Introduction

An important debate is under way in Mexico regarding the environmental impacts of power generation based on fossil fuels. The debate has been prompted in part by historical trends in Mexico's electricity generation. The share of fossil fuels used in generating electricity has increased significantly, from 48.4 percent in 1965 to 71.3 percent in 2002. And residual fuel oil is increasingly the fuel of choice, accounting in 2002 for 42.3 percent of the fuel used for power generation, up from 15.3 percent in 1965. Mexican fuel oil also has a high sulfur content (3.3 to 3.9 percent by weight), which is considered dirty from an environmental point of view (SENER, 2003).

The increasing amount of residual fuel oil consumed by the electricity industry has produced considerable amounts of atmospheric pollutants, including sulfur dioxide (SO2), nitrogen oxides (NOx), and particles. The environmental impacts include health effects, particularly in regions with high population density, as well as soil and water acidification.

Some efforts have been made to mitigate these problems. An official Mexican Norm (NOM) 085-ECOL-1994 (DOF, 1994) has set allowance levels for fixed sources of fumes, particles, sulfur dioxide, and nitrogen oxides. For SO2 emissions, the norm specifies the maximum regional allowance levels for fixed combustion equipment greater than 43000 MJ/h (INE, 1994).

In spite of the existing norm, emissions originating from the Mexican Electric System (MES) are very high. In 2000, the MES emitted 1.552 million tons of SO2, 275,050 tons of NOx, and 108,701 tons of particles. This represents respectively 58 percent, 29 percent, and 0.1 percent of Mexico's total emissions.

In this light, it is important to analyze available technologies and practices for reducing emissions.

The main goal of this study is to present the results of an economic assessment and an environmental effectiveness evaluation of various technologies and practices for SO2,

NOx, and particle emissions controls that might be viable options for the Mexican Electric System—both from a technical and commercial point of view.

One purpose of the economic analysis is to calculate the cost effectiveness of each option. For each thermal power plant and applied option, capital and total costs are expressed in present value. Environmental effectiveness is evaluated in terms of emissions reductions.

This analysis of the economic and environmental viability of various control options can provide decision makers with useful information about the cost of various abatement options and their comparative effectiveness.

The present study has five chapters. The first chapter presents an analysis of the Mexican Electricity System, including electrical generation, fuel use, emissions, and trends in fossil fuel prices. Finally, the chapter explains the general methodology and the fossil fuel price scenario applied to the environmental-economic evaluation of the various technologies and practices for emissions control.

In the second, third, and fourth chapters, we describe various options of technologies and practices to reduce SO2, NOx and particle emissions. These are evaluated from an environmental and economic point of view. Only options that are viable and relevant for the MES are analyzed. In the fifth chapter, based on previous results, we identify the best economic and environmental routes to decrease SO2 emissions and present a comparative analysis of options to decrease NOx emissions. We also discuss the use of particle emissions reduction using electrostatic precipitators in the MES. Finally, we present general conclusions involving all technical and practical options and discussions on environmental cobenefits.

To give a complete picture of costs and environmental benefits, for each applied option we calculated the accumulated capital cost, the accumulated total cost, and the accumulated reduction. Finally, these accumulated costs and reductions were related to the abatement cost calculated for each selected thermal power plant.