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 this 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 that 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/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/upgrading of environmental controls such as a wastewater treatment plant or dust filters/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 the disposal of the gypsum and/or solid waste generated by the FGD.

It is, however, recommended that an environmental audit should 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 in the expected operating life of the plant – 10 or more years – should be subject to an environmental assessment that is 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, wastewater discharges, and solid wastes. Where the rehabilitated plant would be unable to meet the basic guideline for sulfur dioxide without additional and potentially expensive controls, the environmental assessment should review the full range of options for reducing sulfur dioxide 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 on the associated emissions requirements.

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

**Environmental Audit**

An audit of the environmental performance of the existing plant should, at least, cover the following topics:

- review the actual operating and environmental performance of the plant relative 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 future -- for example, with respect to average fuel characteristics;
- assess the scope for making improvements in maintenance and good housekeeping inside and around the plant (e.g., check for excess oxygen level record, actual emission levels, fuel spills, coal pile runoff, fugitive dust from coal piles, record keeping, 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 (e.g., storage of flammables, safe boiler and air pollution control system operation etc.); and
- 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 costs -- both 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 and/or the borrower should submit the report on the environmental audit to the World Bank Group along with a statement of the steps that have been taken to (a) address the problems that were identified, and (b) ensure that such problems do not recur in 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 have been finalized. The assessment should examine (a) the impacts of the existing plant's operations on nearby populations and ecosystems, and (b) the changes in these impacts that would result under alternative specifications for the rehabilitation together with estimates of the capital and operating costs associated with each of the options.

Depending upon the scale and nature of the rehabilitation, the environmental assessment may be relatively narrow in scope -- focusing 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 emission 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 emission standards or other environmental targets for the plant as whole or for specific aspects of its operations; and
• recommendations concerning a range of cost-effective measures to improve the environmental performance of the plant within the framework of the rehabilitation project and any associated emission 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.

In cases where 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 establish site specific emission 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.

**Emission Guidelines**

The following measures must be incorporated while rehabilitating thermal power plants:
• Normally the energy conversion efficiency of the plant should be increased by at least 25% of its current level.
• Compute the baseline emission levels of particulate matter, nitrogen oxides, and sulfur oxides.

• Conduct an analysis of the feasibility (including benefits) of switching to a cleaner fuel. Gas is preferred where its supply can be assured at or below World average prices. High heat-content, low-sulfur coals are preferred over high-heat content, high-sulfur coals which in turn are preferred over low-heat content, high-sulfur coals.
• Normally, switch to washed coal, if feasible.
• Use low NO\textsubscript{x} burners, where feasible.
• Either achieve emission levels recommended for new plants or achieve at least a 25% reduction in baseline level for that pollutant being addressed by the rehabilitation project.
• Maximum emission level for PM is 100 mg/Nm\textsuperscript{3} but aim for 50 mg/Nm\textsuperscript{3}. In rare cases, an emission level of up to 150 mg/Nm\textsuperscript{3} may be considered acceptable.
• Ensure that sulfur dioxide emission levels are such so as to meet regional load targets and avoid short-term exposures by burning cleaner fuels.

**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.