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# National Climate Change Action Plan

2008 - 2012



National Climate Change Action Plan  
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“As climate change leads to greater precipitation and wetter weather conditions, forests of lenga (*Nothofagus pumilio* or South American cherry wood) in the far south of Chile will most likely be affected.”





# Introduction

# 1. Introduction

Warming of the climate system is unequivocal, as is now evident from observed increases in the global average air and ocean temperatures, widespread melting of snow and ice and rising global mean sea level. In fact, according to the latest scientific report from the Intergovernmental Panel on Climate Change (IPCC) in 2007, 11 of the last 12 years (1995-2006) have registered the warmest global surface temperatures recorded since 1850. The linear trend of 0.74°C for the 1906-2005 period is higher than the corresponding trend of 0.6°C indicated in the IPCC's Third Assessment Report for the 1901-2000 period. This increase in temperature is distributed across the planet and is greater in the northernmost latitudes, where the landmass has warmed faster than the oceans.

Coinciding with this warming has been a rise in sea level. Between 1961 and 1993 the world's oceans rose 1.8 mm per year on average and since 1993, this rate has increased to 3.1 mm per year, partly because of thermal expansion and melting of glaciers, ice caps and polar ice sheets.

Furthermore, this warming has led to a corresponding reduction in snow and ice. Satellite data since 1978 indicate that the average area of Arctic sea ice has fallen by 2.7% each decade, with even more pronounced seasonal variations of 7.4% per decade. In general, mountain glaciers and snow cover have also decreased in both hemispheres.

Throughout the world, drought-affected areas have expanded since 1970. According to the IPCC, it is likely that in the last 50 years, cold days, cold nights and frost have become less common in most land areas and that warm days and nights have become more common. Likewise, it is probable that heat waves have become more frequent in most land areas and that the frequency of intense rainfall has increased in most areas. Additionally, since 1975, the incidence of extreme high sea levels has increased globally.

The IPCC projects that in Latin America, increasing temperatures and the corresponding decrease in soil humidity will lead to a gradual transition from tropical rainforest to savannah in eastern Amazonia. Semi-arid

vegetation will slowly be replaced by the vegetation from arid areas. It is possible that there will be a significant reduction in biodiversity, with certain species becoming extinct in many parts of tropical Latin America.

Productivity of some important crops and of livestock is projected to decrease, with adverse consequences for food security. Meanwhile, changes in precipitation levels and the disappearance of glaciers will have a significant impact on water availability for human consumption, agriculture and hydro-electricity. According to the IPCC, Chile is one of the countries which has been affected and which will continue to be affected by some of the changes predicted for the region.

The fundamental importance of the IPCC'S Fourth Assessment Report, which represents the international scientific community on climate change matters, is that it clearly states the indisputable responsibility of human activity for the problem of global warming and that the impacts of such warming are already evident. The IPCC therefore urges that mitigation be placed high on the agenda at international talks and that decisions be taken to ensure that real reductions at a global level begin in 2015. If greenhouse gas emissions continue at the same or higher rate than those seen today, global warming will increase and the world's climate system will experience many changes during the 21st century, probably of a greater order than those seen in the 20th century.

Chile, which as a nation only contributes 0.2% of the world's greenhouse gas emissions, has played a minor role in bringing about this global phenomenon. Nevertheless, the country is firmly resolved to responding quickly both in terms of adapting to the effects of climate change and participating in a constructive manner in developing a solution. The President of Chile, Michelle Bachelet, has made this clear at national and international meetings: in New York, during the 62nd Session of the UN General Assembly, where she stated that developing countries should take additional action to reduce emissions and in her presidential speech on May 21, 2008, where she said that "climate change is the great ethical issue for humanity of this century, just as peace was the issue of the 20th century."

# 1. Introduction

Within this context, our country has created its National Climate Change Action Plan, which establishes a framework for all of the nation's activities aimed at evaluating the impact, vulnerability and adaptation to climate change and mitigating greenhouse gas emissions. It seeks to respond to the imperative made clear by recent scientific evidence regarding projected climate change during the 21st century, from which our country is not exempt. It also aims to fulfill the commitment Chile made when it signed the United Nations Framework Convention on Climate Change.

Both in Chile and internationally, there is ever greater awareness and acknowledgement of the impacts of climate change on areas such as population health, water resources and biodiversity, and on different economic sectors such as agriculture, mining, energy generation, infrastructure and transportation. It is therefore important to focus not only on assessing the impacts on these areas and sectors, but also on preparing to deal with them and on mitigating their negative effects.

As such, the Action Plan is intended to bring together a number of public policies related to climate change and its adverse effects, policies which will be carried out by the relevant public sector organisms. It is therefore important to strengthen the institutions mentioned in the Action Plan, which seeks to coordinate an adequate response by our country to the new national and international challenges resulting from this global problem.

The Action Plan is also a tool for guiding the productive and academic sectors and non-governmental organizations, clearly delineating the topics that should be addressed by society as a whole in order to deal with the impacts of climate change.

The Action Plan has also been designed to respond to the aims and objectives of the National Climate Change Strategy, approved in January 2006 by the Minister's Council of the National Environmental Commission (CONAMA). As such, its policies and actions fall within the same three overarching aims as the National Strategy: adapting to the impacts of climate change, the mitigation of greenhouse gas emissions and capacity-building to address the problem in Chile.

The document begins with an assessment of the national and international climate change situation. It then examines those strategic considerations which will guide its execution and the priority lines of action which will enable the development of a knowledge base for adaptation, mitigation and capacity-building for long-term decision-making.

Finally, it should be mentioned that the Plan was developed through a consultative process that included the participation of institutions and representatives involved with the Minister's Council of the National Environmental Commission, including Chilean academics and researchers.





“Ocean acidification caused by climate change could affect the trophic chain sustaining several species, including these sea lions from Atacama’s isla Grande”.

# Background Information

## 2. Background Information

This section examines the international advances in climate change science and provides details about the progress Chile has made in terms of climate change research and institutional management. Each thematic section below ends with a summary of conclusions and lists urgent needs that must be addressed.

### 2.1 The Science of Climate Change.

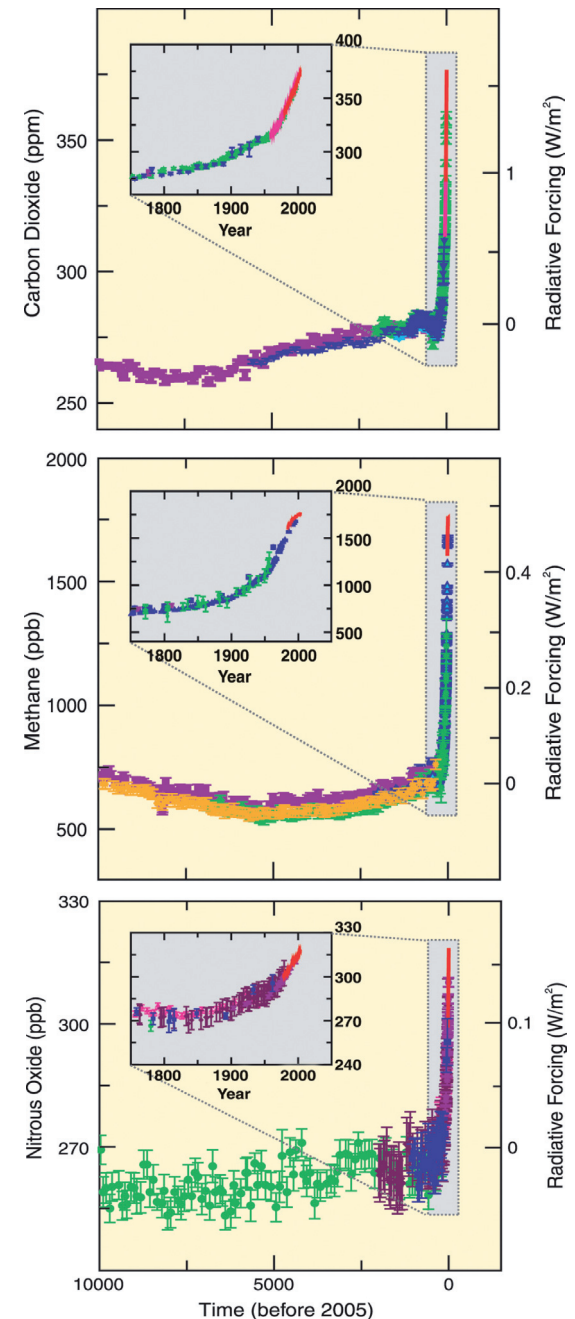
Climate change is recognized as one of the most complex global environmental problems, one which presents the greatest challenges to society as a whole, including the scientific and technical community and government authorities. The greenhouse effect, a beneficial natural phenomenon that enables life as we know it on our planet, is being affected by human activities that release carbon dioxide (CO<sub>2</sub>) and other greenhouse gases (GHGs) into the atmosphere. Anthropogenic emissions change the concentration levels of these gases in the atmosphere, which consequently have an impact on our climate.

The work carried out to date by the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup> has been crucial for improving the degree of certainty about climate change and the role that human activity plays in it. The IPCC has also been critical in supporting the progress made so far in the international negotiation process, specifically the Convention on Climate Change and the Kyoto Protocol. The Panel's scientific reports have gradually confirmed, with increasing certainty, the human influence on the climate system.

The IPCC's First Assessment Report, published in 1990, concluded that greenhouse gas emissions had increased, without assigning a definite cause. The Second Report in 1995, in which the Panel concluded that there was a "discernible human influence" on the global climate, was critical for accelerating the adoption of a binding instrument that would commit industrialized nations to reducing their emissions (resulting in the Kyoto Protocol). In 2001, the Third Report went even further, affirming that "there is new and convincing evidence

<sup>1</sup> This Panel was specially created by the United Nations in the late 1980s to assess available science on climate change and suggest response measures (More information at: [www.ipcc.ch](http://www.ipcc.ch)).

**Fig.1:** Changes in greenhouse gas concentrations, IPCC's Fourth Assessment Report, 2007.





## 2. Background Information

that most of the warming observed over the last 50 years is attributable to human activities,” assigning different percentages to different gases, namely: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O) (60%, 20% and 6%, respectively). Other gases, such as perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulfur hexafluoride (SF<sub>6</sub>), which are more harmful than the other gases in terms of their global warming potential, were also included.

In its Fourth Assessment Report (2007), the IPCC stated with more than 90% certainty that humans are the cause of the recorded increase in carbon dioxide, methane and nitrous oxide emissions (Fig. 1), and that this increase – linked to the global average temperature increase of 0.74°C measured between 1906 and 2005 – is directly linked to the changes observed in many physical and biological systems since the early 1970s. These emissions will continue rising in the coming decades if present climate change mitigation policies and related sustainable development practices are maintained. In order to stabilize GHG concentrations at levels that will cause the least possible impact, a considerable effort must be made to reduce emissions of greenhouse gases into the atmosphere.

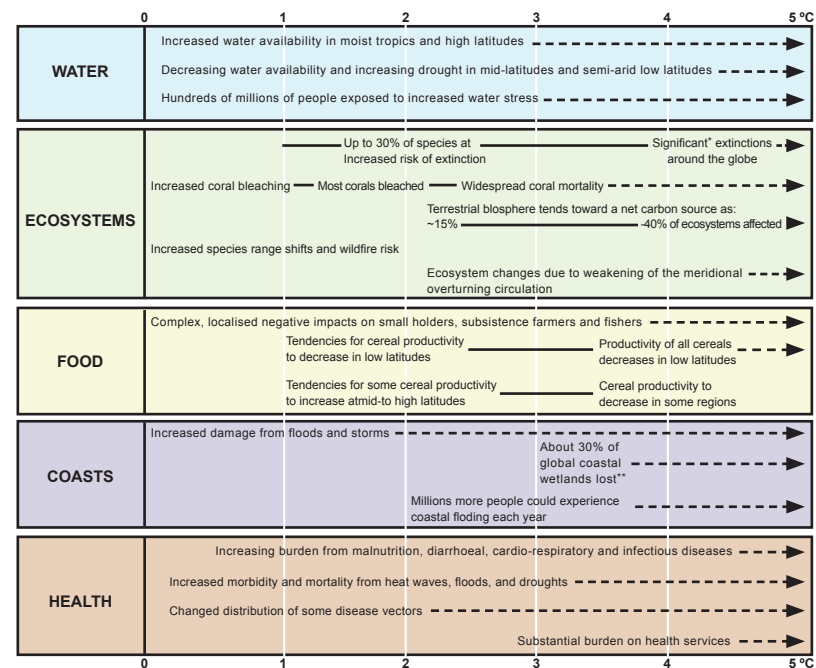
The Panel has clearly stated that to stabilize concentrations of GHGs in the atmosphere between 445 and 490 parts per million (ppm) of CO<sub>2</sub> equivalent by the end of the 21st century (the lowest stabilization level among those assessed by the IPCC), overall emissions must be reduced before 2015, and must fall to at least 50% of their current levels by 2050. To achieve this objective by 2020, industrialized countries must collectively reduce their emissions by 25% to 40% below their recorded 1990 levels. Emissions from developing countries, for their part, will have to drop below the baseline levels projected for the coming decades.

Even if a lower stabilization level of ppm of CO<sub>2</sub> equivalent is reached, the average temperature of the atmosphere will still increase by 2°C to 2.4°C by the end of this century.

This scenario, which is the least pessimistic of all scenarios established by the IPCC, will not be exempt from impacts in different sectors and areas, as shown in Figure 2<sup>2</sup>. Greenhouse gases emitted thus far will remain in the atmosphere for decades or centuries to come and will continue to cause impacts in the long-term. As such, the IPCC proposes the urgent adoption of short-term adaptation strategies associated with a strict emission mitigation schedule instead of the approach of waiting for a complete resolution of the scientific certainty that persists in some areas, especially regarding the precise magnitude of climate change impacts.

**Fig. 2: Impacts of Climate Change, projected to 2100**

Global mean annual temperature change relative to 1980-1999 (°C)



\* Significant is defined here as more than 40%

\*\* Based on average rate of sea level rise of 4.2 mm/year from 2000 to 2080

<sup>2</sup> Adapted from the Fourth IPCC Report, 2007.

## 2. Background Information

### Conclusions and Need for Action.

The IPCC, particularly with its Fourth Assessment Report in 2007, has had an unprecedented impact on public opinion by showing, with an extremely high degree of certainty (above 90%), that the warming of the earth's atmosphere that has occurred over the last 100 years has been caused by human activity. This reality, coupled with evidence from previous IPCC reports, must certainly prompt countries, especially those of the industrialized world, to take the necessary steps to confront climate change.

As the work of the IPCC shows, and given the inescapable reality of this phenomenon, it is necessary to define and implement programs for climate change adaptation and GHG emission mitigation in Chile as soon as possible.

### 2.2 Climate Change in Chile.

#### 2.2.1 International Commitments.

Chile is a signatory of the United Nations Framework Convention on Climate Change and its Kyoto Protocol. As a developing country Chile has no binding commitments under these instruments to reduce its emissions, but is obligated to periodically submit National Communications<sup>3</sup> that should<sup>4</sup> include an inventory of its greenhouse gas emissions as well as information on its vulnerability to climate change, the impacts of climate change on the country, alternatives available for adapting to those impacts and alternatives for mitigating its GHG emissions.

National Communications. In 2000, Chile submitted its First National Communication (1NC), the results of which are described in the following section. In an effort to maintain the regular submission of these reports, Chile began preparing its Second National Communication (2NC) in 2007,

<sup>3</sup> Decision 8/CP.11 (Montreal 2005), stipulates timeframes for the 2nd and 3rd National Communications. Although Article 12.5 of the Convention will be revised in December 2009, it is likely that timeframes will be maintained in future.

<sup>4</sup> The content is defined by the country based on a format established in the Convention.

a task coordinated by CONAMA. Over a three-year period (2007-2010), the 2NC will generate information that is needed to successfully implement the activities outlined in this National Action Plan. Among other data, this document will provide up-to-date information on the evolution of GHG emissions in Chile and the development of programs that include measures to mitigate climate change, identify vulnerabilities and facilitate the country's effective adaptation to climate change. The report preparation process will also generate other important information related to the incorporation of climate change considerations into the public policy agenda, technology transfer, climate research and systematic observation and education.

Taking advantage of potential synergies, the 2NC process will also provide key support for the implementation of various activities related to the Action Plan's short-term actions.

#### 2.2.2 Chile's Vulnerability According to the IPCC.

The Fourth Assessment Report of the IPCC explicitly describes a series of present and future national impacts associated with climate change. For example, regarding the change in precipitation patterns, the Report states that a declining trend in precipitation has been observed in southern Chile in recent years. This coincides with observed climate trends for this area of the country, which were published in a Study on Climate Variability in Chile for the 21st Century, described below. With respect to changes in sea levels, the report states that these could lead to changes in the location of fish stocks in the south-east Pacific (Peru and Chile).

In terms of agriculture, the Panel reports that studies of Chile and other countries forecast future yield reductions for a number of crops including corn and wheat, and that in the more arid zones such as northern and central Chile, climate change could lead to the salinization and desertification of agricultural land.

Regarding water resources, the country is considered highly vulnerable to extreme events. In particular, energy generation and the water supply for

## 2. Background Information

human consumption in Chile will both be severely limited by anomalies associated with El Niño and La Niña. Other recent studies point to potential effects on water availability and sanitary services in coastal cities and the contamination of aquifers due to saltwater intrusion. Additionally, the southern part of Chile has been one of the regions most affected by the dramatic reduction in glacier volume recorded in recent decades.

In terms of human health, specific reports for Chile and other countries have noted an increase in outbreaks of pulmonary syndrome caused by the Hanta virus after prolonged periods of drought. This is probably due to the intense rain and flooding that follow droughts, which increases food availability for the domestic rodents who carry the virus.

Two final conclusions from the IPCC's Fourth Assessment Report indicate firstly, that atmospheric pollution will worsen due to the increase in fossil fuel combustion required to satisfy transportation needs in urban centers such as Santiago and secondly, that the risk of forest fires will increase as a result of climate change.

### 2.2.3 Chile's Vulnerability According to the United Nations Framework Convention on Climate Change.

Article 4.8 of the United Nations Framework Convention on Climate Change places Chile among the countries most at risk of being affected by changes in prevailing global climate patterns. This Article recognizes that countries with the following characteristics are particularly vulnerable to climate change:

- a) Small island countries;
- b) Countries with low-lying coastal areas;
- c) Countries with arid and semi-arid areas, forested areas and areas exposed to forest decay;
- d) Countries with areas prone to natural disasters;
- e) Countries with areas prone to drought and desertification;
- f) Countries with areas of high urban atmospheric pollution;

- g) Countries with areas containing fragile ecosystems, including mountain ecosystems;
- h) Countries whose economies are highly dependent on income generated from the production, processing and export of fossil fuels and associated energy-intensive products, or on their consumption;
- i) Land-locked and transit countries.

Chile has seven of the nine characteristics indicated in this vulnerability framework. It was for this reason that in the mid-1990s, the Chilean government began to conduct studies aimed at providing more precise details about the country's vulnerability to changes in climate.

### 2.2.4 Chile's Vulnerability According to National Studies.

Three studies have been conducted by CONAMA to assess the country's vulnerability to climate change: two of these were prepared for the First National Communication, while a more recent study describes specific scenarios of the country's climate vulnerability projected to the end of the 21st century. These studies are described below.

#### 2.2.4.1 First National Communication.

Chile's First National Communication (1NC)<sup>5</sup>, cited by the IPCC in its Third and Fourth Assessment Reports, assessed the vulnerability of Chile's agricultural sector in relation to climate variations, the vulnerability of its forest types to changing water regimes and variations in average annual surface runoff due to the effects of climate change.

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<sup>5</sup> www.conama.cl

## 2. Background Information

The report used atmospheric CO<sub>2</sub> concentrations as an indicative parameter; such concentrations are projected to double between 1990 and 2040. The analysis of these sectors was carried out at the regional and municipal levels<sup>6</sup>.

In preparing the 1NC, information was also gathered on the impacts of rising sea levels on highly populated coastal areas and major fishing activities, as well as the effects of climate change on fishery resources of economic importance to Chile<sup>7</sup>.

Some of the results, which illustrate Chile's future vulnerability under a scenario in which atmospheric CO<sub>2</sub> levels have doubled, are summarized below:

### **Agriculture, Water Resources and Forests**

This study predicted major temperature changes throughout the country. For example, decreases of less than 2°C in the north (from the 1st to the 4th Region), and increases close to 3°C in central and southern Chile will affect crucial agricultural variables such as frosts, chill hours and frequency of warm days. As current conditions in the north shift southward toward the central and southern zones, these much warmer climates could have a major impact on fruit growing and other large-scale crops; they may also improve livestock-raising activities in the southern regions.

Annual precipitation is forecast to change by more than 30% in some areas of the country by 2040. The central zone, for example, may see a significant reduction in precipitation, while the altiplano zone in the far north will experience higher precipitation levels. Precipitation will decrease by about 20-25% between Antofagasta and Puerto Montt but will increase from Chiloe Island to the south. As a result of these trends, aridity will increase in north and central Chile down to the 8th Region.

<sup>6</sup> Study on vulnerability and adaptation in agriculture, water resources and forestry, as part of the GEF Project Capacity-building in Chile for the Fulfillment of Its Commitments Under the United Nations Framework Convention on Climate Change, Centro AGRIMED, Facultad de Ciencias Agrarias y Forestales, Universidad de Chile.

<sup>7</sup> Study on vulnerability and adaptation in coastal zones and fishing resources as part of the GEF Project Capacity-building in Chile for the Fulfillment of Its Commitments Under the United Nations Framework Convention on Climate Change, Centro EULA, U. de Concepción. Given the lack of information available for the coastal areas of Arica, Valdivia and Puerto Montt, only the impacts for the Gulf of Arauco were assessed.

Using the expected variations in both temperature and precipitation and their resulting impact on water resources, the study assessed the impacts on agriculture, which are both positive and negative and include impacts on natural grasslands, crops (dry-land farming and others), and fruit production (in temperate and arid-temperate zones), as well as impacts from pests and plant disease and productivity due to irrigation concerns. Positive and negative impacts on the productivity of different forest types were also analyzed.

### **Coastal Zones and Fishing Resources**

The study evaluated the effects of increased sea levels on coastal areas such as the Arauco Gulf and the impacts of climate change on fish such as the anchovy, Pacific hake and common sardine. Flood levels were also calculated for the coastal areas of Arica, Valdivia and Puerto Montt.

In regard to coastal zones, the study concluded that in the Arauco Gulf area, fishing villages and populated areas on or near the coast would be vulnerable to an increase in sea level. The study indicated that this was particularly true for the fishing villages of Las Peñas and Tabul and the city of Arauco.

In regard to fish stocks, the study pointed to changes in the distribution and abundance of the anchovy, with major reductions in northern Chile and an increase in anchovy biomass off the coast of the 8th and 10th regions. Common sardine biomass was also expected to decrease significantly in the north, especially in the Coquimbo area, and less so along the coast of the Bío-Bío Region. Further south, catches were expected to increase above historic levels. Hake would be the least affected fish species, with no major changes in distribution or availability predicted, except for slight variations in the north.

## 2. Background Information

### Recommendations

Both studies recommended a number of possible adaptation measures. For example, for agriculture, water resources and forests, the study recommended the evaluation of crop replacement, crop relocation and changes in planting schedules. Other recommendations included the use of integrated pest management systems and agricultural early-warning systems. For coastal zones and fish stocks, the study recommended incorporating climate change impact analyses in municipal zoning plans and preventing human settlement in low-lying coastal areas. More details of these recommendations can be found in Appendix 1 of this document.

### 2.2.4.2 Study on Climate Variability in Chile in the 21st Century.

A 2007 study commissioned by CONAMA to the University of Chile's Faculty of Physical Sciences and Mathematics analyzed climate variability in Chile up through the end of the 21st century<sup>8</sup>. Using two of the IPCC's emission scenarios (A2 and B2), the study showed that changes in temperature and precipitation variables throughout the country would be moderate to severe, with temperature increases ranging between 1°C and 3°C (moderate scenario), and from 2° to 4°C (severe scenario). The same study also indicated that the greatest estimated temperature variation would occur in the Norte Grande (far north of the country) and Norte Chico (the area north of Santiago), mostly in the Andean zone. Highlights of the study's results include:

In regard to surface temperature, positive changes (warming) are prevalent in all regions and are greater in the severe scenario, where they range from 2° to 4°C higher than the current mean for continental Chile. This increase will be accentuated in the Andean regions and will diminish from north to south. Only in southern Chile, under a moderate scenario and for limi-

ted areas, is warming estimated at less than 1°C. Seasonally, warming is greater in summer, exceeding 5°C in some high altitude areas of the Andes Mountains.

For precipitation in general, there is a strong contrast between the two sides of the Andean peaks. Broadly, precipitation is expected to increase on the eastern side (Argentina) and decrease on the western side (continental Chile and the adjacent Pacific), particularly in the middle latitudes and in summer and autumn. This contrast is even more accentuated under the severe scenario in summer, in which precipitation in certain parts of south-central Chile will be reduced to half or even one-quarter of present levels, while on the eastern slopes of the Andes precipitation will double in the future (compared to current levels). Appendix 2 of this document provides details of changes in precipitation by region and the hydrological impacts analyzed in this study.

### 2.2.5 El Niño Southern Oscillation and Climate Change<sup>9</sup>.

The El Niño and La Niña phenomena are climate alterations characterized by extreme precipitation values, air temperatures and sea temperatures, high winds, cloud cover, increased river flows and other parameters. El Niño is considered the warm phase of the phenomenon due to the accompanying increase ocean surface temperatures. During this phase, precipitation also increases in central Chile, causing damage to infrastructure (roads, bridges and ports) and reducing stocks of fish such as anchovy and the populations of sea birds that feed off them. During La Niña, the opposite occurs; precipitation drops (by up to 79% from the 5th to the 7th regions), causing an increase in drought conditions with corresponding impacts on hydropower generation, dry-land farming, livestock production and mining. Droughts also increase cases of pulmonary syndrome caused by the Hanta virus. These phenomena occur on a 2- to 7-year cycle.

<sup>8</sup> Study of Climate Variability in Chile in the 21st Century, conducted by the Department of Geophysics, University of Chile. More information at: [www.conama.cl](http://www.conama.cl).

<sup>9</sup> The information herein was taken from two sources: i) Pizarro, O. and Montecinos, A. 2004. "El Niño y la oscilación del sur" (El Niño and the Southern Oscillation), *Biología Marina y Oceanografía. Conceptos y Procesos*. Consejo Nacional del Libro y la Lectura. Universidad de Concepción; and ii) the Fourth Assessment Report of the IPCC.



## 2. Background Information

With increases in greenhouse gas emissions, the IPCC foresees the possible intensification of these phenomena, with greater increases in ocean surface temperature and, ultimately, in the sea level itself.

### Conclusions and Need for Action.

As the previous paragraphs show, Chile is vulnerable to the effects of climate change. This has been supported by the latest report of the IPCC, the Convention's vulnerability indicators and available Chilean studies. Moreover, both the Vulnerability Study conducted for the First National Communication and the Study on Climate Variability in the 21st Century predict similar average increases in temperature and increases and decreases in precipitation for the areas analyzed. This holds true even under different analysis horizons (2040 versus 2100, respectively) and with different levels of data precision. In the 1NC, details of the scenarios are provided at the municipal level.

In regard to adaptation measures, the First National Communication included a series of recommendations for water resources and the agriculture, livestock and forestry sectors. These were based on expected changes in temperature, precipitation and runoff, calculated with simulation models. Adaptation measures were also proposed in the Coastal Zone and Fishing Resources Study. Given the available information, there is a need to assess and implement the recommendations of the First National Communication.

One point that emerges from these two studies is the need to review the vulnerability scenarios in the First National Communication and harmonize these with the results of the study on Climate Variability in the 21st Century. Among other things, this will enable the improvement of methodologies

used in Chile to assess the impacts of climate change. Specifically, it will allow for a deeper analysis of impacts on priority vulnerable sectors, to be realized in the Second National Communication and other initiatives. Ultimately, the results of this type of analysis will facilitate the preparation of an adaptation plan as soon as possible.

Another important national need is the economic assessment of potential impacts of climate change. This should include a quantification of the cost of inaction versus the cost of early adaptation to climate change in Chile, for the different areas and sectors affected.

Furthermore, the possible influences of El Niño and La Niña should be taken into account when determining future climate change scenarios. It is known that these phenomena, influenced by climate change, will alter expected output in the agriculture, energy generation and fishing sectors, among others.

It is also crucial to assess current sectoral policies to determine their suitability and/or potential for addressing climate change and to ensure the effects of this trend are taken into account in policy implementation strategies. This work should include evaluation of policies and programs related to: water use for human consumption, irrigation, mining and electricity generation; food security and the development of new crop varieties; pest control and diseases that affect crops, forests and human health; forestation and reforestation; early warning systems for drought and frost; biodiversity protection through the creation of protected areas and conservation actions; bridge and hydraulic infrastructure design and the protection of riverside and coastal infrastructure, in light of new water levels projected for Chile as a result of climate change.

## 2. Background Information

### 2.2.6 Greenhouse Gas Emissions in Chile.

In the global context, Chile is not a major source of GHG emissions. According to international statistics (International Energy Agency, IEA; World Resources Institute, WRI), which only take into account CO<sub>2</sub> emissions, as well as those based on CO<sub>2</sub> equivalent that include carbon capture associated with the forestry sector and land use changes, Chile is only responsible for approximately 0.2% of total global annual emissions. This percentage has remained stable in recent years. Chile is 90th in the global ranking of per capita CO<sub>2</sub> emissions for 2004, with a value of 3.9 tons of CO<sub>2</sub> per inhabitant, according to the "Human Development Report 2007-2008: Fighting Climate Change," published by the United Nations Development Program (2007). In the South American context, Chile ranks second-highest in per capita CO<sub>2</sub> emissions.

Notwithstanding the above, national inventories prepared by CONAMA for the First National Communication (2000) as well as subsequent updates affirm that greenhouse gas emissions are increasing rapidly and significantly.

Using the methodology designed by the IPCC for carrying out GHG emissions inventories, Chile created a complete time series for 1984-2003 for the IPCC's two broad emissions categories: energy<sup>10</sup> and non-energy<sup>11</sup>. This series includes data from a recent update of the energy sector series (August 2008) which now ranges from 1984-2006 along with the data from a previous update of the non-energy sector, which covers 1984-2003. An update of the non-energy sector for 2004-2006, as well as subsequent GHG inventory updates are contemplated in the lines of action in this National Plan.

Appendix 3 provides more information on the IPCC inventory categories and on the inventory updates carried out so far in Chile.

<sup>10</sup> Includes emissions from production and consumption of energy and industrial processes.

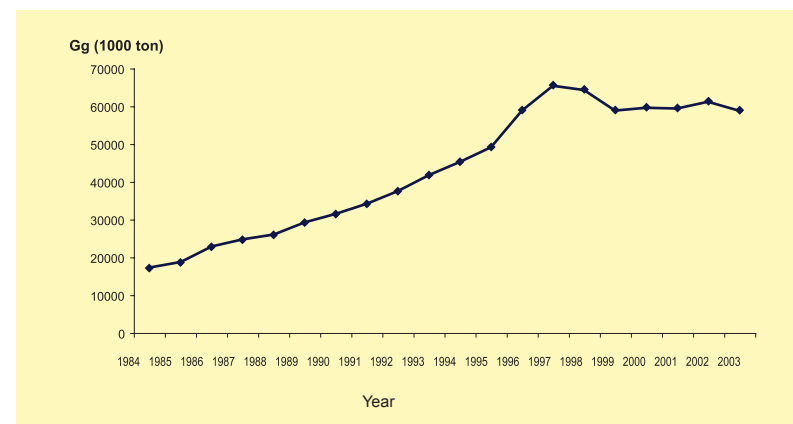
<sup>11</sup> Includes emissions from agriculture, changes in land use and forestry and waste management.

### Results of Greenhouse Gas Inventories.

Graph 1<sup>12</sup> displays the evolution of greenhouse gas emissions in Chile for the 1984-2003 period, expressed in gigagrams (Gg) of CO<sub>2</sub> equivalent<sup>13</sup>. These figures account for all IPCC emission and capture sources.

As the graph shows, emissions of CO<sub>2</sub> equivalents tripled over the 20-year period (from 17 to 59 million tons).

**Graph 1:**  
**CO<sub>2</sub> Equivalent Emissions in Chile, period 1984-2003**



<sup>12</sup> Source: CONAMA, based on studies conducted by PRIEN, INIA, DICTUC and POCH. Emissions from aviation and maritime transport are included in the total shown. Calculation of their share of this total is pending and will be addressed by CONAMA at a later date.

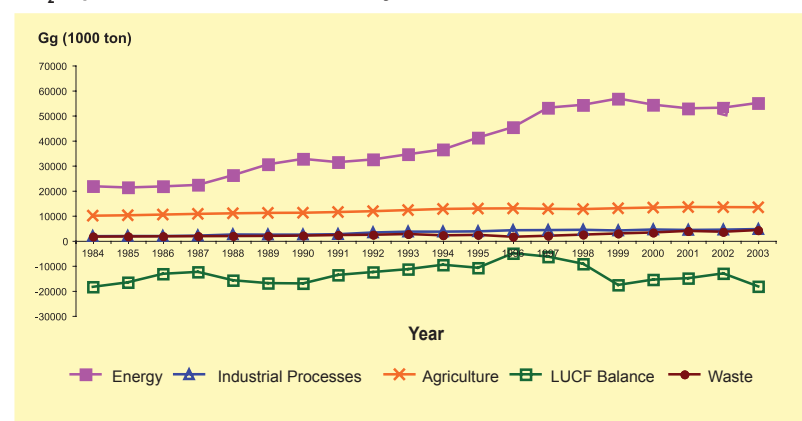
<sup>13</sup> Emissions of CH<sub>4</sub> and N<sub>2</sub>O are multiplied by their global warming potential (21 and 310, respectively), and then added to CO<sub>2</sub> emissions.

## 2. Background Information

Graph 2<sup>14</sup> shows the contribution of the five major sectors of the IPCC inventory for the 1984-2003 period. Those sectors are: energy, industrial processes, agriculture, land use, land use change and forestry sector (LULUCF) and waste.

According to the graph which shows each sector's contribution to the country's total emissions, in 2003 the energy sector had the highest CO<sub>2</sub> equivalent emissions, with close to 55 million tons, followed by agriculture, with somewhat more than 13 million tons. Ranking lower in emissions are the industrial processes sector, with 4.5 million tons of CO<sub>2</sub> equivalent, and the waste sector, with 4.2 million tons.

**Graph 2:**  
CO<sub>2</sub> Equivalent Emissions in Chile by Sector, Period 1984-2003



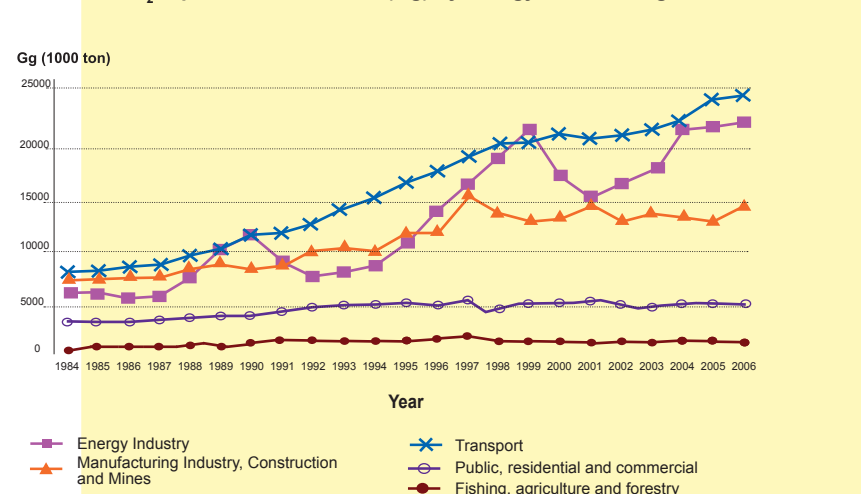
In contrast, the emissions balance (captured emissions minus generated emissions) recorded for the land use, land use change and forestry sector always had a positive net capture for the period studied. In terms of sector-specific emissions increases between 1984 and 2003, energy once again predominates, with an increase of 152%. This is followed by industrial pro-

<sup>14</sup> Source: Study carried out for CONAMA by POCH Ambiental.

cesses and waste, which recorded increases of 142% and 144%, respectively. Further behind was the agriculture sector, in which emissions grew by 33% between 1984 and 2003.

Breaking the figures down by subsector for the 1984-2006 period, the largest CO<sub>2</sub> equivalent emissions in the energy sector came from the transport and energy industries, followed by the manufacturing industry and the construction industry (Graph 3)<sup>15</sup>.

**Graph 3:**  
Evolution of CO<sub>2</sub> Equivalent Emissions (Gg) by energy sector categories



In the non-energy sector (Graph 4<sup>16</sup>), agriculture is the leader in emissions levels, with the most significant subcategories being enteric fermentation and agricultural soils. The land use, land use change and forestry category is an overall net sink<sup>17</sup> in all of the years evaluated; however, it also presents the greatest fluctuation, mainly due to extensive forest fires that have occurred with

<sup>15</sup> Source: Study carried out for CONAMA by POCH Ambiental.

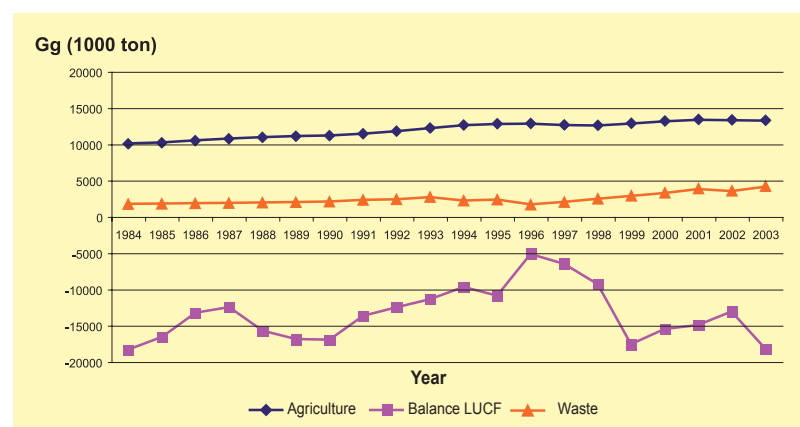
<sup>16</sup> Source: Study carried out for CONAMA by INIA.

<sup>17</sup> "CO<sub>2</sub> absorber by photosynthesis."

## 2. Background Information

increasing frequency and intensity. As such, the level of capture is not able to compensate the total emissions from the non-energy sector. The other two subcategories in this sector with net emissions (apart from forest fires) are forest rehabilitation and substitution, and forestry and agricultural soils.

**Graph 4:**  
**Evolution of CO<sub>2</sub> Equivalent Emissions by Non- Energy Sector Categories**



### Conclusions and Need for Action.

Although Chile's GHG emissions are low in the international context, the country's overall emissions are clearly on the rise. Based on the results presented, between 1984 and 2003 net CO<sub>2</sub> equivalent emissions increased from 17 to 59 million tons, while per capita CO<sub>2</sub> emissions increased from 1.4 to 3.7 tons per capita per year<sup>18</sup>.

At the sectoral level, the main increases have been due to transport and energy generation. This phenomenon will intensify as the quantity of fuels consumed increases, especially if those fuels are coal and diesel, which generate more CO<sub>2</sub> for each unit of energy produced. In the case of Chile,

GHG emissions inventory updates will reflect the current shortages in natural gas supply and increased use of more of the above mentioned CO<sub>2</sub>-intensive fuels. This shift will affect both the industrial and electricity generation sectors, as well as new investments to expand energy capacity.

The tendency of the land use, land use change and forestry sector to act as a sink has held over time, with some variations in gross figures that can be explained by forest fire variability from year to year. Policies should therefore be established to promote and protect these carbon sinks, as this sector is the only one that is a net absorber of CO<sub>2</sub>.

Increases in emissions from the agricultural sector have increased at a slower pace, but it is important to note that the increases are associated mainly with methane, a gas with 21 times more global warming potential than CO<sub>2</sub>.

One challenge for Chile will be to update its greenhouse gas emissions inventories annually in order to provide data on their evolution and eventual reduction through mitigation measures, also to maintain the capacity created and to continue meeting the country's international commitments on climate change.

Institutionalizing these updates will require, among other things, identifying institutions that can generate inventories over the long-term by incorporating this process into their own institutional development programs.

It is also necessary to assess the possibility (in terms of costs, usefulness and feasibility) of generating an energy sector inventory for each region of the country, to complement the national subsector figures that have been generated to date.

<sup>18</sup> Estimated per capita figure based on population data published in "CHILE: Proyecciones y Estimaciones de Población. Total País 1950-2050" (Chile: Population Projections and Estimates, National Totals 1950-2050) (INE, ECLAC) ([www.ine.cl](http://www.ine.cl))

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### 2.2.7 Developments in Greenhouse Gas Emissions Scenarios and Mitigation Options.

In terms of future projections of anthropogenic greenhouse gas emissions and sinks in the energy and non-energy sectors, the 1NC included results for two scenarios up to the year 2020, the first using 1994 emissions as a baseline (without taking into account mitigation measures) and the second including mitigation measures.

In general, the projected scenarios took into account a wide array of variables, including: macroeconomic and demographic trends projected for 2020; the application of energy sector reforms (Chilean-Argentine gas and electricity interconnectivity, petroleum and natural gas supply policies, etc.); the application of sectoral policies already approved, under implementation or pending implementation (in the environmental, public health and forestry development sectors) with indirect effects that could increase or decrease GHG emissions; and projected growth in exports and import substitution rates, particularly in the agriculture and livestock sector (two rates of substitution were used for the scenarios: 30% and 50%).

The energy sector situation has changed with recent natural gas shortages and a greater inclusion of fossil fuels in the energy mix. The country therefore needs to develop a new baseline scenario that takes into account updated national and international circumstances, specifically in regard to energy supply and demand.

#### Results of the First National Communication.

**Energy Sector.** The mitigation scenario was projected up to 2020 based on the assumption of the (non-spontaneous) introduction of technologies and actions that reduce GHG emissions and/or concentrations. The results emphasized the introduction of measures that were cost-effective for users (for example, energy savings and energy efficiency) but limited by market barriers. In regard to fuel switching, emphasis was placed on emerging

technologies and fuel substitution, above all for energy-sector industries. In the residential sector, the future baseline scenario incorporated the large-scale replacement of firewood with commercial fuels.

**Non-energy sector.** The most effective mitigation measures focused on increasing CO<sub>2</sub> capture in forestry activities (commercial plantations of *Pinus insignis* pine and eucalyptus). The assumption was that 60% of the plantations would be planted with eucalyptus and 40% with the *Pinus insignis* pine. As a consequence, economic evaluation of these measures focused on estimating costs associated with the expansion of area planted with these tree species.

The results indicate that the total cost to the private sector for new plantations would reach US\$ 157 million, with estimates ranging from US\$79 million in the pessimistic scenario (least area forested) to US\$ 236 million in the optimistic scenario (most area forested). The fact that revenue for the private sector would be far higher than the costs of planting makes this an economically feasible option. Estimated revenues from these activities would be US\$ 289 million on average (with US\$ 145 million in revenue in the pessimistic scenario and US\$ 521 million from the optimistic scenario).

It is important to note that the total estimated benefit to the private sector took into account public subsidies provided under Law Decree N° 701 and the cost of reinforcing the capacity for administration, management, enforcement, regulatory development and application of any sanctions. Using the same assessment timeframe and applying the same discount rate, the costs to the government of Chile would reach US\$ 160 million on average and range from US\$ 151 million to US\$ 168 million.

According to the First National Communication, the measures proposed for reducing emissions by 2020 would result in a 25% decrease in emissions (in CO<sub>2</sub> equivalents) below the baseline scenario.



## 2. Background Information

### Conclusions and Need for Action.

There exists a foundation of information about possible future scenarios of greenhouse gas emissions and mitigation measures in Chile. However, the mitigation scenarios proposed in the 1NC should be reviewed in light of new local and international conditions, especially considering changes in the energy supply, the country's current and future energy needs, as well as policies and practices for the sustainable management of existing energy sources. Also needed in an analysis of future scenarios are projections of greenhouse gases in Chile up to 2025, that take into account the new commitment scenarios beyond 2012 that are currently being debated by parties to the Convention on Climate Change and the Kyoto Protocol<sup>19</sup>.

One major challenge will be to determine the country's potential for mitigating greenhouse gases, both at the national level and disaggregated by sector. Such estimates will set out Chile's potential contribution to the global and national environment and to the international community interested in acquiring carbon credits. Any such analysis should seek to quantify the cost associated with mitigation for the energy and non-energy sectors.

The analysis of Chile's GHG mitigation potential will include assessments of GHG emission reductions resulting from all relevant programs and policies currently in force in the following areas: energy efficiency (the National Energy Efficiency Program, initiatives by the Economic Development Agency (CORFO), energy efficient housing construction and a number of private initiatives, etc.); renewable energy (including initiatives by the National Energy Commission, the Economic Development Agency and private parties); transportation (for example, sustainable transportation); forestry, agriculture and livestock sector practices (initiatives supported by the Ministry of Agriculture and the private sector); urban pollution control (pollution control plans, for example); and land use planning, especially in urban areas. Such an analysis will facilitate the alignment of these policies and programs with

<sup>19</sup> The Bali Road Map, approved in December 2007, launched a two-year process to strengthen the Convention on Climate Change with the participation of all parties.

the stated goals of the present Climate Change Action Plan and will strengthen the potential for reducing GHG emissions. The evaluation of the country's mitigation potential will be undertaken in preparation for the National GHG Mitigation Plan, which will be carried out through a variety of funding and technology transfer instruments, including the Clean Development Mechanism, the Global Environment Facility (GEF), local programs for pollution control, energy efficiency and renewable energy and other available instruments. Chile's GHG mitigation potential will be analyzed and presented according to the sector and subsector categories established in the current IPCC inventory methodology.

### 2.2.8 The Clean Development Mechanism and the Carbon Market.

Since the Kyoto Protocol was adopted in 1997, Chile has been actively engaged in promoting and implementing projects under the Protocol's Clean Development Mechanism (CDM). During the negotiation and approval process of the Marrakech Accords (2001)<sup>20</sup>, Chile played a leading role in advancing the launch of the Mechanism by proposing an interim implementation phase in 1998. During this interim phase the CDM was organized as outlined in the Marrakech Accords, including the specification of the Executive Board to its methodology panels and accreditation of designated operational entities<sup>21</sup>. Even before the Protocol entered into force, this interim structure facilitated the registration of the first CDM projects with the Executive Board.

True to its interest in making prompt use of the CDM, in 2003 Chile established its Designated National Authority (DNA)<sup>22</sup>, which is a Kyoto Protocol requirement for all countries seeking to develop emissions reductions and capture projects through the CDM and participate in the so-called carbon market. The promotion of the CDM in Chile and abroad, the DNA's review of projects, and Chile's array of cooperation agreements with indus-

<sup>20</sup> Accords negotiated under the Convention on Climate Change that established the framework for implementation of the Kyoto Protocol and specified, among other matters, rules for CDM operation.

<sup>21</sup> Entities that participate in the validation, registration, verification and certification stages of CDM projects.

<sup>22</sup> CONAMA presides over and is responsible for technical coordination of the DNA, which also includes the Ministry of Foreign Affairs, the National Energy Commission, the Ministry of Agriculture and the Clean Production Council.

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trialized nations in areas related to the CDM have helped Chile establish 48 projects approved by the DNA, 25 of which are registered with the CDM Executive Board (as of September 2008). These projects imply an average reduction of 3,949,929 tons of CO<sub>2</sub> equivalent per year, or approximately 5% of all CO<sub>2</sub> equivalent emissions for 2001. Appendix 4 of this document describes how the DNA operates in Chile and includes a table of approved projects as of September 2008.

The carbon market<sup>23</sup> is a significant element of climate change response and has the potential to be a crucial, reliable tool for the future mitigation of this global environmental problem. The market itself is described in Appendix 5 as well as the main transactions carried out for the 2005-2007 period.

### Conclusions and Need for Action.

Chile has so far been a major player in Latin America and even worldwide in the CDM market, as demonstrated by the country's registered CDM projects and approved methodologies. It has participated in all Carbon Expos organized by the International Emissions Trading Association (IETA), the World Bank and the Cologne Trade Fair, with an ever-growing portfolio of projects approved by the DNA. Despite the excellent position it has achieved, however, there is still untapped potential to take further advantage of this mechanism.

This potential for growth, coupled with developed countries' high demand for carbon certificates and the expansion of the carbon market itself, means that Chile should strive to develop and present CDM projects for different productive sectors in order to more actively meet international demand. At the same time, the country should look for ways to apply the Programmatic CDM<sup>24</sup> approach in order to transform the technological characteristics of different sectors of the economy.

<sup>23</sup> Includes compliance markets such as Kyoto and informal markets, in which GHG emission allowances and reductions and captures are traded through projects.

<sup>24</sup> It implies the potential registration with the CDM Executive Board of a GHG emission reduction program in a specific sector or activity, which will be implemented through CDM projects.

With the objective of further expanding the supply of CDM projects available and strengthening the Clean Development Mechanism as a tool for accelerating the introduction of technologies and processes that are environmentally friendly on both a local and global level, Chile will seek to reinforce and improve its system for approving and promoting CDM projects on a national level.

To fortify the use of flexible or market-driven mechanisms such as the CDM, Chile will seek the creation of a national entity (an office or technical unit), specialized in market oriented instruments that facilitate GHG emission reductions, in order to provide technical and legal support to project proponents and support the corresponding promotional activities.

### 2.2.9 The Legal, Institutional and Public Policy Framework for Addressing Climate Change in Chile.

#### 2.2.9.1 The UN Framework Convention on Climate Change and the Kyoto Protocol.

The legal framework that serves as the foundation for Chile's response to climate change is that established under the Convention on Climate Change and the Kyoto Protocol, which were ratified by the country in 1994 and 2005, respectively. These international instruments enable developed and developing countries to undertake "common but differentiated" coordinated actions to address and mitigate the impacts of climate change.

Both the Convention on Climate Change and the Kyoto Protocol provide measures, economic instruments and funding mechanisms to support the transformations that will allow Chile to effectively face climate change, gradually bringing the country's growth into harmony with sustainable development criteria. Both instruments offer Chile a unique opportunity to confront the problem of climate change synergistically with sectoral development agendas that will create opportunities to address local needs such as:

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- Strengthening the National Environmental Policy by reducing local pollutants and other negative environmental externalities and implementing measures to reduce greenhouse gas emissions and adapt to climate change. Based on the potential synergy between global issues and the local agenda, a major challenge for the Chilean government is to integrate climate change into its public policies and management instruments that address issues such as energy generation and use, public health impacts, conservation and sustainable use of biodiversity, education for sustainable development, glacier protection and water resources management through river basin management, among other important issues in this area.
- Advancing sustainable development and poverty reduction through the transfer of technologies that mitigate greenhouse gas emissions and enable adaptation to their expected impacts. This will help to improve the socio-economic and environmental conditions of communities or parties directly affected by this phenomenon.
- Increasing participation in the carbon market through the Kyoto Protocol's Clean Development Mechanism, which is crucial for accelerating the introduction of environmentally friendly technologies that reduce emissions of greenhouse gases and local pollutants.

### 2.2.9.2 National Steering Committee on Global Change.

In order to fulfill its climate change commitments, including the periodic publication of National Communications, the Government of Chile in 1996 created the National Steering Committee on Global Change (CNACG) as an advisory panel on these issues. Currently, CONAMA presides over the Committee and the Ministry of Foreign Affairs (MINREL) is the vice president. Other committee members include representatives of the Ministry of Agriculture (MINAGRI), the National Energy Commission (CNE), the Directorate General of Maritime Territory and the Merchant Marine (DIRECTEMAR), the Chilean Meteorological Directorate (DMC), the Chilean Navy's Hydrographic and Oceanographic Service (SHOA), the National Commission for Scien-

tific and Technological Research (CONICYT) and the Chilean Academy of Science. The Committee's founding decree also allows other institutions and individuals to request an invitation to attend the Committee's meetings<sup>25</sup>.

The Committee meets regularly to analyze and propose actions in different areas of climate change. These include formulating official positions on such climate change issues as adaptation, mitigation, the Clean Development Mechanism, the Convention's funding mechanism and future commitments for the post-2012 period. The Committee was also charged with reviewing Chile's First National Communication and elaborating programmatic lines of action on climate change matters.

### 2.2.9.3 Strategic Guidelines.

A primary task of the National Steering Committee on Global Change was to formulate Strategic Guidelines for Climate Change for Chile. These were approved by CONAMA's Executive Board in 1998 and formed as the basis for preparing a climate change work plan and served to focus national efforts leading up to the National Climate Change Strategy and the National Action Plan.

The Strategic Guidelines reiterate the commitments established under the Convention on Climate Change, promote the national ratification of the Kyoto Protocol and encourage the participation of key sectors and Chilean experts in the discussion of economic mechanisms established in the Protocol. They also promote the use of the Clean Development Mechanism, offer guidelines for new ways of limiting and/or reducing greenhouse gases in developing countries and foster the design and application of a National Climate Change Action Plan. Lastly, the Strategic Guidelines propose a special fund to promote scientific and technical research and capacity-building for climate change in Chile.

<sup>25</sup> The ministries of Economy (MINECON) and Transportation (MTT), the National Petroleum Company (ENAP), the Confederation of Production and Commerce (CPC), Fundación Chile, the Chilean Copper Corporation (COCHILCO), the Climate Action Network for Latin America (CANLA) and the Pontificia Universidad Católica de Chile were invited to be standing members of the committee for the 1998-2001 period.



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### 2.2.9.4 National Climate Change Strategy.

In January of 2006, the Executive Board of CONAMA approved the creation of the National Climate Change Strategy along with its Technical Committee and Board of Directors. The Strategy is structured around three main focal areas (Table 1): adaptation, mitigation and the creation and promotion of national capacities. Each area has its own objectives to ensure a comprehensive response to climate change, while the third area is also a cross-cutting one, in the sense that it is essential to adequately support actions in adaptation and mitigation.

**TABLE 1:**  
**National Climate Change Strategy**

Area	Objectives
Adaptation to the Impacts of Climate Change	<ol style="list-style-type: none"> <li>1. Evaluate environmental and socioeconomic impacts of climate change in Chile.</li> <li>2. Define adaptation measures.</li> <li>3. Implement and follow-up on adaptation measures.</li> </ol>
Mitigation of Greenhouse Gas Emissions	<ol style="list-style-type: none"> <li>1. Analyze alternatives for mitigating greenhouse gas emissions in Chile.</li> <li>2. Define mitigation measures.</li> <li>3. Implement and follow-up on mitigation measures.</li> </ol>
Creation and Promotion of Capacities in the Area of Climate Change	<ol style="list-style-type: none"> <li>1. Promote public information and awareness about climate change.</li> <li>2. Encourage education and research on climate change.</li> <li>3. Improve systematic climate observation.</li> <li>4. Generate high-quality, accessible information for decision-making.</li> <li>5. Build institutional capacities for mitigation and adaptation.</li> <li>6. Develop and transfer technologies for mitigation and adaptation.</li> <li>7. Regularly review and update Chile's national greenhouse gas inventory.</li> <li>8. Actively participate in the international climate change agenda.</li> <li>9. Support international cooperation on climate change.</li> <li>10. Establish synergies with other global conventions being implemented.</li> </ol>

## 2. Background Information

### Conclusions and Need for Action.

As indicated in the preceding paragraphs, Chile has defined a legal and institutional framework to meet its commitments and carry out actions in the area of climate change. The country has also designed a management structure, based on the 1998 Strategic Guidelines and its National Strategy, which has enabled the country to advance the national and international climate change agenda.

A major challenge will be to incorporate the focal areas and objectives of the National Climate Change Strategy contained in this Action Plan into the development plans and programs of key public and private sectors, as well as the area of research. The overarching goal of this approach is to make climate change a strategic theme integrated into national public policy.

In light of the Strategy and the forthcoming implementation of this Action Plan, it is necessary to review the mandate and composition of the National Steering Committee and to identify ways to increase its active involvement in public policy decisions related to climate change.

Another central challenge is institutional reorganization and/or reinforcement in all ministries with authority in the area of climate change. An adequate institutional framework will ensure that responses to the problem of climate change are sustained over time. To accomplish this, Chile will consider the creation of a National Climate Change Office. This Office would oversee all activities in this area and coordinate inter-institutional relations among ministries with different areas of authority, in order to strengthen and improve the responses required to comprehensively address the problem of climate change.

### 2.2.10 International Negotiations.

Chile has actively participated in international negotiations on climate change since 1995. Our country has been present at all meetings of the Conference of the Parties to the Convention and its subsidiary bodies, and at all

Meetings of the Parties to the Kyoto Protocol. Representatives of different Chilean institutions have been members of official delegations to those meetings, representing the country's interests from various perspectives. Historically, the National Steering Committee on Global Change has been responsible for developing the country's national positions.

Due to the unfailing presence of Chilean delegations throughout the negotiation process, Chile has seen its national positions adopted in the Marrakech Accords and later implemented. Examples of Chilean contributions include the new format for National Communications, the role of carbon sinks within the Clean Development Mechanism, and the interim phase of the CDM.

The country has also been actively involved in negotiations since the Marrakech meeting, most notably on the issues of defining the "Programmatic CDM", promoting forest conservation (addressed as avoided deforestation) and increasing the scale of small forest projects and harvested wood products. Chilean delegates have also participated in discussions on implementing the Convention's adaptation plan and administering the CDM adaptation fund, launching the International Transaction Log<sup>26</sup>, establishing the second period for developed countries to meet their Protocol commitments (associated with the adoption of a new GHG emission stabilization scenario) and defining coordinated actions by all Convention parties to most effectively implement this instrument.

Negotiations addressing the majority of the matters referred to above culminated at the 13th Meeting of the Conference of the Parties to the Convention on Climate Change and the 3rd Meeting of the Parties to the Kyoto Protocol, both held in Bali in late 2007. Special mention should be made here of the agreements reached in Bali among all parties regarding the dialogue on long-term cooperative action to address climate change. This initiative, which is known as the "Bali Road Map" (See Appendix 6), seeks to ensure that actions implemented under the Convention are truly effective. The Road Map recognizes that major reductions in global GHG emissions are needed

<sup>26</sup> Among other things, this will enable CDM carbon credits to be traded within the European Union's emissions trading market.

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to fulfill the aim of the Convention<sup>27</sup> and emphasizes the urgency of addressing climate change, as noted in the latest IPCC report. In the corresponding decision, the parties agreed to begin an exhaustive process to enable the complete, effective and sustained implementation of the Convention through long-term cooperative action, both immediately and beyond 2012. This exhaustive process will address a detailed list of activities associated with each of the following topics: mitigation, adaptation, technology development and transfer and financial resources. A key aspect that could potentially have a great impact on developing countries is the Bali Road Map's call for these countries to also carry out mitigation actions. The details of such mitigation actions have yet to be defined, but at least there is now a documented precedent on the matter, which changes the nature of the level of participation that developing countries must have in resolving the problem of climate change.

### Conclusions and Need for Action.

Chile has always been present in the Protocol and Convention negotiations, and therefore has had many opportunities to present its perspectives on climate change. This constant participation should continue and intensify, given the relevance of the issue at both the national and international levels.

The outcome of the debate on new commitments under the Kyoto Protocol and the definition of new actions under the Convention on Climate Change for the period after 2012 will reshape the level of participation required of developed countries and possibly developing countries as well. This potential scenario of binding international commitments should encourage debate on the adverse effects of climate change and on mitigation and adaptation at the highest policymaking level in Chile. This possibility should also incentivize the review and eventual modification of the current institutional framework.

Globally, Chile must continue to keep abreast of new developments in the discussions about the post-2012 period, contributing to them while at the same time protecting the country's own interests. In this regard, there will be an emerging need to evaluate in-depth the proposals currently being developed for both the Convention and the Protocol. Such analysis will strengthen the national positions that Chile takes to negotiations in December 2009, the proposed deadline for new decisions that would enhance the global response to climate change beyond 2012. Evaluation of the proposals presented should begin early and should incorporate related variables, including Chile's possible entry into the OECD. The overall goal is to define strategic guidelines that would guide Chile's involvement in international climate change negotiations.

Finally, Chile is looking to strengthen the participation of relevant institutions, incorporating new members into the official delegation attending the Convention and Protocol meetings.

### 2.2.11 Intergovernmental Panel on Climate Change.

Chile has undertaken a national review of the last three IPCC Assessment Reports, convening national experts under CONAMA's direction. Representatives have also participated in technical and plenary sessions of the Panel since 1996. Likewise, Chilean experts have participated as authors or direct reviewers of the IPCC's work, and in working groups (the working group on emissions inventories, for example), and so have had the opportunity to be recognized in the recent Nobel Prize awarded to the Panel in October 2007.

<sup>27</sup> "Stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system..."

## 2. Background Information

### Conclusions and Need for Action.

Given the great influence that the IPCC's scientific Assessment Reports have on negotiations under the Convention and Kyoto Protocol, not to mention local development policies, especially regarding the Panel's latest affirmations on human interference in the climate system, the national review of IPCC documents must include more scientists and stakeholders. Additionally, it is important that such a review take place at the highest levels of political decision-making in Chile.

There is also an important need to generate scientific information in Chile that can be used as input for future IPCC reports. This can be demonstrated by the fact that the literature used by the IPCC to prepare its reports is notably lacking in scientific research from the developing world, at least compared to the volume of information available from industrialized nations.

### 2.2.12 International and Local Cooperation on Climate Change.

Since 1994, the country has been developing a bilateral and multilateral cooperation agenda to fulfill its international climate change commitments. Appendix 7 provides a list of selected cooperation initiatives Chile has implemented in this area.

Some recent investments and projects in Chile that seek to reduce greenhouse gas emissions, though not designed under a climate change mitigation framework, are worth noting:

- CORFO programs that directly support investment, such as subsidies for pre-investment studies in non-conventional renewable energies (NCREs) and energy efficiency (EE). These programs are intended to promote innovation and energy diversification and foster the expansion of a marketable carbon credit portfolio. They are also designed to encourage studies to identify and assess the technical, economic and financial aspects of different investments that would optimize energy use and reduce costs associated with their use.

Other CORFO initiatives support detailed engineering of NCREs such as geothermal, tidal, solar and biomass power and small hydropower; special financing for NCREs and EE; and the national and international promotion of NCREs.

- The National Energy Efficiency Program was launched in early 2005 by the Ministry of Economy and is now under the purview of the National Energy Commission (CNE). The program has the potential to reduce energy use by 1.5% annually. This program will provide four types of potential benefits: i) strategic benefits, by reducing Chile's dependence on foreign energy; ii) economic benefits, by minimizing the economy's overall energy supply cost; iii) environmental benefits, by decreasing pressure on natural resources and human settlements through controlling increases in energy demand and alleviating global pressures caused by CO<sub>2</sub> emissions; and iv) social and gender benefits, since the aforementioned benefits have a greater impact on low-income families, who spend a larger percentage of their income on energy than other families.

- The Geothermal Information Improvement Program developed by SER-NAGEOMIN (National Service of Geology and Mining), which includes a database of geothermal exploration rights.

- Investor information, in the form of guides focused on: environmental assessment and CDM Project assessment<sup>28</sup>; evaluation of wind, forestry and agricultural resources<sup>29</sup>; building the inventory of hydraulic projects associated with irrigation works (National Energy Commission and the National Irrigation Commission); geothermal energy information; application of technical-economic assessment models for projects (CNE); and feasibility assessment of solar thermoelectric alternatives (CNE).

28 i) Guide for the Environmental Assessment of Non-Conventional Renewable Energies: Biomass Projects, 2007; ii) Guide for the Environmental Assessment of Non-conventional Renewable Energies: Wind Power Projects, 2006; and iii) Guide to the Clean Development Mechanism for Energy Sector Projects in Chile, 2007, all through the cooperative action of CNE, GTZ and CONAMA.

29 i) Wind power potential (CNE, Ministry of National Property); ii) Forest biomass potential: Energy generation potential of waste from managed forest in Chile, 2008 (CNE, GTZ); iii) Availability of timber resources: Waste from the primary logging industry – Availability for energy use, 2007; iv) Biogas potential. Identification and classification of the different types of biomass available in Chile for generation of biogas; the last two of these through the cooperative efforts of CNE, GTZ and INFOR.

## 2. Background Information

- Modification of the Electricity Law (CNE), requiring energy sellers in the Central Interconnected System and Northern Interconnected System (SIC and SING, respectively) to accredit that a certain percentage of the energy sold each year was generated from non-conventional renewable energies (NCREs). This requirement goes into effect for energy sold over a 25-year period, from 2010 to 2035, and applies to all energy sold under supply contracts both to individual clients and distributors who were under contract as of August 31, 2007.

The percentages of NCREs that must be accredited each year are as follows:

2010 to 2014: 5%

2015 to 2024: annual increases of 0.5%

2024 to 2035: 10%

- The creation of a financing mechanism under CONAMA's Environmental Protection Fund (Fondo de Protección Ambiental, or FPA) in 2007 for local development projects that address climate change. This Fund was established by Law 19,300 and is administered by CONAMA. It is a competitive fund that offers partial and total financing for projects and activities that aim to protect or repair the environment, preserve nature or conserve the country's environmental heritage.

As an instrument, the FPA seeks especially to encourage the participation of grassroots organizations (territorial and functional) through demonstration projects that promote new and improved relations with the natural environment. This initiative is intended to foster environmental accountability through projects designed by the community organizations themselves. In the call for proposals in 2007, more than 50% of all projects presented were in the area of climate change. Of these, 67 projects were selected and are currently being implemented, accounting for 46% of all FPA projects running in 2008. In 2009, of the 428 projects currently being evaluated, 209 (48.8%) are related to climate change.

### Conclusions and Need for Action.

Over the years, Chile has made gradual progress in bilateral and multilateral cooperation. So far, efforts to date have enabled capacity-building and the fulfillment of international commitments such as National Communications. Nevertheless, channels for cooperation and locally funded actions need to be further developed in order to improve Chile's ability to effectively address climate change.

A more intense international agenda will be pursued in order to take maximum advantage of funding that is available from different international sources. In addition, the Government of Chile will increase its efforts to provide funding for priority actions that address climate change.

Both the National Energy Efficiency Program and initiatives that promote the introduction of non-conventional renewable energies will be assessed in terms of their real and potential contribution to reducing greenhouse gas emissions. The information generated through this assessment will be very useful, particularly for the Bali Road Map process, as it will enable the country to identify and evaluate early measures and actions that Chile has undertaken to advance sustainable development and foster greenhouse gas mitigation.

Another important matter is the generation and dissemination of up-to-date scientific knowledge on climate change in Chile. To achieve this, the government will strengthen its cooperation efforts with the research community, in order to approach climate change with a clear focus on decision-making.

## 2. Background Information

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Considering Chile's vulnerability to the expected impacts of climate change and the environmental, economic and social opportunities that have emerged from the need for actions in adaptation and mitigation, the following section will present some strategic considerations that build upon this background information and serve to guide the implementation of the National Climate Change Action Plan.  
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**“Glaciers have seen their volumes decrease dramatically in recent decades, and one of the most affected areas is southern Chile.”**

# Strategic Considerations for Addressing Climate Change in Chile



### 3. Strategic Considerations for Addressing Climate Change in Chile

The Chilean Government must explicitly address climate change as part of the various sectoral policies and management instruments that are related to this global problem. Climate Change should be thought of as a strategic theme in all areas of public policy. In order to achieve this, the following strategic considerations provide a guide as to how the actions in the National Action Plan should be defined:

#### 3.1 Climate change as a key issue in Chilean public policy and regulations.

The risk that climate change poses to development, both for present and future generations, is a concern shared by all humanity. Governments, companies and individuals face an enormous challenge of coordinating with each other as they search for ways to address the issue.

The short-term effects of climate change are manifested mainly through extreme climate events, whereas longer-term consequences derive from the ongoing accumulation of excessive amounts of greenhouse gases in the atmosphere. In order to deal with these effects in a coordinated and efficient way, it is crucial to consider this cross-cutting issue as part of all public policies and regulations related to the problem of climate change. This will allow individual interests from different sectors to be brought together and aligned in a single agenda to deal with the effects of climate change. It will also permit critical advances such as economic growth, global insertion and improvements to the health and quality of life to be made in a sustainable way.

Considering synergies between global issues and local agendas, another challenge faced by the government is the integration of climate change into different public policies and management instruments that address areas such as energy generation, efficient use of energy, conservation and biodiversity, education, health and sustainable management of water resources, among others.

The potential development of new international commitments should act as an incentive for debate on climate change at the highest political level in

Chile and for the review and modification of existing structures for dealing with the problem.

The National Action Plan will serve to create the necessary sectoral partnerships and contribute to the debate on how to define the relevant institutional structures.

#### 3.2 Adaptation as a foundation for Chile's future development and as an early response to the impacts of climate change.

Chile is already feeling the effects of climate change, as detailed by national and international studies summarized in the previous section. As such, urgent measures must be taken to decrease the current impacts, to anticipate the potential damage and to minimize threats to economic development, energy security, domestic infrastructure, human health and ecosystems.

Regarding the impacts of climate change, the Government's priorities are prevention, preparation, response and recovery. The capacity to respond to the impacts of climate change must also be aligned with a disaster-risk reduction strategy and an early-warning strategy at the national and regional levels.

When it comes to setting priorities for adaptation, it is essential to first have sufficient knowledge regarding the timeframes and magnitudes of the impacts. Therefore, this Action Plan will concentrate on creating baseline information about impact scenarios and adaptation options for sectors that are considered vital for the country. These sectors include: water resources, due to their influence over many other sectors; the mining sector; the forestry, agriculture and livestock sectors and other industries and services of critical importance to the country's GDP and which are vulnerable to the demands by external markets (such as carbon footprint<sup>30</sup>); the energy sector, due to its importance to Chilean development and expected changes in the ener-

<sup>30</sup> Emissions of CO<sub>2</sub> equivalent that are generated by production of a commercial product (raw materials or end product). The emissions generated by production and transport to the final destination are taken into account for carbon footprint calculations.

### 3. Strategic Considerations for Addressing Climate Change in Chile

gy matrix; marine and fishing resources, which are extremely important to Chile's development; biodiversity and ecosystem services; and health, in terms of preparation for possible health alerts caused by climate change and the subsequent increased pressure on the country's health systems that these might cause.

Likewise, Chile acknowledges the international dimension of climate change impacts and adaptation measures. As a result, the government realizes the need to create a new alliance with partners all over the world in order to respond accordingly. Although measures have to be adopted or applied nationally or locally where the operational capabilities are in place, it is essential to apply a cross-border approach to all vulnerability and adaptation assessments, for example in the case of watersheds or biogeographical regions. It is particularly important for the strategic planning of the country's future development that there exists an awareness about the effects that climate change could have on countries with which Chile has strong trade ties – particularly those from which Chile imports basic necessities.

For example, Chile should be aware of any studies that forecast decreases in the production of foodstuffs, fuels and other essential products that the country regularly imports. Any adaptation strategy should be prepared to deal with these scenarios. Similarly, outbreaks of new or existing diseases in neighboring countries could create the need to take preventative, curative or palliative actions. As a first approach, the evaluation of regional impacts should be prioritized. Along these lines, Chile should coordinate with neighboring countries to carry out relevant studies and cooperate on any necessary adaptation measures as well as work to reinforce cooperation with international organizations.

One alternative for assessing the regional dimension of the impacts of climate change is presented in the Ibero-American Climate Change Adaptation Plan (Plan Iberoamericano de Adaptación al Cambio Climático, known as PIACC)<sup>31</sup>. As part of this Plan, some countries from the region have already initiated national adaptation projects.

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<sup>31</sup> Chile is part of this plan, which is supported by the Spanish government.

At the same time, existing political platforms should be used to allow, at the very least, all South American countries to debate and implement a series of coordinated strategies, measures and actions related to climate change adaptation. For example, international agreements signed by Southern Cone countries should be geared toward integrating strategic sectors such as agriculture, water, biodiversity, fishing, energy grids, etc. by promoting shared research and implementing economic policies aimed at reaching adaptation goals.

#### 3.3 Mitigation as a way to improve quality of growth, reduce overall greenhouse gas emissions and decrease adaptation costs.

According to the latest IPCC assessment report, it is possible to mitigate worldwide emissions at a reasonable cost through the implementation of multiple strategies involving a range of technologies and sustainable practices such as energy efficiency, incentives for renewable energies, biofuels, taxes on fossil fuels, urban planning and best practices in agriculture and forestry.

The IPCC states that the concentration of CO<sub>2</sub> equivalent emissions should be stabilized between 430 and 710 parts per million (least pessimistic range) between 2030 and 2050, so as to minimize expected temperature increases towards the end of the century and avoid exceeding current levels by more than 2° Celsius. The international community is considering this information as it tries to define the most suitable post-2012 emissions reduction stabilization scenario for industrialized countries. It is very likely that the approved stabilization scenarios will fall within the ranges indicated by the IPCC for the least pessimistic scenario.

In 2004, Chile reaffirmed its commitment to the Convention on Climate Change and its objective to stabilize concentrations of greenhouse gases. In similar fashion, as a result of the scenarios envisioned by the IPCC, Chile should also take part in the urgent actions that are required worldwide to reduce the generation of GHGs and should make greater efforts to limit or restrict increases in future emissions. Although Chile is a minor contributor to global GHG emissions (0.2%), it is worth mentioning that the country's emissions increased by 300% over a 20-year period (1984-2003),

### 3. Strategic Considerations for Addressing Climate Change in Chile

according to information obtained from national GHG inventories. These statistics also show that the energy sector has caused, and will continue to cause, the greatest increase in the country's GHG emissions.

Chile's motivation to contribute to worldwide emissions reductions stems from the principle of common but differentiated responsibilities of the parties to the Agreement. The country intends to cooperate with the objective of the Convention, as well as to take advantage of the potential environmental and social benefits and improvements in the quality of growth that can be directly derived from mitigation actions.

President Bachelet has shown strong support for the Convention and Chile's role, emphasizing the fact that Chile is a developing country committed to facing the challenges of climate change. In 2007, she delivered a speech to the Sixty-second Session of the United Nations General Assembly<sup>32</sup>, in which she stated that "...we must be aware that even the greatest effort by developed countries will not be sufficient to stop climate change. Developing countries also need to take actions to reduce emissions, as part of a global effort within the scope of the Convention."

In response to this challenge, Chile's first efforts will focus on changing the country's patterns of production and consumption, starting with the valuation of carbon at a project level and continuing with the valuation of emissions-related externalities in investment and operation projects in various priority sectors.

In this sense, the Kyoto Protocol's Clean Development Mechanism can be considered an important tool in this much-needed effort. Furthermore, considering the current high level of demand from developed countries for carbon certificates, along with the expected growth of the carbon market, Chile should encourage all of its production sectors to develop CDM projects in hopes of playing a more active role in meeting this demand. At the same time, the Government could be using CDM to promote technology transfer at the sectoral level.

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<sup>32</sup> September 25, 2007, New York.

As part of a longer-term strategy for mitigation, Chile will view limitations or restrictions to the growth of its GHG emissions in terms of the reduction in future costs of adaptation. Such an approach implies the integration of mitigation and adaptation actions.

One of the main aims of the National Climate Change Action Plan will be to establish baseline information about future emissions scenarios and mitigation options in Chile. The following factors will be considered as part of this baseline: potential mitigation calculations for the country and the costs of measures to be implemented, the contribution of the Clean Development Mechanism to mitigation and adaptation in Chile, a periodic review and update of national GHG emissions inventories and the feasibility of creating a voluntary internal market to reduce GHG emissions. This market would be connected to existing markets, as a contribution to worldwide mitigation requirements.

#### **3.4 Innovation in the domestic financial and business sectors to increase opportunities for investment in projects related to mitigation and adaptation.**

Innovation in financial and business sectors is essential for increasing the opportunities for investment in mitigation projects and the financial flows associated with the sale of Certified Emission Reductions (CERs or carbon credits); for developing and propagating technologies that are less carbon-intensive and that facilitate adaptation; and for managing the risks related to investment, infrastructure and other sectors that are susceptible to climate risks.

In order to foster investments in mitigation and adaptation measures, Chilean businesses and financial sectors must implement innovative resource mobilization mechanisms, most likely in partnership with regional and international multilateral development banks. A viable alternative could be the creation of development instruments in the form of "carbon funds or markets" and "adaptation funds," both of which are contemplated in this Action Plan as an activity for 2009. As for carbon funds, there are plenty of specific

### 3. Strategic Considerations for Addressing Climate Change in Chile

examples currently operating in the world (funds from the World Bank, the Inter-American Development Bank, Spain and Italy, among many others). Further examples can be found in some countries in Latin America or in the region's financial corporations that have developed local financing mechanisms for CDM projects through the creation of specific "carbon funds." This has been the case in Argentina, Mexico and with the Andean Development Bank (Banco Andino de Fomento). Chile has so far used the method of opening lines of credit for CDM projects in activities related to energy efficiency and non-conventional renewable energies, a process managed by Chile's Economic Development Agency (See Appendix 8).

Chile will be evaluating the possibility of creating one or more types of carbon fund as well as the practicality of establishing local lines of credit for certain adaptation projects.

#### **3.5 A strategic long-term perspective based on the assessment of future commitments related to climate change and their likely effects on international trade.**

Given the potential for the establishment of new commitments for developed countries under the Kyoto Protocol and the work being done under the Convention on Climate Change to determine new actions for all parties, developing countries are now facing the possibility of being forced to action on climate change.

Under one scenario, a future strategy to fight against climate change might include the establishment of "green" trade barriers for different export products. The specifications of such barriers will likely be based on the level of GHG emissions emitted from the processes involved in producing any exportable product. These levels are known as the products' "carbon footprint." The size of this footprint depends on the production, processing and transport of a given product. This means that any product of international origin that has been processed will have a large carbon footprint due to the amount of energy used and materials involved in making it.

As such, any country wishing to sell its products in a scenario of green barriers like the one described will have to demonstrate that it has taken measures to reduce its GHG emissions. Such a barrier could have a significant impact on the Chilean forestry and agricultural sectors in the sense that these products generally travel long distances to reach their markets and as a result have an increased carbon footprint. Additionally, these products' footprint would also have to consider any emissions produced during the production and processing phases.

The previous example provides an additional justification for considering sectoral mitigation efforts in Chile, in spite of the nation's relatively small contribution to global greenhouse gas emissions.

#### **3.6 Development of a baseline of climate change-related knowledge through integrated research, systematic observation of the climate and citizen training and education, as tools to support decision-making.**

Access to solid scientific research is fundamental for implementing measures to tackle the impacts of climate change. Although much progress has been made towards understanding the planet's climate system, there is still a great deal of uncertainty about the precision of forecasts, the impacts of climate change on a regional and local level and the costs and benefits of adaptation measures. As a result, it is necessary for the government to encourage an integrated, inter-sectoral approach, as well as the internalization of environmental costs associated with the degradation of the country's physical and biological systems.

**Research.** A greater amount of Chile-specific scientific information must be developed in order to contribute to future IPCC reports. This is absolutely necessary given that there is still a significant gap between the amount of scientific research in the developing world compared to that available in industrialized countries. Therefore, stronger cooperation is needed between the academic sector and the government to tackle the problem of climate change. For example, the national process for reviewing IPCC documents

### 3. Strategic Considerations for Addressing Climate Change in Chile

should include a greater number of scientists and interested parties.

**Systematic observation.** Chile is one of many developing countries with the need to expand climate observation networks on the ground, in the upper atmosphere and at sea. Such efforts would lead to an improvement of local climate records, recovery of historical data, the standardization of meteorological data collection systems and an improvement in the coverage of national networks, with the resulting benefit of improving future climate scenarios. These initiatives depend on the availability of financing, specifically in order to expand the terrestrial, oceanographic and atmospheric network. As such, the government's involvement is fundamental.

**Education and Awareness.** A critical aspect in terms of climate change education will be the inclusion of climate change into all different levels of the national curricula through the development of corresponding elementary and secondary-level educational programs as part of a National Program for Climate Change Education.

Similarly, as part of this policy initiative, the government should take action to raise public awareness about climate change and carry out an evaluation of the Program to determine its effectiveness (i.e., improving public access to information, participation in studies and drawing up suitable responses). The government should also be responsible for preparing and disseminating educational and informational materials on the subject as well as raising public awareness about climate change in general.

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The following priority courses of action of this National Climate Change Action Plan fully take into account the strategic considerations identified in the previous paragraphs, which are based on the possible consequences of climate change for Chile, the country's current progress on the issue, as well as the opportunities offered by international agreements and conventions that have been signed.

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“Floods are one of the consequences of climate change, caused by more frequent extreme weather events such as heavy rainfall.”





"These children attending an environmental class on the central Chilean coastline could witness changes to the coastal landscape caused by sea level changes expected over coming decades."





# Priority Lines of Action

## 4. Priority Lines of Action

Climate change is a transversal problem that poses significant challenges to the various societal institutions charged with designing and implementing policy to address the issue.

This Action Plan is a tool for decision makers who work on adaptation, mitigation of GHGs and capacity-building in the area of climate change. In this sense, the Plan is an enabling instrument that will make it possible to implement the necessary actions. It will facilitate the creation of a management model aimed at tackling the problem of climate change and meeting the goals set by the National Climate Change Strategy.

This section describes the activities to be carried out from 2008 to 2012. These actions are meant to establish a baseline of climate change-related knowledge, mainly focused on decision-making in the areas of adaptation, mitigation and capacity-building.

The National Environmental Commission will be responsible for coordinating the various institutions included in the Plan as well as for supervising the completion of all actions laid out by the Plan. It will also be responsible for carrying out specific action items that require environmental expertise.

The objectives of the Action Plan are presented below:

### Main Objective

- To minimize the adverse impacts of climate change through integrated actions that determine the country's level of vulnerability to climate change and identify the various adaptation options to confront the impacts of climate change, while at the same time mitigating greenhouse gas emissions.

### Specific Objectives

- Assess the environmental and socioeconomic impacts of climate change.
- Analyze options for mitigating GHG emissions.

- Define possible measures for adaptation to climate change and for the mitigation of GHGs.
- Improve the systematic observation of the climate.
- Raise awareness among citizens about problems related to climate change.
- Promote education and research on climate change.
- Generate information suitable for decision-making.
- Build institutional capacities related to mitigation and adaptation.
- Make progress in designing and implementing an institutional framework that could more efficiently address the problem of climate change.
- Contribute to the formulation of a country position for international discussions on climate change and the various financing mechanisms available.

Based on these objectives, the Plan defines lines of action that must be carried out and organized by the various institutions identified with each action. The following subsections each deal with one of the three main components of the National Climate Change Strategy: Adaptation to the Impacts of Climate Change, Mitigation of Greenhouse Gas Emissions and Capacity-Building.

## 4. Priority Lines of Action

### 4.1 ADAPTATION TO THE IMPACTS OF CLIMATE CHANGE

#### General Objective for Adaptation:

“The development of a package of adaptation measures, aimed at protecting the health of people, water resources, food production, urban and coastal infrastructure and energy supply.”

To achieve this, it is essential to first define future climate change vulnerability scenarios in Chile’s priority sectors, with the aim of assessing the environmental, socioeconomic and health impacts of this phenomenon. This information will allow climate change adaptation measures to be defined on the national and sector levels.

Described below are the actions set out under this vision that will be undertaken to establish and execute measures to adapt to the climate change impacts in the country.

#### 4.1.1 Analysis of Climate Scenarios at the Local Level.

Most impact and vulnerability analyses and risk assessments of future climate change are based on models that require quantitative scenarios of climate data. With this in mind, it is crucial to make this information available and achieve sufficient operational capacity to allow the development of successive climate change scenarios on the local and national levels, incorporating the best simulation techniques and the best scientific knowled-

ge available. Currently, there is a study titled “Climate Variability in Chile in the 21st Century”, that has generated data that can be used for modeling local scenarios.

The creation of these climate scenarios for Chile will allow researchers to determine the level of vulnerability of systems and priority sectors. According to the forecasted scenarios, it will also allow for an assessment of resilience to the adverse effects of climate change, as well as the capacity for adaptation to these effects.

#### Lines of Action

Create climate scenarios at a local level and carry out an analysis of existing information regarding vulnerability and the impacts of climate change. To achieve this, existing vulnerability scenarios and related studies must be reviewed and updated in order to determine the most suitable methodological approaches.

#### Implementing Institution

Chilean Meteorological Directorate in collaboration with the country’s universities and research centers.

#### Implementation Period

2008-2010

“The altiplano wetlands will probably receive more rainfall over the coming decades, which would modify the habitat of species like the flamingo.”





## 4. Priority Lines of Action

### 4.1.2 Determination of Impacts and Climate Change Adaptation Measures.

Once local climate scenarios have been developed, studies will be carried out for the systems and sectors listed below in order to determine current levels of vulnerability and the projected impacts of climate change through 2100, including scenarios for intermediate years. (i.e., 2015, 2020, 2025, 2040, 2060, etc.). At the same time, the studies will seek to evaluate corresponding adaptation measures.

#### 4.1.2.1 Water Resources.

Climate change has a greater impact on water resources than simply the obvious alterations to the water cycle, since it will also affect the way water is controlled and managed. Water resources are highly vulnerable to temperature increases and decreased rainfall levels. The most critical areas are in the north and center of Chile, where water availability is already scarce and where considerable reductions in rainfall are expected<sup>33</sup>.

Knowledge about water systems is key to planning and managing priority sectors of our economy, such as agriculture, forestry, energy generation, population health and the development of infrastructure, among others. The growth of these sectors is influenced by potential adaptation options that could be made available in the future. Furthermore, an assessment of the impact of climate change on water resources will provide information for subsequent assessments of other sectors/systems. For this reason, maximum priority must be given to the matter of water resources in Chile. A detailed assessment must be made of the impacts of climate change on these resources and the adaptation measures necessary to address them have to be defined.

<sup>33</sup> Study of Climate Variability in Chile in the 21st Century, CONAMA, 2007.

### Lines of Action

To establish, at the watershed level, the vulnerability of those water resources under forecasted climate scenarios. This involves identifying and assessing how the climate affects selected hydrological systems and defining adaptation options that would modify the way water resources could be used in a climate change context.

The following actions will be carried out by the implementing institutions:

1. Evaluation of the effects of climate change on different phases of the water cycle.
2. Updating of hydrological balances in the most critical areas.
3. Determination of the availability of water in the future for consumption by humans, mining, agriculture and electricity generation, considering the effects of climate change and demand forecasts.
4. Forecasting of hydrological trends (flows) based on climate evolution predictions.
5. Design of a national aquifer monitoring program.
6. Progress toward commitments set out in the National Strategy for Integrated Watershed Management.
7. Study of water resources and how efficiently they are used, in order to adapt them to climate change in Chile.
8. Application of calibrated hydrologic balance models to various unregulated watersheds.
9. Creation of the Atacama Environmental Research Center, which will focus on the study of the region's water resources.
10. Encourage the construction of desalination plants to provide drinking water for cities in the Norte Grande zone<sup>34</sup>.
11. Implement the bidding processes for technical improvements under the Irrigation Development Law.
12. Carry out the bidding process for the canal repairs stipulated in the Irrigation Development Law.

<sup>34</sup> The first of these initiatives will be developed in the northern city of Arica.



## 4. Priority Lines of Action

13. Carry out a multidisciplinary study of oceanographic and meteorological aspects of marine biodiversity and submarine morphology in remote geographical regions, through research voyages organized by the Maritime Education and Training Center (Centro de Instrucción y Capacitación Marítima, known as CIMAR).
14. Construct a multipurpose ship equipped for reseaching water resources and biodiversity in order to advance research in oceanography, fishing and hydrography<sup>35</sup>.

### Implementing Institutions

General Directorate of Water (DGA): 1, 2, 3, 4, 5, 8

National Environmental Commission: 1, 6

Institute of Agricultural Research (INIA): 7

The Regional Government of Atacama: 9

The Undersecretary for Regional Development and Regional Government: 10

National Irrigation Commission (CNR): 11, 12

Ministry of Defense (MINDEFENSA): 13, 14

### Implementation Period

2008-2010

#### 4.1.2.2 Biodiversity.

Biodiversity is extremely important to Chile for a number of reasons. Such reasons include: the existence of very unique species, ecosystems and territories and the high overall ecological value of endemic species; the presence of significant areas of biodiversity that are world renowned and under threat<sup>36</sup>; the environmental services provided by the different ecosystems; high biological production levels; and the significant economic value of natural resources, which are the basis of the country's economic growth.

<sup>35</sup> This action is part of the MEDUSA project that is being run by the Chilean Navy.

<sup>36</sup> Hotspots.

### Lines of Action

Identify the ecosystems, habitats and species that are most vulnerable to climate change and assess their capacity for adaptation. This assessment should consider existing instruments for managing biodiversity conservation in Chile as well as new instruments that should be created to support adequate adaptation to the effects of climate change on different ecosystems.

The following actions will be carried out by the implementing institutions:

1. Evaluation of the effects of climate change on areas of high environmental value.
2. Analysis of the effects of climate change on species in conservation categories.
3. Begin ecological restoration programs in degraded systems.
4. Carry out climate change impact studies using existing information on public land of significant patrimonial value such as ocean islands, territories that encompass entire watersheds, glaciers or those that form an oasis in absolute desert ecosystems (the Ministry of National Property will contribute with existing information).
5. Develop the Integrated Transport Geodesic Observatory Project (Proyecto de Observatorio Geodésico Transporte Integrado, or TIGO), in order to precisely measure terrestrial factors that influence climate change.

### Implementing Institutions

National Environmental Commission: 1, 2, 3, 4

Military Geographical Institute (IGM): 5

### Implementation Period

2008 -2010

## 4. Priority Lines of Action

### 4.1.2.3 Agricultural, Livestock and Forestry Sectors.

The studies conducted as part of the First National Communication predict that changing climate patterns will have a significant impact on this sector. Climate change will also generate other impacts such as changes in the length of crop cycles, the replacement of crop varieties and changes in planting dates.

Due to the importance of the agriculture, livestock and forestry sectors to Chile's economic, social and cultural development, it is absolutely essential to update the analysis presented in the First National Communication and improve the climate scenarios by including methodological, technical and data-related advances that have occurred since 2000.

#### Lines of Action

Update the amount of information available regarding the vulnerability of the agricultural, livestock and forestry sectors based on improved projected climate scenarios. Identify and assess the climate impacts on these sectors and options for adaptation to climate change<sup>37</sup>.

The following actions will be carried out by the implementing institutions:

1. Perform an analysis of the vulnerability and adaptation potential of the agricultural, livestock and forestry sectors and Chile's water and soil resources (1).
2. Assess and summarize national and international policies and strategies for adaptation in the agricultural, livestock and forestry sectors and water and soil resources (2).
3. Conduct a socioeconomic assessment of the impact of climate change on the agricultural, livestock and forestry sectors (3)<sup>38</sup>.
4. Perform studies to identify climate change adaptation measures and projects in Chile's agricultural, livestock and forestry sectors, especia-

<sup>37</sup> These scenarios and proposals for adapting the sector are being updated in the Second National Communication (2NC).

<sup>38</sup> (1), (2), (3): studies (1) and (2) are currently being carried out by the Faculty of Agronomy Sciences at the University of Chile; study (3) is being done by the Agronomy Faculty at the Universidad Católica. These studies are being performed under an memorandum of agreement between CONAMA, FIA and ODEPA.

lly in rural agricultural areas with small family farms<sup>39</sup>.

5. Develop a system to manage agro-climatic risks and agricultural emergencies.
6. Implement a Genetic Improvement Program to develop new plant varieties (agriculture and forestry) that have been adapted for new climate change scenarios.
7. Foster and promote the efficient use of water in agriculture.

#### Implementing Institutions

Office of Agrarian Research and Policies (ODEPA): 1, 2, 3, 7

Foundation for Agricultural Innovation (FIA): 1, 2, 3, 4

Agricultural Emergency Unit: 5

National Environmental Commission: 1, 2, 3

Institute of Agricultural Research: 6

Forestry Institute (INFOR): 6

#### Implementation Period

2008 - 2009

### 4.1.2.4 Energy Sector.

Because the Chilean energy generation sector is largely dependent on the availability of water resources and because the levels of energy generation affect all production and service activities, future repercussions of energy generation in adverse climate scenarios should be considered as part of Chilean energy policy. For this, knowledge about demand and its implications is key. It is expected that an analysis of vulnerability to climate change will be considered in the preparation of electricity development plans for the energy sector in the future.

<sup>39</sup> Study put out to tender in August 2008 by the FIA.

## 4. Priority Lines of Action

### Lines of Action

Evaluate the potential energy generation scenarios in Chile that take into account the expected impacts of climate change on water resources. This information will be central to any assessment of different alternatives and opportunities that, in the future, could allow for the establishment of a more diverse and sustainable energy matrix.

The following action will be carried out by the implementing institution:

Assessment of the electricity sector's hydrological vulnerability and its effect on Chile's energy security. This will be carried out by developing future hydroelectric generation scenarios.

### Implementing Institution

National Energy Commission

### Implementation Period

2008 -2010

#### 4.1.2.5 Coastal Infrastructure and Urban Areas.

Approximately 2.2 million people in Chile live in coastal urban areas<sup>40</sup>. Due to the effects of climate change, there is an increasing probability of the occurrence of extreme weather events. Such events could cause damage to urban areas and to major infrastructure, especially roads, bridges, ports, industrial areas and buildings. As such, the country needs to assess the vulnerability of these structures to the anticipated impacts of climate change. Coastal areas are extremely important for supporting population and production activities as well as providing biological diversity and a source of

resources. As a result of climate change, many coastal areas will experience more flooding, accelerated erosion, loss of wetlands and salt-water intrusion.

On the other hand, the fact that the variable climate trends that are echoed in multi-year climate ocean regimes strongly influence the occurrence of catastrophic rainfall in mountainous and foothill areas is acknowledged, leading to higher river and estuary levels. This in turn causes flooding in low-lying urban and rural areas as well as the destruction of infrastructure, mainly bridges and riverside roads.

### Lines of Action

Estimate the impacts of climate change on major infrastructure in low-lying urban coastal areas, as well as in inland areas close to bodies of water, and assess the costs of taking preventive action and of making repairs or undertaking reconstruction. Any analysis should take into account criteria for determining the future location of infrastructure as well as environmental criteria for urban growth and for rainwater drainage plans.

The following actions on infrastructure will be carried out by the implementing institutions:

1. Develop scenarios to model the impacts of climate change on major infrastructure in low-lying coastal and river areas susceptible to climate-related damage.
2. Assess the economic impact of preventive measures to prepare for extreme events and of repairs or reconstruction that could result necessary from such events.
3. Develop criteria for adapting regional emergency plans to prepare for the potential destruction of major infrastructure.

<sup>40</sup> Population and housing CENSUS, INE, 2002.

## 4. Priority Lines of Action

- Adapt the design for new bridges and hydraulic infrastructure so that these would account for changes to Chile's hydrology caused by climate change.
- Increase the country's irrigated surface area by 50% through a new dam construction program.
- Expand irrigation and water policies to include small reservoirs, artificial groundwater replenishment, relining of canals and the protection of glaciers.
- Expand the infrastructure and defense program designed to protect the lives of citizens and safeguard public and private property in seaside and riverside areas<sup>41</sup>.
- Improve the capacity to predict and respond to hydrological emergencies caused by destructive rises in river levels due to the new hydrology caused by climate change<sup>42</sup>.
- Incorporate the results of climate change impact studies into zoning plans to avoid the expansion of urban areas into coastal and riverside areas that are susceptible to risk.
- Improve the link between the process for developing urban planning instruments and the incorporation of background information from available studies on coastal areas and watersheds.

### Implementing Institutions

Ministry of Housing and Urban Development (MINVU): 1, 2  
General Directorate of Maritime Territory and the Merchant Marine: 2  
Undersecretary for the Navy: 2

### Implementation Period

2009 -2012

### Implementing Institutions

Ministry of Public Works (MOP): 1-8  
Directorate General of Maritime Territory and the Merchant Marine: 1-3  
Undersecretary for the Navy (SSM): 1-3

### Implementation Period

2009 -2010

The following actions aimed at strengthening urban planning instruments will be carried out by the implementing institutions:

### 4.1.2.6 Fisheries Sector.

The Chilean fishing and aquaculture sectors hold a prominent position at an international level. According to the Food and Agriculture Organization (FAO) in 2005, Chile was ranked 5th place worldwide for total fish production, including both extractive fishing and fish farming. In percentage terms, Chile is responsible for 3.9% of the total world production.

<sup>41</sup> This change will depend on forecasts regarding the evolution of destructive events, based on predictions about sea level increases.

<sup>42</sup> This will be carried out by repairing and repositioning bridges (240 in the 2009-2014 period) and the construction of new bridges (180 in the 2009-2020 period). Similarly, the availability of Bailey bridges will be increased to reinforce the capacity for immediate response to flooding emergencies.



## 4. Priority Lines of Action

### Lines of Action

Estimate the impacts of climate change and update information about the vulnerability of fishing resources to projected climate scenarios; identify and assess options for the adaptation of fishing resources to climate change.

The following actions will be carried out by the implementing institution:

1. Model the distribution and abundance of marine species, according to different climate scenarios.
2. Create scenarios showing the range of climate change impacts on the extraction of fishing resources.

### Implementing Institution

Undersecretary for Fisheries (SUBPESCA)

### Implementation Period

2009 -2010

#### 4.1.2.7 Health Sector.

Different aspects of climate change will affect some of the most important determinants of good health, namely food, air and water<sup>43</sup>. Additionally, negative effects such as those mentioned in previous sections could also put additional pressure on health systems. To reiterate, health systems could be indirectly impacted by any negative impacts on energy generation and supply, availability of water sources, infrastructure and coastal urban areas and population centers located in other vulnerable areas such as those at risk for landslides. Additionally, climate change could potentially increase the propagation of vector-borne diseases caused by pathogenic bacteria and lead to negative health effects from heat waves or cold spells. (See Appendix 9 for more details).

### Lines of Action

Strengthen the capacity of the public health system to confront threats posed by climate change.

The following actions will be carried out by the implementing institution:

Human and Physical Resources:

1. Create probable climate change impact scenarios that could be used to establish the needs for health infrastructure and personnel.
2. Establish criteria for adapting to contingencies and other needs in the sector.
3. Carry out an economic assessment of preventive measures and infrastructure and personnel needs.
4. Strengthen the capabilities of health personnel to address prevention and care of adverse effects caused by climate change.

Improve the sector's capacity to confront the effects of climate change:

1. Identify vulnerable areas or those with the greatest health risks due to different factors. The affected population should also be considered.
2. Improve monitoring of environmental health indicators. Trends in these indicators as well as any stark changes can reveal effects of climate change.
3. Interact with other sectors in order to identify the current or future effects of climate change on the health of the population.
4. Create and develop capacities to address the potential introduction of yellow fever, dengue fever, malaria and vectors such as aedes and anopheles mosquitoes.
5. Adapt monitoring systems and emergency plans by including in risk management practices, any climate change related health effects.

<sup>43</sup> World Health Organization, "Climate Change and Health", Secretary's Report at the 61st World Health Assembly.

## 4. Priority Lines of Action

### Implementing Institution

Ministry of Health (MINSAL)

### Implementation Period

2009 -2012

### 4.1.3 Formulation of a National Plan for Climate Change Adaptation and Related Sectoral Plans.

With the goal of addressing the country's vulnerability and future climate risks, Chile will formulate a National Adaptation Plan that will set forth the country's long-term adaptation policies. This Plan will draw on information about local climate scenarios, the vulnerability of production sectors and strategic resources and scenarios detailing the impacts of climate change on priority sectors. It will also involve the identification and selection of the general criteria for adaptation policy options and measures.

The government will also prepare Sectoral Adaptation Plans with the help of Sectoral Commissions established for this purpose. These Commissions will bring together public, private and academic organizations to discuss the specific actions to be taken by each sector to mitigate climate change and adapt to its effects<sup>44</sup>. The National Adaptation Plan will provide the framework for tying together the Sectoral Adaptation Plans from priority sectors.

The National Plan and resulting Sectoral Plans will be developed and implemented in-line with other similar documents created by the United Nations, such as the Nairobi Work Program on Impacts, Vulnerability and Adaptation or regional initiatives like the Ibero-american Plan for Adaptation to Climate Change. This approach will make it possible to establish synergies with these types of international documents that were developed with the explicit purpose of addressing climate change adaptation.

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<sup>44</sup> The first commission has recently been created for the agriculture, livestock and forestry sector, led by the Ministry of Agriculture.

### Lines of Action

Develop the National Adaptation Plan and the respective Sectoral Adaptation Plans for the period 2010-2030. Their implementation will be monitored over time and the sectoral impact scenarios will be updated, as needed.

### Implementing Institutions

National Environmental Commission  
Sectoral Institutions

### Implementation Period

2010-2012



## 4. Priority Lines of Action



“Renewable energies such as this wind farm in Canela (on the coast of Coquimbo) are crucial for reducing the impacts of global warming.”



## 4. Priority Lines of Action

### 4.2 MITIGATION OF GREENHOUSE GAS EMISSIONS

#### General Objective for Mitigation:

“To work toward becoming a low-carbon economy as a means of promoting sustainable development in Chile as well as a means of contributing to global efforts to reduce GHG emissions.”

To achieve this goal, Chile must first analyze its options for reducing greenhouse gases and then assess various mitigation scenarios. Options for reducing GHG emissions include increasing the availability of carbon sinks (biological absorption of GHGs) or reducing the level of emissions released into the atmosphere, ideally in sectors such as energy generation, transport, mining and agriculture, which produce the greatest amounts of emissions in the country. This being the case, and with the objective of evaluating Chile's potential for GHG mitigation, the Action Plan recommends the guidelines detailed below.

#### 4.2.1 Update of Greenhouse Gas Emissions Inventories.

Inventories of GHG emissions should be updated periodically for the following categories: energy; industrial processes and use of solvents; agriculture; land use, land use change and forestry; and human waste. During the first half of 2009, the Chilean GHG inventory will be updated to include data up to 2006. When completed, Chile will have developed an inventory with annual data covering over two decades. This inventory will facilitate the analysis of the country's mitigation potential and the establishment of sectoral mitigation scenarios. Additionally, the country should improve sectoral emissions estimates in order to allow for the development of local GHG emission factors.

#### Lines of Action

Create a system for updating the national and regional<sup>45</sup> inventory of emissions and carbon sinks on an annual basis. This will allow for a more

<sup>45</sup> For the agriculture, forestry and waste management sectors, available information will allow the inventory to return national and regional results.

precise evaluation of possibilities for restricting emissions growth in different sectors, through the use of various mitigation measures. Additionally, the preparation of such frequent inventories would enable the country to maintain existing capacities, therefore facilitating Chile's compliance with international climate change commitments.

The following actions will be carried out by the implementing institutions<sup>46</sup>:

1. Update and publish the National Inventory of Greenhouse Gases for the Energy and Non-Energy Sectors.
2. Design a structure for collecting and handling information needed for ongoing inventory preparation.
3. Formulate procedures for handling data uncertainties in the inventories and GHG emission calculations.
4. Develop local emission factors.
5. Sign institutional agreements to establish coordination on the periodic updating of the national GHG inventory.
6. Determine annual emissions from copper mining, given that this is the principal activity in the Chilean economy and accounts for 32.7% of the country's consumption of electricity.

#### Implementing Institutions

National Environmental Commission: 1-5

Ministry of Mining (MINMINERIA): 6

#### Implementation Period

2008-2009

<sup>46</sup> Activities 1 through 5 are included in the Second National Communication.



## 4. Priority Lines of Action

### 4.2.2 Assessment of Chile's Greenhouse Gas Mitigation Potential.

The combustion of fossil fuels such as coal, oil and natural gas to generate energy is still the main source of greenhouse gas emissions both internationally and in Chile. Policies and incentives must be developed to reduce the consumption of these fuels, as the reduction of such emissions is an urgent priority. Using fuels more efficiently or encouraging the application of clean technologies such as wind power, geothermal, solar and biological sources can help countries achieve this goal.

The GHG inventories that Chile is developing for the period from 1984 to 2006 can be used to determine each sector's contribution and the potential national and sectoral emissions reductions in a given time period.

Such an analysis would allow for the evaluation of possible mitigation efforts linked to existing plans, policies and strategies such as the National Energy Efficiency Program, the Prevention and Decontamination Plans, various renewable energy actions and best practices in agriculture and forestry, among others. The relevance of considering these initiatives as early actions should also be considered and, as such, they should not be included in Chile's baseline. However these actions together with the Clean Development Mechanism (CDM) and programmatic CDM projects, could be evaluated based on whether the total estimated mitigation potential is achieved.

#### Lines of Action

Conduct an analysis to determine the country's estimated total potential for GHG mitigation along with the estimated potential of each sector, for specific timeframes (i.e., by 2015, 2020, 2025 and 2030).

Based on the application of existing plans, policies and strategies, prepare a proposal for indicators that could be used to evaluate the effectiveness of GHG mitigation efforts (estimated vs. achieved mitigation levels).

The following actions related to energy efficiency and renewable energies will be carried out by the implementing institutions:

1. Improve estimates of potential savings and energy efficiency on a national and regional scale, by consumption sector. To achieve this, the potential for reducing greenhouse gas emissions through implementation of the 2007-2015 Action Plan of the National Energy Efficiency Program will be quantified. The objective of this plan is to limit increases in energy consumption in sectors such as transport, industrial, mining, public and residential. In addition, this program's potential for reducing baseline emissions will be established.
2. Strengthen the National Energy Efficiency Program based on results of the potential for savings and energy efficiency. The purpose of this is to intensify energy efficiency initiatives in sectors such as construction, commercial, residential, industrial and transport and to evaluate their potential for future mitigation.
3. Study the potential for renewable energy generation. To do this, the potential for limiting the increase of greenhouse gas emissions will be calculated and quantified. This potential is a result of new investments being made in this field that have resulted from actions taken to promote the development of non-conventional renewable energies in the country and also of regulatory modifications.
4. Ongoing monitoring of the evolution of the current and projected baseline, for the purpose of tracking the natural evolution of growth in demand, as well as the new energy supply options that are available.
5. Establish the Center for Renewable Energies to create policies that guide and create incentives for investors<sup>47</sup>.

<sup>47</sup> In the country's 2009 Budget Law, funding totaling 700 million pesos was set aside for this Center.

## 4. Priority Lines of Action

6. Implement a government-backed fund for investments in renewable energies and energy efficiency<sup>48</sup>.
  7. Encourage the installation of solar systems for heating water or generating electricity in the public, commercial, residential and industrial sectors, to make maximum use of Chile's solar resources<sup>49</sup>.
  8. Provide the necessary infrastructure and safety features for the large-scale use of bicycles as an everyday means of transport.
6. Implement the "Policy for Biofuels in Chile", which will consider the use of biofuels as an alternative to fossil fuels.
  7. Estimate the carbon captured by plantations of Insignis pine and eucalyptus trees, as promoted by Law 701 of 1974.
  8. Evaluate the Ministry of Agriculture's development programs in terms of their contribution to carbon capture and any resulting decrease in the use of fossil fuels.
  9. Promote native forest management and recovery.
  10. Promote afforestation.

### Implementing Institutions

National Energy Commission: 1, 2, 3, 4, 5, 6, 7

Ministry of Economy (MINECON): 6

Ministry of Transportation (MTT): 8

Ministry of Housing and Urban Development: 8

### Implementation Period

2008-2009

The following actions related to the agriculture and forestry sectors will be carried out by the implementing institutions:

1. Analyze the agriculture, livestock and forestry energy market.
2. Conduct studies on the use of waste for the production of bioenergy, either by individual companies or collectively, in Chile's agriculture, livestock and forestry sectors (\*).
3. Promote a program to calculate the carbon footprint of agricultural, livestock and forestry products exported by Chile (\*\*)<sup>50</sup>.
4. Create and implement consortia for applied research on next-generation biofuels<sup>51</sup>.
5. Carry out a technical and economic assessment of the production and use of biofuels.

48 The fund, administered by CORFO, currently has US\$ 400 million available.

49 As a starting point, a bill is currently being debated that will use tax breaks to encourage the installation of solar hot water systems in new housing.

50 (\*), (\*\*): Studies put out to tender in August 2008 by the FIA.

51 To date, 7 billion pesos have been assigned to two established consortiums which will be coordinated by CORFO.

### Implementing Institutions

Ministry of Agriculture. FIA: 2, 3. ODEPA: 5, 7, 8. National Forestry Corporation: 9, 10.

National Energy Commission: 1, 4, 6

Ministry of Economy: 4

### Implementation Period

2008-2010

#### 4.2.3 Generation of Mitigation Scenarios in Chile.

With potential national and sectoral GHG mitigation scenarios identified and quantified, Chile will be able to specify a range of feasible mitigation scenarios<sup>52</sup>. This process would obviously begin by addressing the most important sectors.

The sectors that produce the highest levels of CO<sub>2</sub> equivalent in Chile (1984-2003 period, according to the categories established by the IPCC for emissions inventories) are transport, mainly terrestrial; energy

52 This involves the establishment of anticipated baseline GHG emission scenarios for the future in specific sectors and determining how these could be modified by the introduction of mitigation measures over specific periods of time.

## 4. Priority Lines of Action

industries, mainly in electricity generation category; the manufacturing and construction industries, mainly the copper industry and mining; agriculture, principally enteric fermentation and agricultural soils; the forestry and land use change sector, mainly forest fires, rehabilitation and substitution of forests and land used for forestry and agriculture; and the management of human waste.

Assessment of these measures will be accompanied by an estimate of the mitigation costs.

### **Lines of Action**

Development of mitigation scenarios for the next 15 or 20 years, which includes creating scenarios up to 2025 or 2030 for those sectors making significant contributions to Chilean GHG emissions. These future scenarios will be based on the new energy sector baseline and will include the most up-to-date international supply and demand conditions.

### **Implementing Institutions**

National Environmental Commission  
National Energy Commission  
Ministry of Agriculture

### **Implementation Period**

2009-2010

### **4.2.4 Formulation of a National Plan for Mitigation of Greenhouse Gas Emissions and Related Sectoral Plans.**

The information provided by the future mitigation scenarios for the sectors mentioned above will be used to develop a National Plan for Mitigation of GHG Emissions, which will be underway by 2012. The formulation of this Plan will involve the identification and selection of a series of options and measures to ultimately create an integrated and coherent mitigation program. Similar to the Adaptation Plan, the National Mitigation Plan will also be made up of Sectoral Plans that will determine the level of mitigation by sector.

### **Lines of Action**

Creation of the 2010-2025 National Plan for Mitigation of GHG Emissions and its related Sectoral Plans.

### **Implementing Institutions**

National Environmental Commission  
Sectoral Institutions

### **Implementation Period**

2008-2010

## 4. Priority Lines of Action

### 4.3 CAPACITY BUILDING

#### General Guideline for Capacity Building:

“To inform the population about environmental problems and, in particular, to raise awareness about the effects of climate change and to encourage education, awareness and research on this subject in Chile.”

The above guideline for the production of quality and accessible information on climate change will help formulate Chile's national position on this international issue.

The actions described below will be carried out under these general guidelines in order to build capacities for comprehensively addressing climate change in the long-term as well as to reinforce capacities already present in Chile.

#### 4.3.1 Creation of a National Program for Climate Change Education and Awareness.

Integration of the problem of climate change into the curricula of primary and secondary education in the country, as well as actions and measures aimed at raising public awareness about climate change and its effects, are vital educational initiatives for providing information and raising awareness on this matter.

#### Lines of Action

Develop a National Plan for Climate Change Education and Awareness, by incorporating the subject into curricula at all educational levels.

#### Implementing institution

Ministry of Education (MINEDUC)

#### Implementation Period

2009-2010

#### 4.3.2 Creation of a National Fund for Research on Biodiversity and Climate Change.

There is an evident need for the establishment of a National Fund for Research on Biodiversity and Climate Change, which would serve to aggregate and centralize different sources of financing and to provide guidance to decision-makers. Urgent funding will be required in order to establish baseline information about different aspects related to climate change adaptation.

#### Lines of Action

Creation of the National Fund for Research on Biodiversity and Climate Change.

#### Implementing Institution

National Commission for Scientific and Technological Research

#### Implementation Period

2008-2009

#### 4.3.3 Evaluation of the Technical and Economic Feasibility of Establishing a Basic Comprehensive National Network (Atmospheric, Oceanographic and Terrestrial) for Monitoring and Studying Climate Change.

The country's existing systematic observation networks need to be improved in order to provide the series of long-term climate data that are required to strengthen and support various climate models. This will facilitate the improvement of local climate records, the recovery of historical data, the standardization of the country's existing meteorological data collection systems and the expansion of the coverage provided by national networks. Before embarking on this activity, there will need to be an assessment of the technical and economic feasibility of improving and expanding existing meteorological networks in Chile.



## 4. Priority Lines of Action

### Lines of Action

Improvement of existing systematic climate observation networks in the country.

The following actions will be carried out by the implementing institutions:

1. Assess current capacities for meteorological monitoring.
2. Carry out a technical and economic assessment of the potential improvement and expansion of existing meteorological networks in Chile.
3. Upgrade the existing meteorological network in order to allow for real-time monitoring of climate behavior.
4. Create and install a network of stations to record environmental parameters, for the purpose of expanding the database of oceanographic information and monitoring of the El Niño Southern Oscillation phenomenon.

### Implementing Institutions

Chilean Meteorological Directorate: 1, 2, 3, 4

Institute for Agricultural Research: 3

General Directorate of Maritime Territory and the Merchant Marine: 4

Hydrographic and Oceanographic Service of the Chilean Navy: 4

### Implementation Period

2009-2010

#### 4.3.4 Creation of a National Glacier Registry.

Glaciers are a key resource that help regulate the local climate. They also provide a significant source of the country's water resources, especially in periods of scarcity and high demand. Global climate processes are one of the most significant threats to the conservation of glaciers as perennial sources of fresh water. Temperate glaciers are most affected by temperature changes happening all throughout the country (in the central,

southern and far southern areas), due to the fact that the ice mass is at temperatures very close to melting. Therefore, even small regional temperature increases can lead to greater rates of melting. If such an effect is not compensated by the accumulation of snowfall, bodies of ice will begin to recede.

Considering the dramatic decrease in the volume of glaciers in southern Chile over recent decades (IPCC, 2007), this Action Plan suggests the necessity of establishing a National Glacier Monitoring System to provide systematic and permanent information about the state of all the glaciers in Chilean territory.

### Lines of Action

Create a National Glacier Registry to monitor the vulnerability of these frozen masses to climate change and other factors (for example, production activities on or around glaciers). This Registry will subsequently facilitate the development of a National Glacier Monitoring System.

The following actions will be carried out by the implementing institutions:

1. Create a National Glacier Inventory.
2. Install a Glacier Monitoring Network.
3. Develop a Strategy for the Oversight and Management of Glaciers that takes into consideration probable climate change scenarios.
4. Identify actions or measures to minimize or mitigate the effect of climate change on glaciers as part of the administration and management of water resources.
5. Identify situations or risk-factors associated with anthropogenic modifications to glaciers that could affect urban areas, industrial developments or mines.
6. Analyze the internal structure of large ice masses and the existing volume of frozen water in order to model and predict the future recession of glaciers<sup>53</sup>.

<sup>53</sup> This action forms part of the Ministry of Defense's Ice Project.

## 4. Priority Lines of Action

### Implementing Institutions

General Directorate of Water: 1, 2, 4, 5

National Environmental Commission: 3

Ministry of Defense: 1, 6

### Implementation Period

2008-2010

### 4.3.5 Development of Negotiation Strategies for Chile in the post-2012 Framework.

In a global context, Chile must remain attentive to the advancement of international discussions concerning the post-2012 period and continuously contribute to the debate in order to protect its own interests. This will require sufficient preparation, well in advance, so that the country can carry out an in-depth evaluation of the proposals being made in respect to the Convention and the Protocol. The development of such a strategy is aimed at strengthening Chile's position at negotiation meetings scheduled throughout 2009.

### Lines of Action

1. Improve the participation of different government institutions in the various rounds of international talks on climate change.
2. Develop strategic guidelines for international talks on climate change.
3. Evaluate post-2012 proposals under the Convention on Climate Change and the Kyoto Protocol and develop national negotiation strategies for the country.

### Implementing Institution

National Steering Committee on Global Change

### Implementation Period

2009-2012

### 4.3.6 Strengthening the Institutional Framework in Chile for Addressing Climate Change.

Given the cross-disciplinary and cross-sectoral nature of the challenges posed by climate change, it is essential that this issue be addressed at the highest levels of the different ministries with jurisdiction in this field. Likewise, there should be a review of the national institutional framework for confronting climate change in Chile (i.e., the National Steering Committee on Global Change), and the institutional framework related to approval of CDM projects (i.e., the Designated National Authority).

### Lines of Action

Review and improve the national institutions for addressing climate change in Chile.

The following actions will be carried out by the implementing institutions:

1. Review the current membership of the National Steering Committee on Global Change, with the aim of incorporating other important ministries such as health, public works, mining and transport, among others.
2. Review the institutional arrangements in different ministries for combating climate change.
3. Evaluate the establishment of a National Climate Change Office.
4. Evaluate the creation of a national organization (office or technical unit), specializing in the use of flexible or market mechanisms such as CDM that could provide technical and legal support to entities that propose projects and support the necessary promotional activities to expand the use of the mechanism.

## 4. Priority Lines of Action

### Implementing Institutions

Ministry of Foreign Affairs: 1

National Environmental Commission: 1, 2, 3, 4

Sectoral organizations: 2

### Implementation Period

2008-2009

#### 4.3.7 Design of Instruments to Promote the Development, Transfer and Adoption of Technologies for Climate Change Mitigation and Adaptation.

The Framework Convention on Climate Change states that signatory countries must promote, facilitate and finance technologies and knowledge-sharing associated with climate change mitigation and adaptation. As such, countries should take appropriate action to design and evaluate various options for promoting economic development instruments and technology transfer related to adaptation and mitigation. Depending on their design, these instruments can complement or be directly integrated into the respective national and sectoral plans. This process should take into account relevant international experiences such as “carbon funds” and “adaptation funds”, either of which could be used to support national mitigation and adaptation initiatives.

### Lines of Action

Design and evaluate instruments to promote economic development and technology transfer related to adaptation and mitigation.

The following actions will be carried out by the implementing institutions:

1. Design instruments to promote the development, transfer and adoption of technologies for climate change mitigation and adaptation. These instruments should complement measures included in the respective national and sectoral plans.

2. Provide incentives for the development of alternative energy projects and evaluate mechanisms to facilitate their implementation.
3. Implement the Integrated Climate Change Project, which seeks to create technologies for climate change mitigation and/or adaptation in the agriculture and forestry sectors.
4. Implement an environmental labeling system to inform consumers about the performance and emission levels of new vehicles, including CO<sub>2</sub><sup>54</sup> emissions.
5. Develop incentives for the promotion of more energy-efficient transportation, such as hybrid or electric vehicles.
6. Support the use of the Kyoto Protocol's Clean Development Mechanism, an instrument that supports the development and transfer of technology and sustainable development.

### Implementing Institutions

Economic Development Agency: 1

National Environmental Commission: 1, 6

National Energy Commission: 2

Institute for Agricultural Research, the Center for Information on Natural Resources (CIREN) and the Forestry Institute: 3

Ministry of Transport and Telecommunications: 4, 5

### Implementation Period

2009-2010

<sup>54</sup> The Ministry of Transport and Telecommunications will establish the guidelines for providing consumers with this information.

## 4. Priority Lines of Action

### **4.3.8 Preparation of the Second National Communication to the United Nations Framework Convention on Climate Change.**

This activity, which began in 2008, will provide basic support for the creation of the climate change baseline information proposed by this Action Plan.

#### **Lines of Action**

Develop, publish and submit the Second National Communication.

#### **Implementing Institution**

National Environmental Commission

#### **Implementation Period**

2008-2010

**Following is a program of activities to be implemented from 2008 to 2012.**



## 4. Priority Lines of Action

<b>ACTION PLAN 2008 - 2012</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>IMPLEMENTING INSTITUTION</b>
<b>ADAPTATION</b>						
<b>Generate climate scenarios at the local level</b>	●	●	●			DMC
<b>Determine the climate change impacts on and adaptation measures for:</b>	●	●	●			
Water resources: Determine the level of vulnerability for watersheds		●	●			DGA, CONAMA, INIA, CNR, Chilean Navy
Biodiversity: Identify the most vulnerable ecosystems, habitats and species		●	●			CONAMA, IGM
Agriculture, livestock and forestry sectors: Update available information about the vulnerability of these sectors to climate scenarios	●	●				MINAGRI, CONAMA, INFOR
Energy: Determine the vulnerability of hydroelectric energy generation in Chile	●	●	●			CNE
Infrastructure and urban and coastal areas: Evaluate the impacts on major infrastructure in coastal and waterfront areas and incorporate into planning instruments.		●	●	●	●	MOP, MINVU, DIRECTEMAR, SSM
Fishing: Assess the vulnerability of fishing resources		●	●			SUBPESCA
Health: Strengthen the healthcare systems ability to respond to climate change			●	●	●	MINSAL
<b>Formulate National and Sectoral Plans for adapting to the effects of climate change</b>			●	●	●	CONAMA/ VARIOUS SECTORS
<b>MITIGATION</b>						
<b>Update the country's Greenhouse Gas Emissions Inventories</b>	●	●				
Create a system to annually update the national and regional inventory of GHG emissions and sinks	●	●				CONAMA, MINMINERÍA
<b>Evaluate the country's potential to combat the effects of greenhouse gases</b>		●	●			
Determine the potential total and sectoral reduction in emissions	●	●				CNE, MTT, MINECON, MINVU, MINAGRI, CONAMA
Propose a set of impact indicators to be applied to a wide range of plans, policies and strategies	●	●				CNE, MTT, MINECON, MINVU, MINAGRI, CONAMA
<b>Create mitigation scenarios for Chile</b>		●	●			
Develop GHG mitigation scenarios for given time horizons (2015, 2020, etc.)		●	●			CNE, MINAGRI, CONAMA
<b>Formulate a National Program and Sectoral GHG Mitigation Plans</b>	●	●	●			CONAMA/ VARIOUS SECTORS
<b>CAPACITY BUILDING</b>						
Develop a National Climate Change Education and Awareness Program		●	●			MINEDUC
Create a National Fund for Research on Biodiversity and Climate Change	●	●				CONICYT
Carry out a technical and financial assessment of the climate change monitoring network		●	●			DMC, INIA, DIRECTEMAR, SHOA
Develop a national glaciers registry	●	●	●			DGA, CONAMA, MINDEFENSA
Develop negotiation strategies for Chile in the post-Kyoto context		●	●	●	●	CNACG
Strengthen national institutions so they are prepared to address climate change	●	●				CONAMA, MINREL
Design development instruments to reduce emissions and for adaptation		●	●			CORFO, CONAMA, CNE, INIA, CIREN, INFOR, MTT
Prepare the Second National Communication (2NC)	●	●	●			CONAMA



**“The flavor of the wine depends on several factors, including the local climate and the soil in which the vines have been growing. Over the next thirty years, changing climate and soil conditions could affect the quality of Chilean wines.”**





# Appendices

# Appendices

## APPENDIX 1

### Adaptation Recommendations Published in the First National Communication and the Coastal Zone and Fishing Resources Study.

The recommendations for reducing the impact of climate change on agriculture, water resources and forests include the following:

1. Study the replacement of crop varieties and changes in planting dates and the possibility of relocating crops;
2. Assess the impact of climate change on protected natural areas;
3. Identify and deepen the knowledge about the impacts of changes in hydrothermal regimes on native forests, especially in those areas which are expected to become more arid;
4. Identify and deepen the knowledge about the impact of climate change on advancing desertification and erosion processes in the northern and central parts of the country;
5. Assess and promote research into the use of integrated systems for controlling pests and diseases;
6. Design and implement early warning systems for the El Niño and La Niña phenomena; and
7. Assess the groundwater resources in the different basins, especially in the center and north of the country.

Some of the key recommendations for assessing and reducing the impact on coastal areas and fishing resources are:

1. Include a vulnerability assessment in municipal zoning plans;
2. Generate information on a scale compatible with the needs for this type of research;
3. Include the use of geographic information systems for evaluating vulnerability to climate change into local decision-making processes;
4. Improve access to basic information for assessing vulnerability;
5. Increase awareness about the negative effects of sea level rise (SLR), its costs and possible adaptation measures and strategies which the government could take;
6. Avoid the future growth of human settlements in low-lying coastal

areas, so that in the medium to long term there is no permanent, residential use of areas where SLR will be a problem;

7. Implement relocation programs to move homes inland and reorient the focus of coastal areas toward tourism, recreation and scientific uses, in order to improve the quality of life for citizens;
8. Explicitly include the topic of vulnerability into the National Policy on the Use of the Coastline; and
9. Carry out research to aid understanding of the behavior of the coastline in seismic events.

## APPENDIX 2

### Regional Impacts Resulting from Changes in Precipitation and Hydrological Impacts as Established in the Study on Climate Variability in Chile in the 21st Century.

The regional precipitation analysis enabled the following to be established:

1. The Chilean altiplano region will experience an increase in precipitation in spring and summer, which will be more pronounced in spring in the 1st Region under the A2 scenario (severe) and extending towards the 2nd Region in the B2 scenario (moderate).
2. In the Norte Chico (the near north region), in the B2 scenario, the increase in precipitation is projected to cover all Chilean territory between the latitudes of 20° and 33° S in fall. However, in winter, only the Andean area is expected to be affected, with the greatest increase being in the mid-North.
3. In central Chile, the A2 scenario predicts a general reduction in precipitation. Under the B2 scenario the same is true, except for latitudes below 33° S during fall. The drop in lowland areas is expected to be around 40%, and greater still in areas closer to the Andes during the summer months, but is reduced during fall and winter under the B2 scenario.
4. The southern part of Chile shows a transition towards the current climate figures during fall and winter, but in the case of the B2 scenario, this happens more rapidly. During the summer, rainfall is expected to fall by around 40% and in spring by around 25%.



5. The far south of Chile is expected to experience around 25% less rainfall during summer, but it should normalize towards winter, with a slight year-round increase in the extreme south.

In regard to the hydrological impact:

The regional PRECIS model shows that the climate of continental Chile will experience significant changes in temperature and precipitation by the end of the 21st century, above all in the most severe scenario (SRES A2). It seems appropriate to try to summarize those aspects which have greatest impact on water resources. There are two aspects which stand out, one deriving from the change in temperatures and the other from the change in precipitation. The first is related to the reduction in the Andean area which is capable of storing snow pack from season to season. Given that the warming process causes the 0°C isotherm to rise, the winter increase in water flowing down rivers which begin in the Andes will be swelled further by the corresponding increase in the watersheds which supply them and the end result will be lower levels of water reserves.

For the mountainous area between latitudes 30° and 40° S, which are the most productive regions in terms of agriculture, livestock raising and forestry, as well as for hydroelectric generation for the interconnected system, the area covered by the zero isotherm during all seasons of the year is expected to diminish. This loss will be very significant for the first four months of the calendar year. With the exception of the altiplano region in the summer and the southernmost part of the country in winter, rainfall is set to decrease.

It is worth noting that in the winter season, the whole of Chile between latitudes 30° and 40° S are predicted to experience lower precipitation. This is also true for the summer season for the latitudes between 38° and 50° S, and even further north in the Andean area. These declines in rainfall, together with the rise in the zero isotherm, create a particularly worrisome picture for the central and central-south regions.

## APPENDIX 3

### The IPCC Methodology for Preparing GHG Emissions Inventories and Updates in Chile.

National GHG inventories are used to quantify the impact of countries' GHG emissions and their capture by sinks. In order for countries to report on their impacts using common format, enabling these national inventories to be compared, they need to be prepared with common assessment methods. The Intergovernmental Panel on Climate Change (IPCC), in addition to preparing reports with the latest climate change information from around the world, including the 2007 Fourth Climate Change Report which created great international interest, also provides signatory countries to the United Nations Convention on Climate Change with methods for estimating their national inventories of anthropogenic GHG emissions and absorption by carbon sinks. The methodologies proposed by the IPCC recognize that different countries differ in terms of the quality and availability of information for preparing this type of inventory. Therefore, the IPCC offers a methodology with differing degrees of complexity to deal with the varying levels of quality of information available in different countries. If countries have more disaggregated information (for instance, spatially), they can prepare inventories with a greater level of detail.

The information relating to GHG sources and sinks is organized by "Main Sectors" or "Categories", which are groups of related processes, sources and sinks. Each sector or category is then divided into subcategories.

As GHGs are a group of chemical compounds, in order to carry out calculations and determine their aggregate impact the values for emissions and captures are converted into one common unit (Gigagrams, abbreviated as Gg, or 1,000 tons of CO<sub>2</sub> equivalent).

The main data used to prepare these inventories depends on the type of sector. For example, for those sectors related to the consumption of different types of fuel, the key information is related to national consumption levels. In other cases, such as agricultural data, where the in-

# Appendices

formation is available in disaggregated form at a regional and sectoral level, it is also possible to use it to differentiate between emissions levels at a more local level. Bearing this in mind, the GHG emissions inventories do not identify specific industries as sources or sinks of GHG but attribute emissions and capture to predefined categories or sectors.

The methodologies outlined in the 1996 IPCC Guidelines and the recommendations from 2000 are still used for preparing GHG inventories. These divide the sources of emissions and sinks into six categories: 1) energy; 2) industrial processes; 3) use of solvents and other products; 4) agriculture; 5) land use, land use change and forestry; and 6) human waste.

## Detail by Sector.

**The energy sector**, whose emissions are the result of fuel combustion, is divided into the subcategories of energy industries (electricity and heat production, oil refining and natural gas, manufacture of solid fuels and other energy industries); manufacturing industries and construction (iron and steel, non-ferrous metals, chemicals, pulp, paper and print, food processing, beverages and tobacco, cement, nitrous oxide, various mining); transport (air, road, rail, maritime); commercial/institutional/residential and agriculture and fishing.

**The industrial processes sector**, whose emissions are attributed to the processes themselves rather than the result of energy combustion, includes sources of production and use of cement, iron and steel, copper, paper and wood pulp.

**The solvents use sector** includes the emissions of volatile organic compounds resulting from the manufacture and use of paint and the use of solvents in laundries and domestic use.

The non-energy sector is subdivided into agriculture (enteric fermentation,

manure management, rice cultivation, agricultural soil, burning of crop residues); forestry and land use change (forestry management, forest rehabilitation and substitution, soil used for forestry and agriculture, abandonment of managed lands, forest fires, management of forestry waste, urbanization); and human waste (solid waste, liquid waste, waste incineration).

In 2006, the IPCC updated its Guidelines for preparing GHG emissions inventories, regrouping the GHG sources and sinks into 4 categories: 1) energy; 2) industrial processes and product use; 3) agriculture, forestry and other land use; and 4) waste. However, the Convention on Climate Change has still not adopted this update, nor has it required that countries use the 2006 methods. Copies of all of these methodologies can be found in the CONAMA library and on the IPCC website: <http://www.ipcc.ch>. The process of updating the methodologies for calculating the emissions inventory consists of proposals for alternative methodologies, or a change in parameters of equations that permit calculation of the relationship between production data and their conversion to GHG emissions. This is an ongoing process based on the knowledge which is generated about how to improve GHG estimates. This can imply changes when the values are updated, even for values corresponding to the same year. For this reason it is important to indicate the methodology and year in which the GHG emissions calculations were performed.

**Inventories in Chile.** As part of the First National Communication (2000) and in line with the requirement of the Climate Change Convention, Chile presented a national GHG emissions inventory for the years 1993 and 1994. At that time, the country reported emissions by sources and captures by sinks for the greenhouse gases CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O, and the precursors of ozone and aerosols (NO<sub>x</sub>, CO, COVNM, SO<sub>2</sub>), for the sector categories included in the 1996 IPCC Guidelines. In addition to developing an inventory for both years, a computer program was developed for storing, managing and updating the basic data which enabled the subsequent calculation of emissions.

Since the First National Communication was presented, CONAMA has continued to commission studies which, using the IPCC recognized methodologies, update the information related to GHG emissions in Chile. In 2002, an annual series for the period 1984-1998 was updated for the agriculture,

land use, land use change and forestry and waste categories (carried out by INIA, part of the Ministry of Agriculture), and an annual series for 1986-1998 for the energy, industrial processes and use of solvents categories (carried out by PRIEN at the Universidad de Chile).

In 2004, a 2001 inventory was carried out for the energy, industrial and solvents use sectors (this work was carried out by DICTUC of the Universidad Católica), and then, in 2005, INIA revised the annual series 1984-1998 for the non-energy sector, extending it to 2003, using the specifications suggested at that time by the IPCC. It is worth pointing out that for this sector, in addition to estimated national figures, inventories were also estimated for each administrative region of Chile.

During the first half year of 2008, the 1984-2006 series for the energy sector was updated, and this study was carried out by consultants POCH Ambiental.

For their part, COCHILCO has led a process of estimating GHG emissions for the mining sector (copper) and in 2007 produced a study called: "GHG emissions from copper mining in Chile" (Emisiones de gases de efecto invernadero de la minería del cobre en Chile), which used more sophisticated data for calculating emissions from the public mining sector, covering the corresponding contributions in a time series 1995-2004.

## APPENDIX 4

### The Approval System for Carbon Credit Projects in Chile.

In 2003, Chile formed the Designated National Authority (DNA) for the Clean Development Mechanism (CDM). The Executive Board of CONAMA has the greatest representation in this new authority. To fulfill the functions of the DNA, a committee was set up whose role is to analyze the relevance and integrity of the information requested for CDM applications. This committee, chaired by the Executive Director of CONAMA, comprises one representative each from CONAMA, the Ministry of Foreign Affairs, the Ministry of Agriculture, the National Energy Commission and the Clean Production

Council.

As it deals with projects which can involve other ministries or public services, the Committee is able to call on one or more representatives from these public entities.

In order to analyze the relevance and integrity of the information presented by a CDM project proponent, the Committee uses the criteria behind the Environmental Impact Assessment System, or EIAS, which was enacted through Law No. 19,300. For example, for projects which are required to go through the EIAS and have earned a final, favorable environmental qualification, it will be assumed that it meets the sustainability requirements refer-

red to in Article 12 of the Kyoto Protocol. If, on the other hand, for projects or enterprises which are not subject to the EIAS, the project must obtain the permits and sector authorizations required by current law.

Once this information has been analyzed by the committee, the Executive Director of CONAMA sends a project approval letter to the proponent. This is a fundamental part of registering a CDM project, as it authorizes the project owner to participate in the CDM, confirms that participation of the project in the CDM is voluntary and confirms the project's contribution to the country's sustainable development.

Following is a list of projects approved by the DNA as of September 2008:

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1. Reduction of GHG emissions of Comeche-Los Guindos	Methane capture	Agrícola Super Ltda.	July 2003
2. Reduction of GHG Emissions by Peralillo	Methane capture	Agrícola Super Ltda.	July 2003
3. Reduction of GHG Emissions at Pocillas-La Estrella	Methane capture	Agrícola Super Ltda.	July 2003
4. Fuel Switching in the Graneros Plant	Fuel switching	Nestlé Chile S.A.	July 2003
5. Chacabuquito Hydroelectric Plant	Hydroelectric	Hidroeléctrica Guardia Vieja S.A.	October 2003
6. Forestry Association (Sociedad Forestal Millalemu S.A. and Small Owners of the 8th Region)	Reforestation	Forestal Millalemu S.A.	November 2003
7. Metrogas Watt's Alimentos Package Cogeneration	Cogeneration	Metrogas S.A.	December 2003
8. Hornitos Hydroelectric Plant	Run-of-river plant	Hidroeléctrica Guardia Vieja S.A.	September 2004
9. GHG Emissions - Trupan 2	Biomass, cogeneration	Celulosa Arauco y Constitución S.A.	September 2004
10. GHG Emissions - Valdivia	Biomass, cogeneration	Celulosa Arauco y Constitución S.A.	September 2004
11. Reduction of GHG Emissions	Hydroelectric	Hidroeléctrica La Higuera S.A.	March 2005
12. El Molle Landfill Gas Project	Methane recovery	Gestión Integral de Residuos S.A.	July 2005
13. Center for storing, transferring, recovering and revaluing waste. Treatment and disposal of industrial and household waste.	Methane recovery	Empresa de Tratamiento de Residuos Copilemo S.A.	July 2005
14. Improvement of the Extraction System at the Old Cosmito Landfill	Methane recovery	Empresa de Tratamiento de Residuos Copilemo S.A.	July 2005
15. Quilleco Hydroelectric Plant	Hydroelectric	Colbún S.A.	August 2005
16. Reduction in GHG emissions at the Nueva Aldea Forestry Industrial Complex	Biomass, cogeneration	Celulosa Arauco y Constitución S.A.	October 2005
17. Forestal Russfin Biomass CHP Project	Biomass	Forestal Russfin Ltda.	November 2005
18. Biogas recovery from the Southern	Methane recovery	Aconcagua SA	January 2006
19. Licán Hydroelectric Plant	Hydroelectric	Inversiones Candelaria Ltda.	April 2006
20. Reduction in Emissions at 'Maitenlahue'	Methane capture	Agrícola Super Ltda.	June 2006
21. Reduction in Emissions at 'Valdebenito'	Methane capture	Agrícola Super Ltda.	June 2006
22. Reduction in Emissions at 'Ramirana'	Methane capture	Agrícola Super Ltda.	June 2006
23. Reduction in Emissions at 'La Manga'	Methane capture	Agrícola Super Ltda.	June 2006
24. Biogas management of Santa Marta Sanitary Landfill	Methane capture	Consorcio Santa Marta S.A	July 2006
25. Rucatayo Hydroelectric Plant	Hydroelectric	Hidroeléctrica del Sur S.A.	August 2006
26. Degasification of former Landfill at Lajarilla	Methane capture	Sistema de Biogases Bionersis Chile Ltda.	September 2006
27. Degasification of former Rancagua municipal landfill	Methane capture	Sistema de Biogases Bionersis Chile Ltda.	September 2006
28. Degasification of Leña Dura Sanitary Landfill	Methane capture	Sistema de Biogases Bionersis Chile Ltda.	September 2006
29. Recovery of Biogas from the Viñita azul landfill site in Copiapó, 3rd Region of Chile	Methane capture	Sistema de Biogases Bionersis Chile Ltda.	September 2006
30. Ojos de Agua Mini Hydroelectric Plant Project	Hydroelectric	Endesa Eco S.A.	October 2006
31. Biogas in Loma Los Colorados sanitary Landfill	Methane capture	KDM S.A.	November 2006
32. Cogeneration with Biomass Waste	Biomass	Forestal y Papelera Concepción S.A.	January 2007
33. Gas capture at the Coronel landfill site	Methane capture	Inversiones Biogas Chile Ltda.	March 2007
34. Puclaro Hydroelectric Plant	Hydroelectric	Hidroeléctrica Puclaro S.A.	April 2007
35. Chile: Chiburgo 20 MW run-of-river plant	Hydroelectric	Colbún S.A.	May 2007
36. Chile: Lircay 19.04 MW run-of-river plant	Hydroelectric	Hidromaule S.A.	May 2007
37. Catalytic Destruction of N <sub>2</sub> O in the Tail Gases of the PANNA 3 Nitric Acid Plant of Enaex S.A.	N <sub>2</sub> O	Enaex S.A.	June 2007
38. Nerquiue Small-scale reforestation CDM project using Mycorrhiza inoculation in Chile	Small scale A/R	Mikro-Tec Chile	July 2007
39. El Alto Landfill Gas Project	Methane capture	Eco Garbage Ltda.	July 2007
40. De Martino WWTP upgrade	Methane capture	Santa Teresa SA	July 2007
41. Canela Wind Farm	Wind Power	Endesa Eco S.A.	December 2007
42. Group of project for implementing renewable generation units in biomass generation systems in Constitución and Laja, Chile	Biomass	Energía Verde S.A.	April 2008
43. Regional Landfill Sites in Chile	Methane capture	Bionersis Chile S.A.	April 2008
44. Cuchildeo Hydroelectric Plant	Hydroelectric	Energía de la Patagonia y Aysen S.A.	May 2008
45. Reduction of GHG Emissions	Hydroelectric	Hidroeléctrica La Higuera S.A.	June 2008
46. Biogas Recovery Project at the Hormiga de San Felipe and El Belloto de Quilpué landfill sites	Methane capture	Bionersis Chile S.A.	June 2008
47. Alto Cautín Hydroelectric Plant Project	Hydroelectric	Agrícola Río Blanco S.A.	June 2008
48. Biogas Recovery at El Empalme landfill sites	Methane capture	Sociedad Commercial Rexin Ltda.	June 2008



## APPENDIX 5

### The Carbon Credit Market and International Experience in Selling Certificates of Emission Reductions.

In international parlance, the “carbon market” is the transaction between two or more interested parties involving a certified reduction in greenhouse gas emissions. This reduction can be generated by carrying out projects to reduce or capture GHG or by trading the emission rights which have been set for those countries required to reduce GHG emissions. The trading unit is known as a carbon certificate or carbon credit.

#### Unit of Measure

The unit of measurement for trading certified emission reductions for gases such as CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>, PFC, HCFC y HF<sub>6</sub>, is tons of CO<sub>2</sub> equivalent. That is to say, the other gases are converted to the CO<sub>2</sub> equivalent by multiplying their global warming potential (GWP) by the number of tons of reduction generated by a particular project<sup>55</sup>. The GWP of CO<sub>2</sub> is 1. The value of the ton reduced through a CDM project (CER), initially trades at between US \$3 and US \$7<sup>56</sup>.

#### Types of Carbon Markets

Among the different types of markets on which carbon certificates are traded are those of international compliance (Kyoto), national and regional markets (European Union, Great Britain, Denmark), provincial or sub-national markets (Australia, U.S.A.), informal markets (companies and individuals who have voluntarily reduced their GHG emissions) and renewable energy certificate markets.

<sup>55</sup> For example, the methane and nitrous oxide produced during handling and disposing of waste from the swine industry have a GWP of 21 and 310, respectively. If a project transforms 1 ton of methane into carbon dioxide, it generates 21 tons of CO<sub>2</sub>. The same calculation is made to determine the monetary value of each certificate.

<sup>56</sup> The price of a CER varies according to the level of progress in the approval process and the method of payment chosen. The further along the approval process that a CDM project is, the higher the value of the CER, because the risk to the buyer, in relation to the generation and delivery of the certificates, is lower.

Among the different types of markets on which carbon certificates are traded are those of international compliance (Kyoto), national and regional markets (European Union, Great Britain, Denmark), provincial or sub-national markets (Australia, U.S.A.), informal markets (companies and individuals who have voluntarily reduced their GHG emissions) and renewable energy certificate markets.

These markets may be grouped according to two types of transactions: emissions markets and project-based markets. The first includes the EU Emissions Trading System (EU ETS), the New South Wales Abatement Scheme (NSW), the Chicago Climate Exchange (CCX) and the United Kingdom Emissions Trading Scheme (UK ETS). The second includes those resulting from the obligations of Kyoto, as well as the EU-ETS and NSW, where trading is made by preference in markets which already have established compliance systems.

Market analysts estimate that the future global GHG market will be worth between US\$10 billion and US\$1 trillion by 2010. Between 1997 and the end of 2004, over 250 million tons of CO<sub>2</sub> equivalent had been traded in a market that still had no legal certainty that the Kyoto Protocol was going to enter into effect but which was operating according to the guidelines of the international treaty.

The ratification of the Kyoto Protocol in February 2005, the beginning of the European Union trading system in January of the same year and the probable creation of other national markets such as Canada, Japan and Norway have lent greater dynamism to this vibrant market.

#### Different Market Experiences

Table 1 shows the transactions which took place in 2006 and 2007 in the Emission Allowances Markets and the Project-based Markets. The data shows that in 2007 this market had grown to US\$64 billion, twice the figure for 2006. The sale and resale of emission allowances in the EU Trading System dominated this figure, with a value close to US\$ 50 billion.

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Trading in carbon credits related to CDM projects and the Joint Implementation mechanism grew to almost US\$ 7.5 billion and around 91% of this value was generated by CDM projects in developing countries. Meanwhile, the voluntary market, made up of corporations and individuals, grew strongly compared with 2006<sup>57</sup>, by about US\$ 265 million.

**Table 1:**  
**Carbon Market, Transaction Values and Volumes for the 2006-2007 Period**

	2006		2007	
	Volume (MtCO <sub>2</sub> e)	Value (MUS\$)	Volume (MtCO <sub>2</sub> e)	Value (MUS\$)
<b>Allowances Markets</b>				
EU ETS	1.104	24.436	2.061	50.097
New South Wales	20	225	25	224
Chicago Climate Exchange	10	38	23	72
UK ETS	na	na		
<b>Sub total</b>	<b>1.134</b>	<b>24.699</b>	<b>2.109</b>	<b>50.394</b>
<b>Project-based Markets</b>				
Primary CDM	537	5.804	551	7.426
Secondary CDM	25	445	240	5.451
JI	16	141	41	499
Other				
Compliance/voluntary transactions	33	146	42	265
<b>Sub total</b>	<b>612</b>	<b>6.536</b>	<b>874</b>	<b>13.641</b>
<b>TOTAL</b>	<b>1.745</b>	<b>31.235</b>	<b>2.983</b>	<b>64.035</b>

## European Union Emissions Trading System

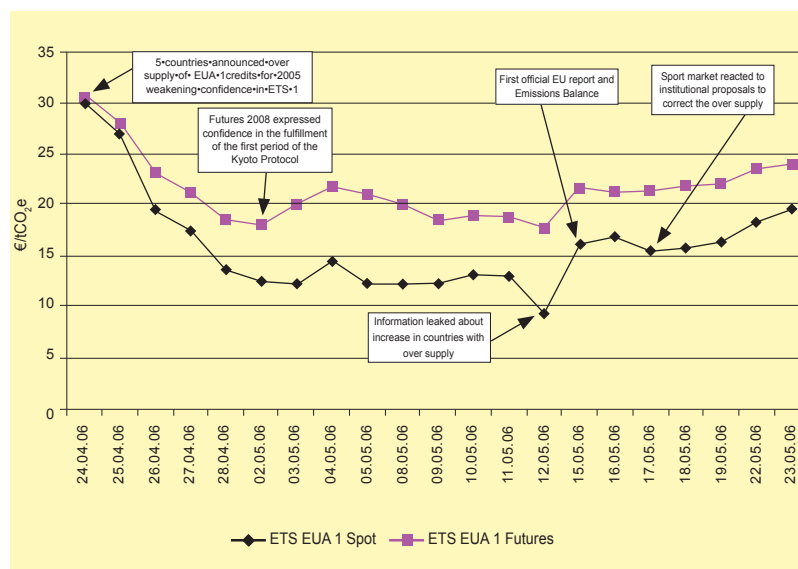
In January 2005, the European Union began a system based on the Kyoto precepts for trading greenhouse gas emission credits, together with a Linking Directive which enables carbon certificates from other countries, especially developing countries, to be sold. This system has financial sanctions for those European countries which exceed the agreed caps, with fines that vary between 40 and 100 euros per ton of CO<sub>2</sub> equivalent of unreduced allowance. It is based in two stages: one up to 2008 (ETS-1, the “spot” market) and the other from December 2008 (ETS-2).

The ETS-1 European market was the first linking market for emission reduction credits to be put into operation and represents high potential demand for CERs for CDM projects. In its first year of operation, almost US\$ 8 billion of carbon credits were traded and for 2006, predictions that this volume would triple proved correct, as more than US\$ 24 billion were traded (Table 1).

In this system, in 2005, trading in emission reduction units (Article 6 of the Joint Implementation), achieved 29 euros per ton reduced. During the first quarter of 2006, this value dropped to 12 euros per ton, because some EU countries announced in advance that they had met their approved caps, so their emissions were below the level allowed, which generated an excess of certificates and thus lower demand. This could imply that the caps set in the emissions reduction plans have been very lax thus far, which creates an incentive for increasing them for EU countries.

<sup>57</sup> State & Trends in the Carbon Market 2008, World Bank.

**Figure 1:**  
Prices Influenced by Corrective Proposals from European Regulators



This situation was corrected and some countries (such as Germany), indicated that they would strengthen the requirements of their emission reduction plans, which automatically made the price of certificates rise. Figure 1 shows the variation in prices of emission allowances in the ETS-1 for the period April-May 2006, when they were highly volatile, as they were affected by decisions made by authorities in each country involved in this system.

After peaking at a maximum price of 30 euros in April 2006, the ETS-1 lost two-thirds of its value after the uncoordinated release of information about emissions verified up to that moment. Towards the end of 2006 and in early 2007, the ETS-1 dropped again in value to levels below 1 euro, influenced by the inability to keep unused emission allowances for Phase II (ETS-2). As a result of internal matters relating to the European energy markets, prices began to rise again, with the contract prices for Phases I and II reaching 16 euros.

In spite of the price volatility experienced in the ETS-1, the EU Trading System and its Directive emerged as an important legal and market solution for mitigating greenhouse gas emissions, in the face of uncertainty as to whether there would be a second and subsequent periods of commitment compliance under the Kyoto Protocol after 2012. It is worth mentioning that this system does not have an end date.

## Carbon Funds

There is a series of initiatives focused on the acquisition of carbon credits, which can be summarized in three broad areas: CER funds or purchasing programs managed by or on behalf of governments; multilateral funds (such as those of the World Bank) and private funds. Table 2 shows a range of examples in operation.

**Table 2: Carbon Funds in Operation**

Prototype Carbon Fund (PCF) (*)	Renewable Energy
European Carbon Fund	All sectors, except afforestation and reforestation
German Carbon Fund (KfW)	Energy efficiency, renewable energy
IFC-Netherlands Carbon Facility (INCaF)	Energy efficiency, renewable energy, methane capture and fuel switching
Japanese Carbon Fund	All sectors
Community Development Carbon Fund (CDCF) (*)	Mini hydroelectric plants, use of urban and agricultural solid waste, energy efficiency, transport and forests
Netherlands CDM Facility (NCDF) (*)	Renewable Energy, transport, industry
Italian Carbon Fund	All sectors and technologies
Spanish Carbon Fund (*)	All sectors and technologies, apart from forestry projects
Biocarbon Fund (*)	Agriculture, forestry, carbon sinks
Danish Carbon Fund (DCF) (*)	Energy from wind, hydro, biomass and combined cycle, sanitary landfill projects
Latin American Carbon Program (PLAC)	Renewable energy, transport, industry, carbon capture
Climate Cent Foundation	Energy efficiency, renewable energy, methane capture and fuel switching
(*) Funds managed by the World Bank	

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## World Bank Carbon Funds

Mention should be made of the work carried out since late 1999 by the World Bank, which began to implement the rules of the Marrakech Agreement for CDM and Joint Implementation projects long before the Kyoto Protocol entered into effect. Its pioneering work began with setting up the Prototype Carbon Fund to finance projects in the areas of renewable energy, fuel switching, energy efficiency and waste management. Today it has expanded to create various other funds<sup>58</sup> which finance the reduction and capture of GHG emissions.

All of the World Bank carbon funds are managed by the Carbon Finance Unit (CFU) and work in a similar way: Governments and companies from industrialized countries supply financing for the development of projects based on the Kyoto rules. The host countries for the projects (developing countries), present a CDM project idea, which is subjected to scrutiny by experts from the CFU. If one of the funds accepts it, the World Bank supplies the necessary financial and technical resources with the objective of financing the development costs for drawing up the project design document, baseline methodology, developing the monitoring and verification plan and the emission reduction purchase agreement.

Additionally, the World Bank has been publishing a series of documents related to climate change, the funds it manages and the carbon market. One of these is the State and Trends in the Carbon Market Report, which is global in scope and updated annually, and provides very complete information about the current and future behavior of the different markets (formal and voluntary). The following two sections show a summary of that document.

<sup>58</sup> These include the Spanish Carbon Fund, Italian Carbon Fund, Netherlands European Carbon Facility and Community Development Carbon Fund, among others.

## Buyers of Carbon Credits

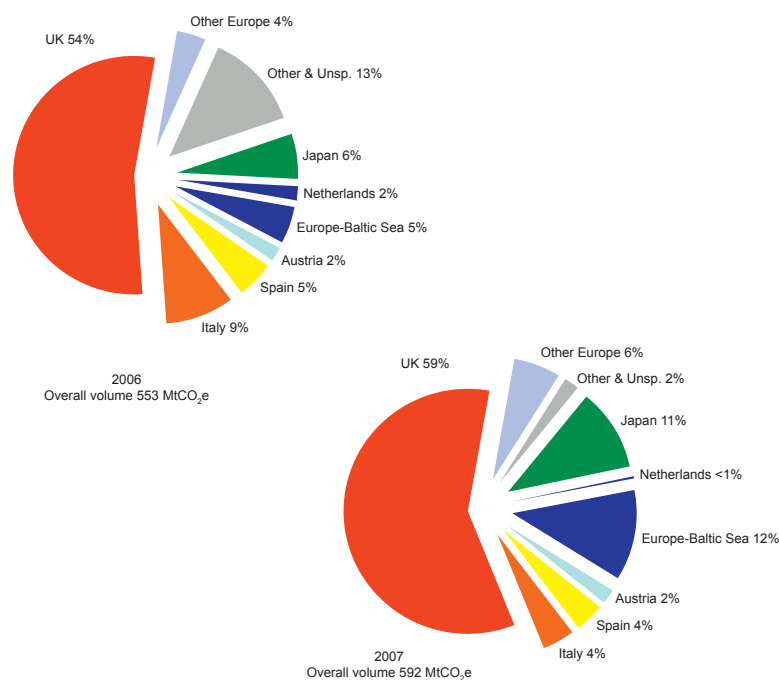
For the second consecutive year, European buyers dominated the CDM and Joint Implementation market and at the close of 2007, their participation reached 90% (somewhat more than in 2006), as can be seen in Figure 2.

The most active buyers were private companies, whose traded volume was 79% (2% higher than 2006). London has continued to transform itself into the trading center, with trading growing from 54% in 2006 to 59% in 2007.

Japan has begun to increase its trading again, practically doubling its 6% share in 2006 to 11% in 2007.

**Figure 2: Main Buyers of Carbon Credits**

Source: State and Trends in the Carbon Market 2008, World Bank



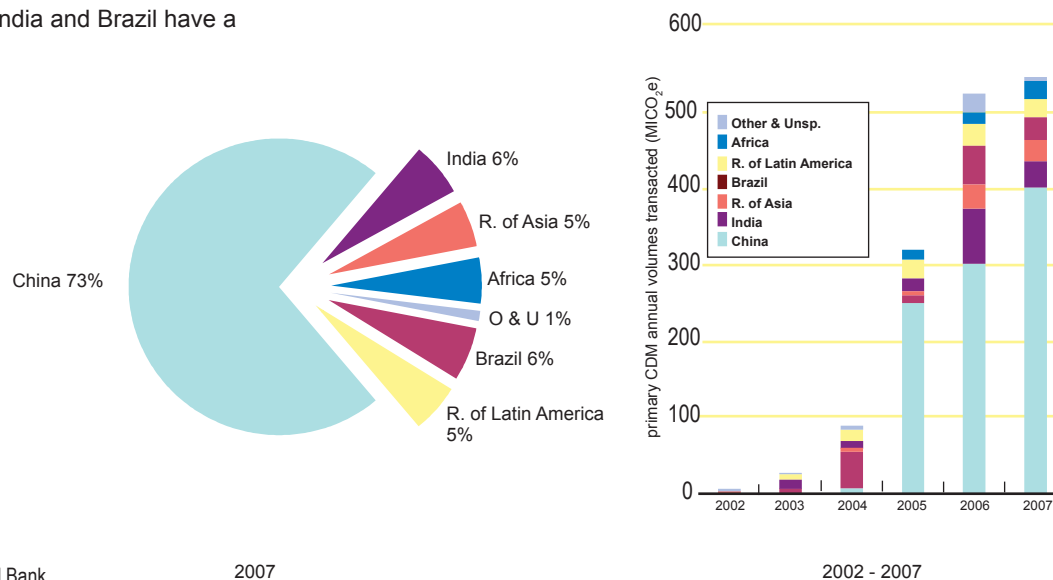


## Sellers of Carbon Credits

For the third year in a row, China was the world leader in the supply of CDM projects, with 73% share of the world market in terms of volumes traded (compared with 54% in 2006), as can be seen from Figure 3. Leading with 62% of the supply of primary CDM, China continues to be an ideal destination for buyers of carbon credits, due to its large size and favorable investment climate. Buyers have reported closing trading in the range of 8-11 euros per ton of CO<sub>2</sub> equivalent, with one or two notable transactions fetching over 13 euros in recent months.

China consolidated its position as the key supplier of carbon credits, by quadrupling its number of projects in the period January 2007- March 2008, thus putting it way ahead of other countries, with 53% of the potential supply of CERs to 2012, and with 1104 projects.

In turn, Brazil and India, each with a 6% share of the market, traded the next highest volumes after China, although both dropped their volumes compared to 2006 levels. Africa follows with 5% of the market. In contrast to their position in the supply of CDM projects, both India and Brazil have a relatively low share of the trading market.



**Figure 3: Main Sellers of Carbon Credits**

Source: State and Trends in the Carbon Market 2008, World Bank

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## APPENDIX 6

### The Bali Action Plan (Bali Road Map).

In the Bali Action Plan<sup>59</sup>, the Conference of the Parties recognized that significant reductions in global emissions would be necessary in order to achieve the objective of stabilizing the concentration of greenhouse gas emissions drawn up by the Convention and also emphasized the urgency of addressing climate change, as had been signaled in the Fourth Report of the IPCC.

The Conference of the Parties to the Convention also launched “a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012, in order to reach and adopt a final decision in 2015.”

This comprehensive process includes such topics as “a shared vision for long-term cooperative action, including a long-term global goal for emission reductions, according to the principle of common but differentiated responsibilities”; enhanced national and international action on mitigation and enhanced action on adaptation, technology development and transfer to support mitigation and adaptation as well as improved action on the provision of financial resources and investment. The Bali decisions include a detailed list of issues to be considered under the following topics:

#### Enhanced mitigation actions include:

- Nationally appropriate mitigation commitments or actions in developed countries which are measurable, reportable and verifiable;
- Nationally appropriate mitigation actions in developing countries within the context of sustainable development and supported and enabled by technology, financing and capacity building;

- Policy approaches and positive incentives in developing countries on issues relating to reducing emissions from deforestation and forest degradation.

#### Enhanced action on adaptation includes:

- International cooperation to support urgent implementation of adaptation actions;
- Risk management and risk reduction strategies; Disaster reduction strategies and means to address loss and damage associated with climate change impacts in vulnerable developing countries;
- Economic diversification.

#### Enhanced action on technology development and transfer includes:

- Effective mechanisms and enhanced means for the removal of obstacles to financial and other incentives, for increasing the development and transfer of technology in developing countries;
- Ways to accelerate the deployment, diffusion and transfer of affordable, state-of-the-art environmental technologies;
- Cooperation on research and development of current, new and innovative technology.

#### Enhanced action on the provision of financial resources and investment includes:

- Improved access to predictable and sustainable financial resources and technical support;
- Positive incentives for developing countries for enhanced implementation of national adaptation and mitigation strategies;
- Mobilization of public- and private-sector funding and investment.

<sup>59</sup> Contained in the document COP FCCC/CP/2007/L.7/Rev.1 (www.unfccc.int)

To drive this process forward, the Conference of the Parties decided to set up a subsidiary body known as the Ad-Hoc Working Group on Long-term Cooperative Action, which should complete its work in 2009. It will define a long-term global agreement for addressing climate change between the parties of the Convention.

## APPENDIX 7

### International Cooperation on Climate Change.

#### Among the international cooperation activities from which Chile has benefited are:

- The GEF Greenhouse Gas Reduction Project in Chile (1996), to identify and apply energy efficiency and renewable energy options for reducing CO<sub>2</sub> emissions from burning fossil fuels. Analysis of the creation of a sub-company of energy services within a state-owned mining complex and construction of a biomass gasification pilot project in a rural community (Chiloé) are among the results.
- The development of the first GHG emissions inventory, with funds from the United States Department of Energy (DOE), and the subsequent updates using funds from the United States Environmental Protection Agency (EPA) and the Global Environment Facility (GEF).
- The GEF project to remove the barriers to rural electrification using renewable energy in Chile, supporting existing social policies and programs, aimed at bringing electricity to 90% of Chile's rural dwellings during 2005.
- The development of 1stNC (1997-2000), which enabled the strengthening and creating of a national technical capacity-building for developing inventories of GHG emissions and impact assessments and mitigation studies and development of the current 2ndNC (2007-2010), both with GEF funding. Taking these steps implied fulfillment of Chile's commitments to the Climate Change Convention.
- GEF project on Sustainable Transport and Air Quality in Santiago (2002), to reduce greenhouse gas emissions from Santiago transport by promoting a long-term modal change to more efficient, less polluting forms of transport.
- Identification of CDM Transport Projects (2003), through the Canadian International Development Agency (CIDA).
- Development of forestry projects for CDM through cooperation with the Japan International Cooperation Agency (JICA) and the Forestry Institute.
- The National Strategy Study for the use of CDM in Chile (2001), with financing from the German international cooperation enterprise (Deutsche Gesellschaft für Technische Zusammenarbeit GmbH, GTZ), which sought to establish a national institutional framework for making use of CDM in Chile and preparing a portfolio of CDM projects.
- The GEF project on Self-assessment of National Capacity for Implementing the Conventions on Biodiversity, Climate Change and Desertification (2007), which sought to analyze the strengths and weaknesses of the country with regard to implementing the three agreements and develop a plan of action to promote the full execution of these, incorporating synergies between the three.
- The GEF Top-UP Phase project (2003), which involved carrying out four studies (technology transfer, Chile as a technological platform for wind energy in Latin America, capacity building for the systematic observation and inventory of emissions for the energy sector for 2001).
- Study of Climate Variability in Chile in the 21st Century (2007), which delivered a vision of what would happen to the temperature, precipitation and wind variables in the last 30 years of the century,

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according to two IPCC emissions scenarios (moderate and severe).

- The scientific research projects funded by the Inter-American Institute for Global Change Research (IAI)<sup>60</sup>.
- The project on Institutional Adaptation to Climate Change (in progress), which aims to analyze institutional responses to changes in climate in two important watersheds, one in Canada (Saskatchewan) and another in Chile (Elqui)<sup>61</sup>.

## APPENDIX 8

### Carbon Funds and Financial Initiatives in Latin America.

**Argentine Carbon Fund.** The Argentine Carbon Fund is an initiative promoted by that country's government to facilitate the development of new investment projects in Argentina which promote the use of the Clean Development Mechanism (CDM) established by the Kyoto Protocol. Its key function is to contribute financing to enterprises designed to expand industrial production capacity, increase energy efficiency, replace conventional energy with renewable energy sources and broaden the range of energy sources, all within the framework of sustainable production.

According to its promoters, this Fund will help strengthen the range of Argentine projects and optimize Argentine participation in the carbon market, obtaining better prices and boosting the country's negotiating capacity in the world market. As an additional advantage it could help some uncompetitive projects become competitive, in turn improving the internal rate of return.

<sup>60</sup> Agreement ratified by the Chilean Congress, which sought, among other things, to develop the capacity to understand the integrated impact of global changes on the American regional and continental environment and to create networks of scientists and scientific institutions.

<sup>61</sup> [www.parc.ca/mcni/index.php](http://www.parc.ca/mcni/index.php)

**Mexican Carbon Fund (FOMECAAR).** Launched in September 2006, this is a joint initiative between National Bank for Foreign Trade (Banco Nacional de Comercio Exterior, or Bancomext) and the Mexican Ministry of the Environment and Natural Resources (Semarnat), with initial capital of US\$ 350 million and plans to add additional lines of credit valued at US\$200 million. This initiative makes Mexico the first country to finance CDM projects through a government mechanism. Through FOMECAAR, the use of financial instruments in line with CDM will be promoted and GHG Emission Reductions Certificates and/or carbon credits will be generated so that the companies proposing these projects can decrease costs and generate additional annual income, estimated at between US\$300 and US\$400 million. Bancomext has signed important technical assistance agreements with the World Bank to secure this organization's support of the formation of FOMECAAR.

In the short term, the Fund would operate like a trust fund, with largely private participation, to which would be added financial companies and institutions such as the Inter-American Development Bank (IDB) and the World Bank, as well as Carbon Funds in purchasing countries like Spain.

**Ibero-American Carbon Initiative.** This is managed by the Andean Development Corporation (Corporación Andina de Fomento, CAF) and was created in October 2005 with an endowment of 47.43 million euros to be used to purchase carbon credits through CDM projects for up to 9 million tons of CO<sub>2</sub> equivalent. The priorities for this fund are energy efficiency, renewable energy, gas capture and waste management projects in Latin America. As of 2006, it had 8 projects in its portfolio, for a total of 2.4 million tons of CO<sub>2</sub> equivalent, with an investment of 13.4 million euros. The portfolio was due to close by the end of 2007.

Chile's Pre-Investment Program for Energy Efficiency. In 2005, through the Chilean Development Agency (CORFO), Chile launched an initiative to finance pre-investment in energy efficiency projects which may incorporate the CDM. The instrument supports the studies for identifying and evaluating, from a technical, economic and financial perspective,



investment options which optimize energy use and reduce costs associated with it. The areas which can be covered in a plan financed by this fund are:

1. **Energy Efficiency Audits:** These are aimed at understanding a company's sources of energy, its uses, sub-processes and level of production in order to identify the potential for efficiency.
2. **Plan for Implementing Energy Efficiency Measures:** This consists of designing an implementation plan of energy efficiency actions and measures, taking into account cost prioritization, benefits and timelines.
3. **Investment Project to be Presented to a Local Financing Source:** This is the development of an investment project for carrying out energy efficiency measures, taking into account the audit, the measures themselves, the situation of the company and the requirements of local financiers.

**Pre-Investment Program for Non-Conventional Renewable Energy (NCRE) Projects in Chile (2007).** This is a program with a year-round application process. It is designed to boost innovation and energy diversification, taking advantage of the wide range of available natural resources. It also seeks to stimulate the development of a commercially viable carbon credit project portfolio. Through the program, CORFO supports companies in applying a plan which can include some or all of the following actions:

- Pre-feasibility and feasibility studies.
- Other studies necessary for securing investment.
- Specialized consultancies needed to make a project happen (such as prospecting studies for energy resources; technical-economic analysis; basic engineering and detailed engineering studies; and preparation of a business plan and financial strategy).
- Studies needed to evaluate and incorporate the project into the clean development mechanism.

## APPENDIX 9

### World Health Day 2008.

#### PROTECTING HEALTH IN THE FACE OF CLIMATE CHANGE

Climate change puts at risk the basic determinants of health. It is generally recognized today that the Earth is warming up as a consequence of the emission of greenhouse gases caused by human activity. It is also clear that current trends in energy consumption and demographic growth will prolong climate change and make it more severe.

Climate change will inevitably affect the basic necessities essential to health: clean air and water, sufficient food and adequate heat. Every year, some 800,000 people die for reasons related to urban air pollution, 1.8 million die from diarrhea related to the lack of hygiene and access to clean, healthy water, 3.5 million die as a result of malnutrition and some 60,000 die in natural disasters. Warming and greater climate variability threaten to increase the concentration of some air pollutants, increase the transmission of disease through unhealthy water and contaminated food, compromise agricultural production in some less developed countries and further increase the dangers associated with extreme weather phenomena.

Climate change also brings with it new challenges for controlling infectious diseases. Many of the main causes of mortality are very sensitive to meteorological conditions such as temperatures and rainfall, including cholera, diarrheic diseases, malaria and dengue and other vector-transmitted diseases. Climate change threatens to decelerate, interrupt or reverse the progress which the global public health community has made in combating many of these diseases.

However, in the long term, the principal sanitary impacts will probably not be a result of acute crises like natural disasters or epidemics but a gradual increase in the pressure put on the natural, economic and social systems which maintain health and which are already stretched in most of the developing world. Among these gradual tensions are reductions and seasonal

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changes in the availability of drinking water, regional decreases in food production and an increase in the sea level. Each of these changes can displace populations and increase the risk of civil war.

All populations are vulnerable but some are more so than others. All over the world, populations will be affected by climate change, but the initial hygiene risks depend strongly on the place where people live and their lifestyle. The inhabitants of small, developing island countries and other coastal regions, megalopolises and mountainous or polar regions are all especially vulnerable but in different ways.

It is predicted that the effects on health will be greatest for the elderly, those who are sick or already have some kind of health problem. It is likely that most of the additional morbidity will occur among children and poor people, especially women. The main diseases with significant sensitivity to climate change --diarrhea, vector- transmitted diseases such as malaria and infections related to malnutrition-- are more serious in children living below the poverty line.

Our common interest is to address the sanitary risks wherever they occur on Earth. The climate change underway, together with globalization, will make it more difficult to contain infectious diseases within their current limits. The health challenges resulting from population displacement and conflicts will probably not remain confined to national boundaries. Critical to the world's health security is the improvement of the sanitary services for people all around the world, together with a more rapid and efficient international oversight of morbidity.

Protecting human health is the most important reason for undertaking strategies to combat climate change.

Climate change can no longer be considered merely an environmental or development problem. What is most serious is that it endangers the protection and improvement of human health and wellbeing. Greater recognition must be given to the health implications of climate change for

humans, in order to adopt efficient measures and mobilize the population.

Strengthening public health services should be a key component of adaptation<sup>62</sup> to climate change. The international health community already has a great wealth of experience in protecting people from weather-related risks and has efficient sanitary interventions which have been demonstrated to be efficient in combating the diseases which must be addressed urgently. Increasing the coverage of available interventions would make significant sanitary improvements unnecessary. If this were linked to far-sighted planning, it would also reduce vulnerability to the future climate changes.

The diversity, generalized nature, long duration and unequal distribution of health risks make climate change a true global challenge which requires a hitherto unprecedented level of joint collaboration. To respond efficiently, measures will have to be taken throughout society, beginning with the private sector, the health sector, community members and political leaders. Moreover, for the response to be equitable and efficient, those countries which have contributed most to climate change should share responsibility with those most vulnerable to the effects of it, with the aim of safeguarding and improving world health security.

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<sup>62</sup> Adaptation to climate change refers to adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which can moderate harm or exploit its beneficial aspects. There are various types of adaptation, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (extract from the glossary of Working Group II of the Intergovernmental Panel on Climate Change, 2007).



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“It is very likely that the central part of Chile will have lower precipitation than at present, which could affect its agricultural activity.”





Cover photos:

**“The Chilean altiplano will experience higher precipitation in spring and summer, which could lead to greater water availability in the high Andean wetlands.”**





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