



# The Integrated Environmental Strategies (IES) Program in Santiago, Chile

## What is the IES Program?

The IES Program helps developing countries identify policies and technologies that reduce emissions of greenhouse gases (GHGs) and local air pollutants. By analyzing and implementing “integrated” policies and measures such as clean energy (e.g., renewable energy), energy efficiency (e.g., improved energy efficiency standards for appliances), and public transportation (e.g., converting diesel buses to compressed natural gas (CNG)), IES communities have an opportunity to make a positive impact on local air quality, public health, and the economy, while at the same time reducing GHGs at the global level.

**“The IES work was really helpful in recognizing and enhancing our understanding of the greenhouse gas/local air pollution link.”**

– *Dr. Luis Cifuentes, P. Catholic University of Chile, Santiago*

## Objectives of the Program in Chile

IES work in Santiago, Chile—the first study of its kind in the country—was initiated in March 1999. The IES-Chile team conducted the in-country analysis at the Pontificia Universidad Católica de Chile (P. Catholic University of Chile). The goals of the effort were to aid government officials and other stakeholders in understanding the air pollution reduction benefits of clean energy technologies that also reduce GHG emissions, and to enhance in-country capacity to conduct co-benefits analysis of integrated measures.

The IES project in Chile was conducted in two parts. The first analyzed the potential health benefits for air quality measures in Chile. The

IES-Chile team considered measures from the Chilean National Environmental Commission’s (CONAMA) Climate Policy (CP) scenario for 2000 to 2020, a study used to support national level policy for GHG mitigation in Chile. The second part focused more specifically on analysis of mitigation measures under consideration in the Santiago Decontamination Plan—the air quality management plan for the city. Specific measures from the plan, as well as a range of additional integrated measures that would improve air quality and reduce GHG emissions, were analyzed for their impact on public health.

**Figure 1: Mitigation Measures in CP Scenario and Resulting Carbon Emission and PM<sub>2.5</sub> Concentration Reductions for the Year 2020 Relative to the Year 2000**

Mitigation Measure	% Carbon Emission Reductions	% PM <sub>2.5</sub> Concentration Reductions
<b>Fuel Switching Measures</b>		
Residential Wood to Natural Gas (NG)	–	95%
Residential Kerosene to NG	21%	86%
Boilers - Diesel to NG	24%	61%
<b>Electricity Saving Measures</b>		
Incandescent to Compact Fluorescent Lamps (CFL)	80%	80%
Efficient Reflectors for Fluorescent lamps (FL)	44%	44%
Sodium Lamps for Public Lighting	48%	48%
<b>Transport Sector Measures</b>		
CNG Buses	6%	70%
Hybrid Diesel-Electric Buses	29%	39%
CNG Conversion Kit	13%	0%
Diesel Particulate Traps	-5%	20%
Taxi Renovation	9%	78%

This figure shows the percent reductions in carbon dioxide equivalent emissions and particulate matter (PM<sub>2.5</sub>) concentrations from the application of each mitigation measure from the CP scenario in 2020 relative to the 2000 base year.



## Solutions Offered

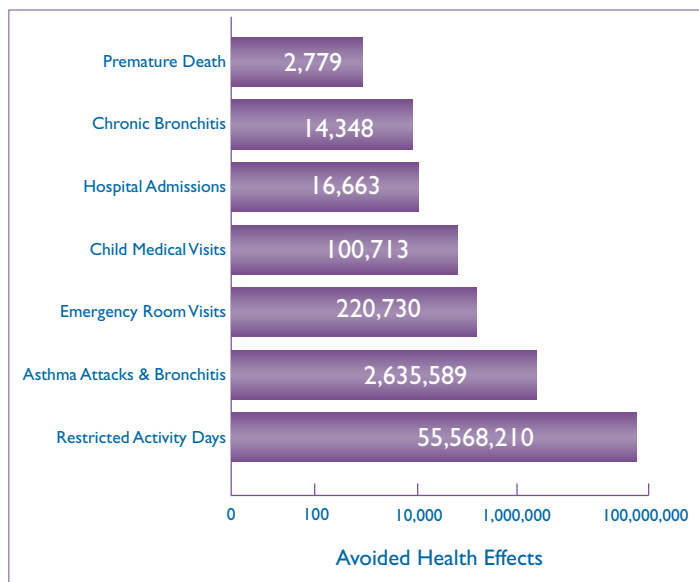
After completing the analysis, the IES-Chile team found that several of the co-benefits measures analyzed were particularly worthwhile and cost-effective. Transportation policies emerged as the most promising because the transport sector contributes the largest portion of, and is the fastest growing sector for, GHG emissions and local air pollutants in Santiago. For the transport sector, the IES team looked at switching to cleaner means of transportation (e.g., dedicated bus lanes) and improvements in fuel efficiency (e.g., renovating the taxi cab fleet, introducing hybrid diesel-electric buses). Other measures analyzed included the use of new technologies like compact fluorescent lamps (CFL), more energy-efficient appliances for the residential and commercial sectors, more efficient electric motors for industry, and the increased use of co-generation power for the industrial sector.

## Program Outcomes

IES work in Chile produced many positive outcomes. At least four articles on the co-benefits approach have been published by members of the IES-Chile team in journals such as *Atmospheric Environment*, *Environmental Health Perspectives*, and *Science*. These articles generated media coverage in the local, regional, and international press, including coverage on CNN en Español and BBC. The team also developed health effects benefits modeling software called Air Pollution Health Effects Benefits Analysis (APHEBA), which IES teams in other countries have modified and used for their respective countries' analyses.

For its work, the regional environmental agency (CONAMA) recognized the technical capacity of the team and awarded P. Catholic University a five-year grant to establish a "Center of Excellence" to continue analyzing air quality. Team members, including Dr. Luis Cifuentes, have helped IES teams in China, India, and the Philippines start their health impacts assessments, increasing South-South exchange of expertise. Dr. Cifuentes also speaks at numerous air quality/GHG conferences and served as a lead author of the co-benefits section of the Intergovernmental Panel on Climate Change's (IPCC) Third Assessment Report.

Figure 2: Total Health Effects Avoided in CP Scenario Compared to the Business as Usual (BAU) Scenario During the Period 2000 to 2020



This chart illustrates the estimated number of health effects avoided between 2000 and 2020 by adopting all of the policies in the CP scenario (see Figure 1 for the complete list of mitigation measures).

In related work by another Chilean government agency, the Executive Secretariat Commission for Planning of Transportation Infrastructure Investments (SECTRA) generated a proposal for a \$7.4 million (USD) grant to the Global Environment Facility (GEF). This grant, which GEF approved, supports the reduction of GHG emissions from vehicles in Santiago by promoting a long-term modal shift to more efficient, less polluting forms of transportation. The specific measures included reducing private car use and promoting public transportation; encouraging replacement of old buses with low-emission buses; increasing the use of bicycles; and modifying travel patterns through land-use changes. Projects are expected to be in place by late 2006.

## For More Information

Visit the IES Web site at < [www.epa.gov/ies](http://www.epa.gov/ies) >. You may also E-mail < [ies@epa.gov](mailto:ies@epa.gov) > or call +1 202 343-9731.

