



Figure I-4 – Water Use and Balance

2. Impact Summary

The potential positive and negative impacts identified in the Environmental Impact Study (EIA) are summarized below:

- atmospheric dispersion studies indicate that the ground concentration of all pollutants produced by the operation of the Macaé Merchant Power Plant would be well below the maximum acceptable limits for air quality. The air quality in the region prior to project implementation was rated as satisfactory, with low concentrations of the pollutants evaluated. Therefore the project should not alter air quality significantly, not jeopardizing either the health of the community or the integrity of local flora and fauna.
- Noise level simulation studies were carried out for sixteen and twenty turbines, each generating noise levels of 85 dB(A) at one meter from the enclosures. This was combined with the background noise in the region, as measured during the baseline studies. Owners acquired 200 hectares of adjacent land, ensuring acceptable noise levels at the site boundaries, in compliance with the applicable legislation.
- The scale of the planned water intake to supply the Macaé Merchant Power Plant has been considered as acceptable for the existing and future demands for the water of the Macaé River downstream of the project, as indicated in hydrological and water demand studies and specific official authorizations.
- Effluents will be discharged into the Macaé River upstream from the water intake, with 86% of the intake make-up flow of approximately 300 m³/h used and evaporated in the process, not returning directly to the water bodies. The final plant effluent (approximately 43 m³/h in normal full load operating regime) that will return to the Macaé River will comply with the criteria established by Brazilian legislation and World Bank guidelines. These treated wastewaters returned to the Macaé River should produce measurable impacts only in the mixing zone, given the estimated minimum flow (Q_{7,10} – minimum average seven days, ten years recurrence) of approximately 17,500 m³/h.
- Around 3 m³/day of solid wastes (sludge) will be generated by the water treatment unit. Together with other solid wastes such as oil sludges, used filters, spent resins and empty chemical recipients, this will be managed according to Brazilian law and World Bank guidelines.
- The social and economic impact of plant operations will be favorable in terms of tax collection and income generation, although the number of direct jobs (55) will be low, as expected in any modern power plant.
- The additional generation capacity will boost the reliability and quality of the electricity supplied by the integrated

South / Southeast/Center-West system, fostering economic growth.

The summary of all operational impacts identified is presented in Table I.1.

For each impact identified, all possible sources are listed. An indicator of the impact is also presented in the Table, so as to measure the effectiveness of mitigatory actions and allow for a more quantitative re-evaluation of the project impacts. All the impacts listed were subject to a detailed evaluation, applying the following concepts:

- *Nature*: positive, when resulting in an improvement of the environmental quality, or negative if resulting in damage or deterioration of environmental quality.
- *Type*: direct, if caused by an action of the project, or indirect, if resulting from another impact of the project.

- *Duration*: temporary, when occurring in clearly defined periods, or permanent, when lasting for an unspecified period of time that may be longer than the project life;
- *Location*: tightly located, restricted spatial scope, or dispersed, when occurring in a widely-disseminated manner.
- *Significance*: low, medium or high, based on the analysis of the relative magnitude of the impact in relation to other impacts and to the environmental baseline established for the project area of influence.

Table I.2 presents a summary of the impacts and the related mitigatory and monitoring measures.

Table I.1- Operations Impact Assessment

IMPACT	SOURCE	INDICATORS	CHARACTERIZATION				
			NATURE	TYPE	DURATION	LOCATION	SIGNIFICANCE
01. ADVERSE EFFECTS ON AIR QUALITY BY ATMOSPHERIC EMISSIONS	• Gas Turbines	• Ambient and emitted concentrations of SO ₂ , NO _x , CO, PM and HC	-	⊙	∞	◆	○
02. ADVERSE EFFECTS ON ENVIRONMENTAL QUALITY IN TERMS OF NOISE POLLUTION, DUE TO OPERATION OF THERMO-POWER PLANT	• Gas Turbines • Other equipment	• Near field noise level • Far field noise level	-	⊙	∞	◆	○
03. REDUCTION IN THE AVAILABLE WATER IN THE MACAÉ RIVER DOWNSTREAM FROM THE UPTAKE POINT DUE TO WATER INTAKE	• Water Intake for Macaé Merchant Power Plant	• Volume of water in Macaé River • Water Consumption • Macaé River minimum flow (Q 7,10)	-	⊙	∞	◆	○
04. VARIATION IN THE WATER QUALITY DOWNSTREAM FROM THE POINT AT WHICH EFFLUENTS ARE DISCHARGED BY THE MACAÉ MERCHANT POWER PLANT	• Effluents Discharge	• Effluent pH, temperature, TSS, SS, O&G, Cl, BOD, N, Cu, phenol, Mn, Fe, PO ₄ , Zn, COD • Concentration in Macaé River of pH, temperature, O&G, BOD, turbidity, DS, Cl, PO ₄ , NH ₃ , Zn, Fe	-	⊙	∞	◆	○
05. GENERATION AND DISPOSAL OF SOLID WASTES GENERATED BY THE OPERATIONS OF THE MACAÉ MERCHANT POWER PLANT WATER TREATMENT STATION	• Sludge from plant water treatment station	• Volume of solid waste from plant water treatment station	-	⊙	∞	◆	○
06. IMPACTS ON VEGETATION CAUSED BY EMISSIONS OF ATMOSPHERIC POLLUTANTS	• Gas Turbines	• Ambient and emitted concentrations of SO ₂ , NO _x , CO, PM and HEALTHCARE	-	↻	∞	◆	○
07. IMPACTS ON BIRDLIFE CAUSED BY EMISSIONS OF ATMOSPHERIC POLLUTANTS FROM THE POWER PLANT	• Gas Turbines	• Ambient and emitted concentration of SO ₂ , NO _x , CO, PM and HC	-	↻	∞	◆	○
08. PREVENTION OF THE REGROWTH OF VEGETATION ALONG THE GAS PIPELINE		• Gas pipeline right of way	-	⊙	∞	◆	○
09. GENERATION OF JOBS BY OPERATION OF THE THERMO-POWER PLANT	• Plant Operations	• Demand for Labor	⊞	↻	∞	◆	○
10. BOOSTING THE ECONOMY BY POWER GENERATION	• Energy availability • Energy sales	• Increment in local income • Number of kW generated per year • Reais paid in taxes • Reais paid in wages	⊞	↻	∞	◆	○
11. RESTRICTIONS ON LAND USE FOR GAS PIPELINE / TRANSMISSION LINE RIGHTS OF WAY		• Gas pipeline and transmission line right of way	-	⊙	∞	◆	○

CLASSIFICATION

NATURE	⊞: positive	-: negative
TYPE	↻: indirect	⊙: direct
DURATION	∞: temporary	∞: permanent
LOCATION	◆: local	◆: disperse
SIGNIFICANCE	○: minor	○: medium
		○: high

Table I-2 – Environmental Impacts and Management Measures

IMPACT	MANAGEMENT MEASURES	OBJECTIVE	SCHEDULE/ FREQUENCY
01. Compromising of air quality by atmospheric emissions	Continuous emissions monitoring program Air quality monitoring program	Minimize impact on air quality	continuous before operation / continuous
02. Compromising of environmental quality in terms of noise pollution, due to the operation of the thermoelectric plant	Noise levels and emission monitoring program	Control and minimize noise and vibration emissions	continuous
03. Reduction in the available water in the Macaé River, downstream from site of the impounding as a result of water intake	None. Besides having little effect on the availability of water in the Macaé river, 14% of the water taken out will be returned to the Macaé river after due treatment	Return water to the Macaé river in good quality	continuous
04. Variation in the water quality downstream of the point at which effluents from the Macaé Merchant are discharged	Control on the discharge of liquid effluents Water quality and effluent monitoring program Adaptation of gas pipeline maintenance work to rainfall	Minimize impact on water quality	continuous continuous when needed
05. Generation and Disposal of solid waste arising from the operation of the Macaé Merchant Plant Water Treatment Station	Adequate disposal of residues	Reduce risks of contamination to minimum possible	when needed

Table I-2 – Environmental Impacts and Management Measures

IMPACT	IMPLEMENTATION MEASURES	OBJECTIVE	SCHEDULE/ FREQUENCY
06. Impacts on vegetation of the emission of atmospheric pollutants	Atmospheric emissions monitoring program	Reduce impacts on vegetation	continuous
07. Impacts on avifauna caused by emissions of atmospheric pollutants from the Plant	Atmospheric emissions monitoring program	Reduce impacts on avifauna	continuous
08. Prevention of the regrowth of vegetation along the gas pipeline	Signposting of the gas pipeline Gas pipeline maintenance work	Minimize damage or accidents along the gas pipeline	before operation continuous
09. Generation of jobs by operation of the Thermoelectric Plant	Priority in contracting local workers	Enhance positive impact	before operation
10. Boosting of the economy by energy generation	Pay taxes	Provide reliable energy	continuous
11. Restriction of land use in the right of way of the gas pipeline and the transmission line	Signposting of the gas pipeline and transmission line Control on access of areas nearby	Protect the right of way of the gas pipeline and transmission line	before operation continuous