chile’s commitments to effective environmental monitoring and enforcement under various FTAs, however, and the fact that enforcement is one of the seven priorities in the 2002-05 environmental policy, progress in this area can be expected.

A notable exception to the general slowness of technology take-up in Chile, often cited as a good example of effective and efficient adaptation of foreign technology, was the introduction of catalytic converters on motor vehicles. It was accomplished in little more than a year, compared with at least half a decade in most nations with similar emission level requirements — especially car-producing countries. Bauner (2003) links this feat to a number of factors, including a common understanding of how severe environmental problems were in the Santiago basin; the existence of an appropriate organisation to develop and implement the necessary legal framework; the absence of a national industry for which the costs of developing the required technology would be a liability; access to emission control technology produced elsewhere; strong economic growth, including strong growth of the polluting vehicle fleet; and local regulatory incentives for change (e.g. new rules permitting only catalyst-equipped vehicles to circulate freely). Nevertheless, as the USDC (2000) notes, a large share of the fleet began installing this equipment only in 1998, five years after the regulation was introduced. This shows how long diffusion of the technology can take in the absence of an effective vehicle scrapping programme in an economy with many low-income car owners (Bauner, 2003).

## ***EG&S exports***

### *Evolution of Chilean EG&S exports*

Table 6 shows the evolution of Chilean exports of environmental goods over 1997-2001. Goods used for air pollution control and wastewater management represented only 8% of these exports, while methanol accounted for 85% (Box 2). The share of wastewater management exports dropped steadily until 2000, then rose by 6.6% in 2001, in line with the economic performance of Latin American countries, for which these exports were mainly destined. The principal goods exported tend to be the much same as those imported in the wastewater management field: water handling systems and equipment, screens and strainers, and aeration systems. This situation can be explained by the fact that many imported products are re-exported to other Latin American countries, but it may also reflect the broadness of the six-digit HS classifications that cover these goods.<sup>20</sup>

Air-pollution-related exports tend to follow a similar pattern, though they represent only 1.4% of total environmental goods exported. The main products are catalytic converters (filtering or purifying machinery

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<sup>20</sup> See footnote 15.

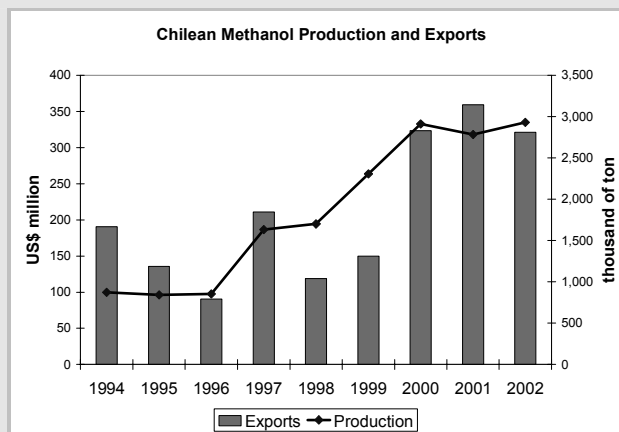
or their parts) and air-handling equipment (air or gas compressors and compressors used in refrigerating equipment and their parts).

### Box 2: Chilean methanol production and exports

Methanol in Chile is produced by the Canada-based Methanex Corporation, operating as Methanex Chile Limited, Agencia en Chile. The company was established in 1985 and began production in 1988. Manufacturing facilities are located at Cabo Negro, 28 km north of Punta Arenas on the Strait of Magellan, in the heart of Chile's oil and gas producing region.

The Cabo Negro facility is Methanex's largest and lowest-cost hub, with annual production capacity of 3 million tonnes at three plants. The newest and largest plant is Train III, with operating capacity of just over 1 million tonnes. Commissioned in May 1999, it is the world's largest single-train facility based only on natural gas reforming.

In November 2002, Methanex announced that it would expand its production hub in Chile by 840 000 tonnes per year, with construction expected to be completed during 2005.



The project will raise annual capacity at Cabo Negro to nearly 4 million tonnes and increase the share of Chilean methanol in world production to 20%.

Source: [www.methanex.com](http://www.methanex.com); Methanex Chile Ltd.

In 2001, Chile added “Environmental Services” to the “Export Supply” category of ProChile, the country's export promotion agency. Table 7 shows the breakdown of about 55 Chilean companies in this area in ProChile's database as of 2003. They are being assessed according to their capacity to offer environmental services to external markets. Environmental management consultancy, pollution prevention and treatment, transport and management of solid and liquid waste (including composting) and air monitoring are the main services concerned. They are exported mainly to Latin American countries. In 2000, Chilean exports of such services amounted to around USD 300 000, but they increased to USD 3.5 million in 2001, largely thanks to capacity expansion over the previous decade (FIC, 2001).

Promotion of these services is based on the assumption that Chilean companies could become important regional suppliers, with advantages over European and US companies in terms of culture and language, knowledge of Latin American environmental needs and lower costs. Some Chilean firms exporting environmental services — to Panama, Bolivia, El Salvador, Paraguay, Colombia and elsewhere in the region (Borregaard *et al.*, 2003) — already consider themselves leaders in this field in Latin America. Moreover, because Chile was one of the first countries to begin privatising its water-supply services, Chilean enterprises acquired skills and expertise they can offer to other Latin American countries adopting this model: not only engineering services and equipment, but also advice on the design and legal aspects of privatisation. Chile's statutory model for privatisation has been promoted in Peru, Argentina and even Zimbabwe, and Chilean consultants helped design Peru's water legislation.

Thus, despite a general lack of skilled staff in Chile, some highly qualified professionals, especially consultants, occupy particular niches in which Chilean firms' capacities are sufficiently developed that

they can export some environmental services to other Latin American markets and compete directly with companies from industrialised countries (Borregaard *et al.*, 2003).

### *Export promotion measures*

Chile's economic development strategy, with its reliance on market deregulation and giving equal treatment to all economic sectors, means that, in practice, very few specific instruments are used to support environmental exports.

In the 1990s, ProChile promoted non-traditional exports and disseminated information to facilitate their introduction in external markets. The agency does not have any special instruments to promote environmental exports, but such exports have been "receiving preferential treatment among the funds for the promotion of Chilean exports"<sup>21</sup> since their inclusion in 2001 in ProChile's official "Export Supply" category. Thus, ProChile organises and sponsors fact-finding missions abroad so that participants can become acquainted with other countries' regulations, environmental standards and technology, as well as acquiring more general market information and establishing initial business contacts. The agency also organises visits to international environmental fairs and marketing missions to promote Chilean products and services (FIC, 2001).

In September 2001, CORFO introduced three mechanisms to help SMEs adopt cleaner production standards: co-financing to help pay for expert technical assistance in adopting cleaner production processes and products; co-financing for pre-investment studies to encourage investment decisions on pollution prevention and monitoring; and long-term financing through banks and leasing agencies for both cleaner production technology and end-of-pipe equipment, with total funding of USD 32 million available. These measures have increased the number of SMEs with access to competitively priced credit.<sup>22</sup> They were designed to provide continual financial support through the various stages of a cleaner production project: initial diagnosis, pre-investment studies, technical assistance and acquisition of the appropriate technology (FIC, 2001).

CORFO offers two instruments for financing and promoting innovation and technical development: the National Technology and Production Development Fund (FONTEC) and the Development and Innovation Fund. Although designed for general purposes, they can be adapted and applied to environmental matters in areas such as clean production, environmental management and information systems.<sup>23</sup>

### *Trade barriers to Chilean EG&S exports*

Tariff and non-tariff barriers related specifically to Chile's EG&S exports have never been evaluated as such, but it seems likely that while tariffs have generally decreased substantially over time, non-tariff measures have increased at least as significantly (Borregaard *et al.*, 2003). The average "most favoured nation" tariff levels applied in 1996 by Argentina, Brazil, Chile, India, Indonesia, Malaysia and Thailand were 6.8% for wastewater management items and 16.3% for air pollution exports (OECD, 2001), compared with respective OECD averages of 3.2% and 2.9%. A more recent analysis by the WTO Secretariat shows tariffs applied by developed countries on environmental goods averaging around 4% while tariffs on the same basket of environmental goods averaged around 8% in developing countries and 10% in the least-developed countries (World Trade Organization, 2004).

<sup>21</sup> Personal communication from Pia Barros, ProChile, July 2002.

<sup>22</sup> For more information, see [www.pl.cl](http://www.pl.cl).

<sup>23</sup> For more information, see [www.fontec.cl](http://www.fontec.cl).

Regarding non-tariff issues, the existence of subsidies and other forms of support, especially in industrialised countries, results in some cases in unfair competition for Chilean exports. In contrast to Chile, with its highly competitive, unregulated markets and its few support measures being short term and limited in resources, developed countries commonly offer a wide range of grants and low-interest loans for the promotion of cleaner technology (OECD, 1998), sometimes in quite significant amounts. By 1994, all OECD countries had set up financial support programmes for the introduction of EST, using instruments such as project grants, credits and tax exoneration (OECD, 2000). Borregaard *et al.* (2003) state that support to research and development (R&D) has also played an important role in the development of EST in industrialised countries. The authors give examples for the Canada, Japan, Spain and the United States, in which the amounts involved are often enormous. In some of the cases cited, the authors assert, the subsidies are clear barriers to Chilean environmental exports. One example they give concerns grants of up to 50% for production of wastewater treatment equipment by companies in southern Italy, which as a result can set very low prices and thus shut Chilean companies out of the market. Another involves loans from the Government of Catalonia to local companies at low annual rates where the equipment for which the loans were given was accepted as collateral.

Tied aid can also pose important barriers to Chilean exports. Borregaard *et al.* (2003) note, for example, the credits given by Spain to help Honduras, Guatemala and Nicaragua remedy sanitation problems caused by Hurricane Mitch in 1998, which could be released only if 85% of the funds were spent on products of Spanish origin. Lack of uniformity and differences regarding standardisation in Latin America (Blanco and Bustos, 2003) constitute another potential barrier: for example, they may inhibit imports by eroding economies of scale.

A further key issue involves qualification and certification requirements in other Latin American markets, which may block Chilean environmental service exports that require staff on site. Thus far no studies analysing this type of restriction have been made. Further work in this direction, including the impact on Chilean environmental service exports, is required.

#### Internal barriers to growth in environmental export trade

Just a few companies, mostly providing consultancy and pollution treatment services, have succeeded in building up a range of exportable EG&S. Their major asset is the high professional quality of their staff (Leal, 2003), with cultural and cost factors giving them an added advantage over competitors in Latin American markets.

Most Chilean environment-related companies, however, are as yet in no position to export EG&S. Among the factors behind this situation are the problems with technology absorption discussed earlier. The Chilean EG&S market has been shaped by environmental regulations that encourage development of environmental services rather than environmental goods (Leal, 2003). In addition, the regulations still focus on command-and-control instruments, favouring the development and introduction of ad-hoc solutions and end-of-pipe technology over that of EST. Chilean firms need to improve their technical knowledge in order to meet a potential demand for EG&S. The lack of qualified technical staff to support companies' efforts and the existence of financial problems that limit resources for R&D<sup>24</sup> also represent clear barriers to the development of the country's EG&S industry, especially as regards environmental goods. These barriers are exacerbated by the fact that Chilean companies operate in very competitive markets, vying for sales with subsidised firms from developed countries.

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<sup>24</sup> Urzúa (2001) notes that Chile's private sector accounts for less than one-third of total R&D funding and that human resources devoted to R&D are scarce. Over 1981-95, Chile had 364 researchers and engineers working on R&D projects, compared with 2 500 in Australia, 1 778 in New Zealand and 3 000 in Sweden, Norway and Finland.



The lack of technical staff on the national demand side also represents a barrier. Only in the last few years have corporate environmental managers existed in Chile, and then only at large companies, mostly in mining and forestry. SMEs generally have no specialised technical staff. In short, a large majority of Chilean companies lack environmental awareness, take a reactive approach to environmental problems, and do not know which products and processes can best address environmental issues.

Nevertheless, opportunities to develop the Chilean EG&S sector are increasing, notably as a result of two factors: the emergence of new, cleaner technology that could create new niches for firms with highly skilled workers; and implementation of cleaner production policy since the late 1990s, which encourages a more proactive approach on using cleaner production strategies to address environmental problems (Leal, 2003).

### **Conclusions: future directions and further measures**

Chile, like most developing countries, lacks a national policy or strategy that addressed both the supply and demand sides of its EG&S market. This lack makes it rather difficult to develop a coherent trade policy that enhances the environmental, developmental and economic benefits of trade liberalisation.

On the demand side, with the market still largely focused on end-of-pipe technology, a key issue is how to improve access to and use of EST or cleaner technology. A holistic approach to the transfer of EST is needed, one linking technology transfer to investment, access to other sources of funding, licensing of IPR, availability of skilled staff and support through development co-operation and multilateral environmental agreements. Policies to improve SMEs' financial situation and build their capacity also require more attention, given the key role SMEs play in Chile's environmental market.

Information is crucial in enhancing win-win-win opportunities. More and better information is needed at virtually all levels, including that of individual companies, where initiatives to spread awareness of the availability and benefits of cleaner technology, and of the financial instrument available, should be a priority.

On the supply side, a strategy to build domestic capacity is needed. Suppliers of EG&S at both the national and the international level would benefit from an evaluation of Chile's comparative and competitive advantages, including the potential of its companies and professionals to supply EG&S. In other words, an assessment of the opportunities for emerging Chilean companies in this growing, highly dynamic market is required, along with an assessment of the instruments and policies needed for the companies to improve their participation in the market. Processes for consultation in the country, support for capacity building and improved access to credit have important roles to play. The GTZ-funded project for ECLAC to assess "needs and opportunity areas" for SMEs in EG&S markets in Chile is a step in the right direction. In terms of export strategy, initiatives to generate more information on potential market needs, technical standards and regulations, trade barriers and other requirements in the relevant markets, and their impact on Chilean suppliers, would be most useful.

Finally, it is important to highlight the emergence of some EG&S suppliers in the field of cleaner technology. While this part of the sector is as yet quite small, it has great potential. Thus, further research to identify key ways to encourage its growth should be a high priority.

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## ANNEX 1: TABLES

Table 1: Government environmental expenditure in Chile, 1998-2001

| Year | Investment expenditure (USD million) | Other expenditure (USD million) | Total environmental expenditure (USD million) | Share of GDP (%) | Share of public finances (%) | Air <sup>25</sup> (%) | Water <sup>26</sup> (%) | Waste (%) | Biodiversity (%) |
|------|--------------------------------------|---------------------------------|---|------------------|------------------------------|-----------------------|-------------------------|-----------|------------------|
| 1998 | 95.52                                | 159.61                          | 255.13  | 0.4              | 1.98                         | n/a                   | n/a                     | n/a       | n/a              |
| 1999 | 152.79                               | 138.35                          | 291.14  | 0.5              | 1.85                         | 2.13                  | 18.18                   | 15.33     | 14.10            |
| 2000 | 158.11                               | 149.43                          | 307.53  | 0.5              | 1.86                         | 4.45                  | 25.66                   | 14.49     | 13.13            |
| 2001 | 160.88                               | 152.05                          | 312.93  | 0.4              | 1.76                         | 5.56                  | 7.80                    | 4.80      | 18.19            |

Source: Brzovic (2002).

Table 2: Environmental expenditure in Chile by state firms, 1998-99 (USD million)

| Year | CODELCO | ENAMI | ENAP  | Sanitation firms | TOTAL  |
|------|---------|-------|-------|------------------|--------|
| 1998 | 199.01  | 24.62 | 38.21 | 83.98            | 345.81 |
| 1999 | 136.87  | 11.64 | 27.16 | 83.86            | 259.53 |

Source: Brzovic (2002).

Table 3: Emissions in the Metropolitan Region, change from 1997 to 2000 (%)

| Source             | PM10 | CO  | NO <sub>x</sub> | VOCs | SO <sub>2</sub> |
|--------------------|------|-----|-----------------|------|-----------------|
| Stationary sources | -64  | -32 | 2               | -9   | -71             |
| Mobile sources     | 17   | -7  | 12              | -2   | 29              |
| Other sources      | -48  | -24 | -8              | -6   | -34             |
| Dust               | -1   | n/a | n/a             | n/a  | n/a             |
| Total              | -6   | -8  | 10              | -4   | -61             |

Source: Pizarro and Vasconi (2001).

<sup>25</sup> This category includes air and climate protection expenditures.

<sup>26</sup> This category includes the management of liquid waste, soil, underground water and superficial water.

**Table 4: Air clean-up plans for copper mining smelters**

| State firm/division            | Smelter            | Start of the plan | Investments up to 2000<br>(USD 000) | Status of the plan  |
|--------------------------------|--------------------|-------------------|-------------------------------------|---|
| CODELCO, Chuquicamata Division | Chuquicamata       | 1992              | 654 777                             | PM <sub>10</sub> and SO <sub>2</sub> air quality norms achieved in 1999.  |
| CODELCO, EI Salvador Division  | Potrerillos        | 1998              | 163 369                             | Due to the impossibility of achieving PM <sub>10</sub> and SO <sub>2</sub> air quality norms, in 1999 CODELCO decided to resettle the Potrerillos population. Although the plan was relaxed, the smelter still has to comply with specific emission limits for SO <sub>2</sub> and PM <sub>10</sub> . |
| CODELCO, EI Teniente Division  | Caletones          | 1998              | 192 665                             | PM <sub>10</sub> and SO <sub>2</sub> air quality norms achieved in 2000.  |
| ENAMI, Ventanas Division       | Ventanas           | 1992              | 64 615                              | PM <sub>10</sub> and SO <sub>2</sub> air quality norms achieved in 1995 and 1999, respectively.   |
| ENAMI, Paipote Division        | Hernán Videla Lira | 1994              | 98 888                              | SO <sub>2</sub> air quality norm achieved in 1995.  |
| <b>TOTAL</b>                   |                    |                   | <b>1 174 314</b>                    |   |

Source: www.cochilco.cl, accessed on 30 September 2003.

**Table 5: Chilean environmental goods imports, 1997-2001**

(USD 000)

| Item                  | 1997           | 1998             | 1999           | 2000           | 2001           | Share 2001 (%) |
|-----------------------|----------------|------------------|----------------|----------------|----------------|----------------|
| Air pollution control | 214 021        | 208 324          | 139 255        | 149 630        | 152 120        | 20.1           |
| Wastewater management | 351 691        | 357 479          | 246 077        | 275 533        | 301 911        | 40.0           |
| Others                | 368 518        | 469 878          | 293 779        | 281 640        | 301 350        | 39.9           |
| <b>Total EG&amp;S</b> | <b>934 230</b> | <b>1 035 681</b> | <b>679 111</b> | <b>706 803</b> | <b>755 381</b> | <b>100.0</b>   |

Source: Author, from data provided by the Comtrade UN database.

**Table 6: Chilean environmental goods exports, 1997-2001**

(USD 000)

| Item                  | 1997           | 1998           | 1999           | 2000           | 2001           | Share 2001 (%) |
|-----------------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Air pollution control | 7 785          | 5 506          | 5 154          | 4 986          | 5 986          | 1.4            |
| Wastewater management | 29 755         | 27 721         | 24 838         | 22 587         | 28 290         | 6.6            |
| Others                | 244 717        | 166 141        | 184 015        | 335 208        | 396 694        | 92.0           |
| <b>Total EG&amp;S</b> | <b>282 258</b> | <b>199 368</b> | <b>214 006</b> | <b>362 780</b> | <b>430 970</b> | <b>100.0</b>   |

Source: own elaboration from data provided by the Comtrade UN data-base

**Table 7: Chilean environmental services, ProChile database**

| Type of Service                             | Subsector                                 | No Enterprises |
|---|---|----------------|
| <b>Consultancy</b>                          | Consultancy on Environmental Management   | 13             |
|   | Consultancy on Solid Waste Management     |                |
|   | Consultancy on Liquid Waste Management    |                |
|   | Consultancy on Atmospheric Emissions      |                |
| <b>Treatment</b>                            | Treatment of Hospital Waste               | 14             |
|   | Treatment of Hazardous Waste              |                |
|   | Treatment of Alternative Fuels            |                |
|   | Treatment of Industrial Effluents         |                |
|   | Treatment of Wastewater                   |                |
| <b>Transport</b>                            | Transport of Industrial Waste             | 3              |
| <b>Resources, Measuring and Monitoring</b>  | Monitoring Services                       | 5              |
| <b>Waste Disposal</b>                       | Domiciliary and Industrial Waste Disposal | 3              |
| <b>Compostage</b>                           | Compost of Organic Waste                  | 2              |
| <b>Sales &amp; Equipment Representation</b> |   | 3              |
| <b>Sales of Waste</b>                       |   | 2              |
| <b>Certifiers</b>                           |   | 2              |
| <b>Recycling</b>                            |   | 2              |
| <b>Sale of Inputs</b>                       |   | 1              |
| <b>Green Areas Construction</b>             |   | 1              |
| <b>Technical Assistance &amp; Training</b>  |   | 1              |
| <b>Management of Construction Waste</b>     |   | 1              |
| <b>Technical Publications</b>               | Specialized Environmental Journal         | 1              |

Source: PROCHILE