

Thermal Power: Rehabilitation of Existing Plants

Key Issues

The range of circumstances in which the rehabilitation of an existing thermal power plant may be considered is extremely large. It is neither possible nor desirable to attempt to prescribe specific environmental guidelines for all of the different cases that may arise in the World Bank's operational work. Hence, this document focuses on the process that should be followed in order to arrive at an agreed set of site-specific standards that should be met by the plant after its rehabilitation.

At the heart of this process is the preparation of a combined environmental audit of the existing plant and assessment of alternative rehabilitation options relevant to the future impact of the plant on nearby populations and ecosystems. The coverage of the environmental assessment component of the study will depend on the rehabilitation activities involved and may be similar to that required for a new thermal power plant when major portions of the plant are being replaced or retrofitted. The amount of data required, the range of options considered, and the coverage of the environmental analysis will typically be less than appropriate for a new plant. At the same time, the initial environmental audit should not be restricted to those parts of the existing plant that may be affected by the rehabilitation. It should review all the major aspects of the plant's equipment and operating procedures in order to identify environmental problems and recommend cost-effective measures that would improve the plant's environmental performance.

The time and resources devoted to preparing the environmental audit and assessment should be appropriate to the nature and scale of the proposed rehabilitation. It would, for example, not

be appropriate to carry out an extensive environmental assessment in cases involving minor modifications or the installation or upgrading of environmental controls such as a wastewater treatment plant or dust filters or precipitators. For larger projects, such as the installation of flue gas desulfurization (FGD) equipment, the environmental assessment might focus particularly on the range of options for reducing sulfur emissions and for disposing of the gypsum or solid waste generated by the equipment.

It is, however, recommended that an environmental audit be undertaken in almost all cases. Experience suggests that such investigations will often pay for themselves by identifying zero- or low-cost options for energy conservation and waste minimization. In addition, such an audit may indicate ways in which the project could be redesigned in order to address the most serious environmental problems associated with the plant.

Major rehabilitations that imply a substantial extension (10 years or more) of the expected operating life of the plant should be subject to an environmental assessment similar in depth and coverage to one that would be prepared for a new plant. In such cases, the plant will normally be expected to meet the basic guidelines that apply to new thermal power plants for emissions of particulates, nitrogen oxides (NO_x), wastewater discharges, and solid wastes. Where the rehabilitated plant would be unable to meet the basic guidelines for sulfur dioxide (SO₂) without additional and potentially expensive controls, the environmental assessment should review the full range of options for reducing SO₂ emissions, both from the plant itself and from other sources within the same airshed or elsewhere in the country. On the basis of this analysis, the government, the enterprise, and the World Bank Group will agree on specific measures, either at the plant or

elsewhere, to mitigate the impact of these emissions and will also agree on the associated emissions requirements.

Any rehabilitation that involves a shift in fuel type—i.e., from coal or oil to gas, as distinguished from a change from one grade or quality of coal or oil to another—will be subject to the same basic emissions guidelines as would apply to a new plant burning the same fuel.

Environmental Audit

An audit of the environmental performance of the existing plant should do at least the following:

- Review the actual operating and environmental performance of the plant in relation to its original design parameters.
- Examine the reasons for poor performance to identify measures that should be taken to address specific problems or to provide a basis for more appropriate assumptions about operating conditions in the future—for example, with respect to average fuel characteristics.
- Assess the scope for making improvements in maintenance and housekeeping inside and around the plant (e.g., check for excess oxygen levels, actual emissions levels, fuel spills, coal pile runoff, fugitive dust from coal piles, recordkeeping, monitoring, and other indicators of operation and maintenance of thermal power plants).
- Evaluate the readiness and capacity of the plant's emergency management systems to cope with incidents varying from small spills to major accidents (check storage of flammables, safe boiler and air pollution control system operation, and so on).
- Examine the plant's record with respect to worker safety and occupational health.

The report on the environmental audit should provide recommendations on the measures required to rectify any serious problems that were identified in the course of the study. These recommendations should be accompanied by approximate estimates of the capital and operating costs that would be involved and by an indication of the actions that should be taken either to implement the recommendations or to evaluate alternative options.

The management of the plant or the borrower should submit the report on the environmental audit to the World Bank Group, along with a statement of the steps taken to address the problems that were identified and to ensure that such problems do not recur in the future. Implementation of the actions outlined in the statement will be treated as one of the elements of the site-specific requirements for the project.

Environmental Assessment

An environmental assessment of the proposed rehabilitation should be carried out early in the process of preparing the project in order to allow an opportunity to evaluate alternative rehabilitation options before key design decisions are finalized. The assessment should examine the impacts of the existing plant's operations on nearby populations and ecosystems, the changes in these impacts that would result under alternative specifications for the rehabilitation, and the estimated capital and operating costs associated with each option.

Depending on the scale and nature of the rehabilitation, the environmental assessment may be relatively narrow in scope, focusing on only a small number of specific concerns that would be affected by the project, or it may be as extensive as would be appropriate for the construction of a new unit at the same site. Normally, it should cover the following points:

- Ambient environmental quality in the airshed or water basin affected by the plant, together with approximate estimates of the contribution of the plant to total emissions loads of the main pollutants of concern
- The impact of the plant, under existing operating conditions and under alternative scenarios for rehabilitation, on ambient air and water quality affecting neighboring populations and sensitive ecosystems
- The likely costs of achieving alternative emissions standards or other environmental targets for the plant as a whole or for specific aspects of its operations
- Recommendations concerning a range of cost-effective measures for improving the environmental performance of the plant within the

framework of the rehabilitation project and any associated emissions standards or other requirements implied by the adoption of specific measures.

These issues should be covered at a level of detail appropriate to the nature and scale of the proposed project.

If the plant is located in an airshed or water basin that is polluted as a result of emissions from a range of sources, including the plant itself, comparisons should be made of the relative costs of improving ambient air or water quality by reducing emissions from the plant or by reducing emissions from other sources. As a result of such an analysis, the government, the enterprise, and the World Bank Group would agree to set site-specific emissions standards for the plant after it has been rehabilitated that take account of actions to reduce other emissions elsewhere in the airshed or water basin.

Emissions Guidelines

The following measures must be incorporated when rehabilitating thermal power plants:

- Normally, the energy conversion efficiency of the plant should be increased by at least 25% of its current level.
- Baseline emissions levels for particulate matter, nitrogen oxides, and sulfur oxides should be computed.

- An analysis of the feasibility (including benefits) of switching to a cleaner fuel should be conducted. Gas is preferred where its supply can be assured at or below world average prices. Coal with high heat content and low sulfur content is preferred over coal with high heat content and high sulfur content, which in turn is preferred over coal with low heat content and high sulfur content.
- Washed coal should be used, if feasible.
- Low-NO_x burners should be used, where feasible.
- Either the emissions levels recommended for new plants, or at least a 25% reduction in baseline level, should be achieved for the pollutant being addressed by the rehabilitation project.
- The maximum emissions level for PM is 100 milligrams per normal cubic meter (mg/Nm³), but the target should be 50 mg/Nm³. In rare cases, an emissions level of up to 150 mg/Nm³ may be acceptable.
- SO₂ emissions levels should meet regional load targets. Cleaner fuels should be used, to avoid short-term exposure to sulfur dioxide.

Monitoring and Reporting

Monitoring and reporting requirements for a thermal power plant that has been rehabilitated should be the same as those for a new thermal power plant of similar size and fuel type.