

## **THERMAL POWER PROJECTS**

1. The thermal power projects that is supported West African Development Bank include gas-fired , oil- or coal -fired mixed fuels , gas turbine or diesel-powered. (The Bank also participated in the exploitation of geothermal energy projects and is likely to fund projects related to solar energy and alternative fuels, but these are rare at present and are not covered in this section.) The main components of a thermal power project include plant itself (including turbines and generators) and related facilities, such as the cooling system , equipment washing gas fireplace, storage areas and handling of fuel, the fuel distribution system , the solid waste storage areas , worker colonies , substations conversion and transmission lines. Types of facilities and scope of thermal power projects and their location will determine both the types and importance of related facilities.

### **Potential impacts on the environment**

2. Adverse effects may well occur during the construction of thermal power plants that during their operation. The impacts caused by the construction are primarily due to the following site preparation activities: clearing, excavation, clearing, draining, dredging or damming of rivers or other bodies of water exploitation, establishing the site, borrowing and filling pews. The number of workers employed in the construction of power plants may have serious socio-cultural impacts on local communities.
3. Thermal power plants are significant sources of air emissions that may affect the air quality at the local and regional level. Fuel combustion in

power plants emit sulfur dioxide (  $SO_2$  ) , nitrogen oxides (  $NO_x$ ), carbon monoxide (CO) , carbon dioxide (  $CO_2$ ) and particles (which may contain trace metals ) . The quantities of each of these substances depend on the type and size of the installation, the type and quality of the fuel used and the way it is burned. The dispersion of these emissions and their concentration at ground level is determined by a complex interaction of physical features fireplaces, physic- chemical properties of emissions, meteorological conditions of the site or near it when the emissions fall on the surrounding land, topography of the land on which the plant is located and the surrounding areas as well as the nature of the receptors (eg. populations, crops and natural vegetation).

4. The polluted water discharges from power plants is most commonly consist of relatively clean cooling water that can be recycled or discharged into water bodies with minimal effects on the chemical quality of the water. By cons, it is important to consider when evaluating plant projects that are being considered a non-recirculating cooling system, the effects of residual heat on the water temperature, the slightest increase in temperature may serious injury to wildlife and aquatic life. If other effluents emitted by thermal power stations are in smaller amounts, however, they may seriously affect the quality of water. Effluent thermal coal plants consist , for example, discharges from the drain cooling systems and boilers, washing water demineralization by against the tide , wastewater from regenerative resin , wastewater carrying ash, runoff from coal piles , piles of ash and field in general and various wastewater discharges resulting from spills. Trace metals, acids and other chemicals of varying composition are also found in these effluents.

**Oil spills have a negative impact on the quality of water near coal-fired power stations.**

5. Insofar as it is possible to avoid a number of impacts or mitigate them more successfully and at a lower cost by carefully choosing the location of the plant, it should read the phrase "Location factories and development of land for industrial purposes "in conjunction with this section. (Refer to Table gives a summary of the potential environmental impacts during construction and operation of a thermal power plant.)

### **Specific issues global**

#### **Impacts and transboundary effects**

6. Emissions from thermal power plants may be the precursors of acid rain, especially if the used fuel is coal with sulphur content is very high. Acid rain accelerates the deterioration of buildings and monuments deeply alter aquatic ecosystems of certain lakes and damage vegetation of forest ecosystems. Moreover, the fossil-fired power plants generate also CO<sub>2</sub> and NO<sub>x</sub>, gas whose increase in the atmosphere would be responsible for global warming. It is however impossible, at present, to ascertain the contribution of emissions from a thermal power plant to these issues both regional and global

### **Cooling water and residual heat**

7. Many power plants that use steam are also equipped with a system of once-through cooling. If large quantities of water that require large plants are harvested from natural bodies of water , such as rivers, streams and bays, the cooling system, carrying aquatic organisms and impeding their movement , may cause their death and significantly reduce populations of fish and shellfish , some of which are widely marketed.
8. The heated water discharges can raise the temperature of the receiving water and thus would alter the aquatic fauna and flora, while promoting the development of organisms adapted to higher temperatures. These new communities are then vulnerable to adverse effects, especially the lowering of the temperature of the water after the closure of the plant as a result of failure or lack of regular maintenance.
9. The use of evaporative cooling tower reduces the volume of water taken to the only required amount to compensate for evaporation. Although these towers avoid thermal shock due to water discharge their waters drain must be removed. There is another solution in cold climates can reduce the temperature of the waste water by taking advantage of the residual heat in the form of hot water or steam to heat , for example, buildings or aquaculture ponds.
10. There is no cooling system that causes water loss and thereby reduces the amount available for human consumption, irrigation, navigation and other uses in areas experiencing water shortages.

### **Impacts on communities**

11. One of the most important impacts of power plants for the influx of workers during construction. A central large may require thousands of workers during the year construction period, and hundreds of workers for its operation. If the host community is small, it can lead to significant risks of tension. A situation of «boomtown " or induced development may also occur , with significant negative impacts on local infrastructure such as schools, police, means of protection against fire , medical centers, etc. . In addition, the influx of workers transforms local demographics and disrupts the social and cultural values of communities in the region as well as the lifestyles of people. Displacement of local populations caused by the land requirements of the plant and related facilities is another impact. Major traffic problems may occur in the region, caused by the construction and operation of the plant. Finally, large plants can disfigure the landscape and create noise.

### **Alternatives to projects**

12. The assessment of impacts on the environment should include an analysis of reasonable alternatives, so that the real objectives of the thermal power project to be realized. The analysis may show that these solutions are the ecological point of view, sociocultural and economic, more acceptable than the originally proposed project. In addition to the option not to go ahead with the project (ie. Examine the consequences that would do nothing to meet the demand ) , alternatives should be taken considered in the following areas:

- alternative fuels ;

- management of the supply and demand for energy ;
- location ;
- waste heat ;
- supply or water intake ;
- waste management plant and sanitary facilities;
- solid waste disposal ;
- engineering equipment and pollution control ;
- controls;
- social structure , including infrastructure and employment.

13. Although the evaluation of these alternatives should be an integral part of the design process of the project, it is best to select control measures effective environmental protection in terms of cost . It is important that the validity of these solutions based on environmental and economic criteria.

### **Management and Training**

14. Given the importance of the impacts a proposed power plant poses to the environment during construction and during its operation, it is necessary that a team of environmental experts (scientists and engineers) do part of the staff responsible for the design and management of the facility. This team should work with the engineers of the plant during all phases of the project have an impact on the environment. A training program for environmental management in the context of a thermal power project can be specified according to the knowledge and experience of staff of the environment.

It is essential to master a number of environmental disciplines relating to the management of thermal power projects , including the following :

- monitoring , modeling and the fight against air pollution ;
- monitoring , modeling and the fight against water pollution ;
- Solid waste management and industrial hygiene ;
- management of toxic substances and hazardous waste ;
- noise reduction ;
- protection of natural resources and land ;
- assessment of the socio -economic impacts.

15. Training environment may be necessary in respect of general concepts and methods of impact assessment, theory and methods of monitoring, collection and analysis of data and the means of pollution control. These courses should be completed during the phase of the environmental assessment of the project with the assistance of a consultant specializing in environment. The team responsible for environmental issues should, wherever possible, to participate in the environmental assessment study to ensure that it is understood. It is important, in particular, that the staff understands the *raison d'être* for monitoring and mitigation measures recommended they are likely to implement. A training program should also be provided to technical and management personnel who will liaise with engineers and managers of the plant.

16. Standard operating and maintenance staff training in best practices will be required together with an administration charge of their implementation. Moreover, the regulations relating to health and safety will also be essential

to reduce the risks to the health and safety of staff and the impact on the environment when the plant put into operation.

17. The borrowing country does not have regulations often limit emissions standards or air quality can exert weight on future thermoelectric projects. The criteria of the World Bank can serve as standards instead of national standards for air quality. These principles and accepted criteria (studies that, for example, known effects) should be used to determine the boundaries that do not endanger human health and the environment.
18. The environmental agencies at the local, regional and national levels involved in the review and approval of the project and its supervision may also need a training program that will enable them to ensure monitoring and enforcement of regulations, during the construction of the project and its commissioning.

### **Tracking**

19. A monitoring program seeks to establish that the expected impacts of a project within acceptable limits both from the point of view of engineering structures and the environment. Its purpose is also to provide information indicating conditions unacceptable environment quickly. It would be important that the monitoring activities to be undertaken before the implementation of the thermoelectric project to determine the basic conditions of the environment. Monitoring of construction of the plant and its operationalization establish the degree and significance of impacts that occur during the various stages of the project. Generally, a year of monitoring the activities of pre-construction suffices to identify the

environmental resources potentially affected by the project. As for the time required to monitor the construction and put into operation, it will depend on the type of resources involved and the duration of the expected impact. If , for example , was planned to install a system of continuous discharge of cooling water , it may be necessary to exercise then a weekly or daily monitoring of water quality to ensure the life of the installation.

Specific monitoring programs will be required depending on the type of project and resource thermoelectric considered potentially affected.

20. Continuous monitoring of the atmosphere detecting primary pollutants emitted by the plant will be required. Control devices should be used to measure the concentrations of emissions in the atmosphere and at ground level in the receiving areas previously defined (eg. Residential and agricultural sectors). It is also necessary to determine the weather site for purposes of determining atmospheric models. If meteorological data are not available, it will then perform a weather monitoring.
21. Control environment in which the staff work of plant operation ensures their protection by monitoring the amount of dust, noise and levels of toxic gases.
22. The type and nature of wastewater discharges determine the need for surveillance of the quality of surface waters. It would be necessary to measure the expected pollutants and quality parameters of importance for the maintenance of health and well-being water. All control of the less seasonal water quality may be necessary. A groundwater monitoring may be required if it is expected that they are polluted. This monitoring should

be carried out prior to the release site and downstream from the transmission where the receiving waters are used by the public or considered of ecological importance (e.g. Rivers, wells used for potable water or irrigation). A geophysical control may be required to determine the location of geological central conditions. If the proposed use of groundwater as cooling water, a pumping test may be necessary to determine the quantity and quality of them.

23. There is a need to undertake a biological monitoring if important biological resources are present near the project and perceived may suffer cooling effluent discharged into an estuary. Should, in this case, to take samples of the representative species of aquatic organisms. The receiving areas of importance for the air quality (eg . Species susceptible crops) as well as areas downwind of the stacks are likely to require a control if it is expected to appear effects perverse. The sampling will be seasonal. As for monitoring the social environment, it may be justified to ensure that infrastructure impacts do not exceed acceptable limits.

24. The monitoring program should be designed to provide, on the one hand, scientific data that determine the state of environmental resources affected by the thermoelectric project and secondly, information to predict its effects on the long-term information with regard to decisions on possible mitigation measures if the expected or actual impacts are seen as unacceptable.

**Table: summary of potential impacts and mitigation measures**

Potential negative impacts	Mitigation measures
<b>Direct impacts</b>	
<b>1</b> Effects of air emissions on human health, agriculture, local wildlife and vegetation	<ul style="list-style-type: none"> <li>• Locate the system away from atmospheric sensitive areas.</li> <li>• Designing chimneys height higher to lower concentrations at ground level.</li> <li>• Use of cleaner fuels (e.g. Coal with low sulfur content)</li> <li>• Install equipment to fight against air pollution</li> </ul>
<b>2</b> Increasing noise and vibrations	<ul style="list-style-type: none"> <li>• Call for equipment complying with more stringent standards.</li> <li>• Make sure to choose the times when noise and vibration have the least possible occurrence.</li> <li>• Install noise barriers</li> </ul>
<b>3</b> Alteration of the quality of surface and groundwater.	<ul style="list-style-type: none"> <li>• Treat on-site releases by chemical or mechanical methods (oil-water separators).</li> <li>• Contain groundwater pollution by using sealing materials.</li> <li>• Use deep injection wells below the drinking water areas.</li> <li>• Install sealants in basins and areas of solid waste disposal.</li> <li>• Dilute effluent from point sources</li> </ul>



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4	Toxic effects caused by chemical releases and spills.	<ul style="list-style-type: none"><li>• Develop prevention plans against spills.</li><li>• Develop systems for containment and trapping and chemically treat waste on site.</li></ul>
5	Aquatic organisms suffering from thermal shocks.	<ul style="list-style-type: none"><li>• Seek ways to heat dissipation (e.g. Closed cycle cooling).</li><li>• Reducing the thermal conditions in rejecting water in large water bodies.</li><li>• Install mechanical broadcasters.</li><li>• Cool water in tanks prior to discharge.</li><li>• Explore opportunities for using waste heat.</li></ul>
6	Carried aquatic organisms and compromise.	<ul style="list-style-type: none"><li>• Select areas where sampling effects will not be significant.</li><li>• Install screens to avoid deportation or obstruction organizations.</li></ul>
7	Alteration of the amounts of surface water and groundwater	Develop a plan to recycle water.
8	Changing the flow of surface water and discharges.	Building drainage systems and containment ponds on site.
9	Removal of vegetation and habitat loss.	<ul style="list-style-type: none"><li>• Select another site or another in order to avoid the loss of wetlands overall plan.</li><li>• Restore or create similar environments</li></ul>
10	Dredging and filling of wetlands.	<ul style="list-style-type: none"><li>• Select another site or a different plan in order to avoid the disappearance of the wetlands.</li></ul>

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- Restoring or creating similar habitats

**11** Dangers of chimneys, towers and distribution lines to birds.

- Place the chimneys and towers away from flight paths.
- Install baffles, lights and other devices visible.

**12** Displacement of human populations

- Choose another site or a different plan to prevent displacement.
- Involve members involved in the planning and resettlement program.
- Develop and install infrastructure developments that are socially and culturally acceptable
- Provide places of resettlement of populations.

**13** Traffic disruption.

- Implement traffic plans that integrate a staggering commissioning portions borrowed by the workers.
- Improve roads and intersections

**14** Alteration of historical and archaeological structures of importance or sites (e.g., churches, temples, mosques, cemeteries).

- Select another site or a different plan.
- Develop and conduct surveys designed to discover, restore, move or restore such structures (see "Cultural Heritage" section for more details).
- Install fencing in order to protect structures or land.

**15** Degradation of the aesthetic quality of historical, archaeological and cultural sites and

- Select another location or develop a whole different level.
  - Construct visual buffers (eg. Planting trees).
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landscapes.

<b>16</b>	Employees exposed to dust from ash and coal.	<ul style="list-style-type: none"><li>• Provide dust collectors.</li><li>• Keep dust levels <math>\leq 10\text{mg}/\text{m}^3</math>.</li><li>• Monitoring of the contents are free of silica dust.</li><li>• Provide protective masks if dust levels are excessive.</li></ul>
<b>17</b>	Employees exposed to toxic gases escaping from the boilers.	Maintain boilers adequately. <ul style="list-style-type: none"><li>• Exercise control levels by ensuring that levels do not exceed: 5ppmSO<sub>2</sub> 50ppmCO 5ppm NO<sub>2</sub></li></ul>
<b>18</b>	Employees exposed to excessive noise	Keep noise levels below 90 dBA otherwise provide earplugs.

### Impacts Indirects

<b>1</b>	Induced secondary development and increased demand in infrastructure	<ul style="list-style-type: none"><li>• Provide infrastructure plan and financial assistance to meet the increased demand.</li><li>• Construct facilities to reduce demand.</li></ul>
<b>2</b>	Changes in demographic characteristics, disturbance values and cultural and social patterns.	<ul style="list-style-type: none"><li>• Develop educational programs to educate workers on sensitive values and cultural characteristics.</li><li>• Provide programs of psychological adjustment and behavior and provide</li></ul>

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services relating thereto.

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