

Environmental and Social Review Summary

Ghana Expansion and Enhancement of the Takoradi Power Project

This Environmental and Social Review Summary (ESRS) is prepared by MIGA staff and disclosed in advance of the MIGA Board consideration of the proposed issuance of a Contract of Guarantee. Its purpose is to enhance the transparency of MIGA's activities. This document should not be construed as presuming the outcome of the decision by the MIGA Board of Directors. Board dates are estimates only.

Any documentation which is attached to this ESRS has been prepared by the project sponsor, and authorization has been given for public release. MIGA has reviewed the attached documentation as provided by the applicant, and considers it of adequate quality to be released to the public, but does not endorse the content.

Country:	Ghana
Sector:	Energy
Project Operator:	The Volta River Authority (VRA)
Project Enterprise:	Société Générale Ghana Branch
Environmental Category:	B
Date ESRS Disclosed:	September 30, 2010
Status:	Due Diligence

A. Project Description

The proposed project is the Takoradi 3 expansion of the Takoradi Thermal Power Station (TTPS), which will be owned and operated by the Volta River Authority (VRA) with financing provided through a credit agreement between Société Générale-Canada Branch (SG-CB) and the Republic of Ghana (RoG). The 132 MW Takoradi 3 Thermal Power Plant (T3) is currently under construction within the existing TTPS complex and will increase total TTPS capacity to 792 MW when completed. T3 is designed to operate as a peaking power plant to provide additional capacity to the national grid during high demand and supplement base load during periods of low water levels when hydroelectric generation is affected. Overall, T3 will involve the construction and operation of the following:

- Four 25 MW Combustion Turbine Generators CTGs (open cycle);
- Four Once Through Steam Generators (OTSG);
- Two 16 MW Steam Turbine Generators (STGs);
- Four 88 ft. (27 m) stacks for each of the four STGs;
- Raw water storage;
- Cooling water system;
- Raw diesel fuel storage;
- Treated diesel fuel storage;
- Raw light crude oil (LCO) fuel storage;
- Treated LCO fuel storage; and

- Four continuous emissions monitoring systems, one per stack.

The project site is located in the district of Sharma Ahanta East, Ghana approximately 15 km northeast of the city of Sekondi-Takoradi and immediately west of the village of Aboadze.

Proposed plant, process and operations: T3 is designed as a combined cycle generating plant that will have dual firing capability to burn LCO as the principal fuel for operation and natural gas when available. Combined cycle power plants recover the high temperature turbine exhaust gases to produce steam. The four 25 MW CTGs will be equipped with heat recovery boilers that produce steam to supply the two 16 MW STGs, increasing output capacity from 100 MW to 132 MW. While heat recovery does not alter the composition of the gaseous emissions, the temperature of the exhaust gases released from the four 27 meter stacks will be reduced from approximately 499 °C during bypass operation (combustion turbine only) to 193 °C during combined cycle operation. Additional facilities and support buildings include cooling tower systems, fuel supply and storage provisions, water supply pipeline, and drainage facilities.

Transmission line: T3 will evacuate its power output through the existing 161 kV TTPS transmission line immediately west of the proposed site and running parallel to and north of the main Takoradi-Cape Coast Highway at Inchaban. The social and environmental impact resulting from the installation of this transmission line was thoroughly studied, subject to public consultation and disclosed in a prior Environmental Impact Assessment (EIA) and Supplementary Environmental Impact Statement (SEIS). No major structure will be added to or around the existing transmission lines to accommodate T3 and no social or environmental impact is expected.

B. Takoradi Thermal Power Station Complex

The 3.6 ha site allocated for T3 is within the TTPS complex, which comprises approximately 168 ha including, the 26.5 ha Takoradi 1 Thermal Power Plant (T1), 7.5 ha Takoradi 2 Thermal Power Plant (T2), a 72 ha township with recreational facilities and 58.4 ha of construction laydown area and wetland. The T3 site has already been partially cleared of vegetation during the construction of T1 and T2 and is bounded to the north and east by drainage channels and the Inchaban road, and bounded to the south by both T1 and T2 plants.

T1 is a 330 MW LCO and natural gas dual firing capable combined cycle thermal generating plant. The EIA for T1 was prepared in 1995 and the plant commissioned in 1997. T1 was designed to provide for expansion in order to accommodate future electrical energy demand growth and to double the plant's output from 330 MW to 660 MW. An SEIS was prepared in accordance with guidance from the Ghana Environmental Protection Agency (GEPA) for the Takoradi 2 Thermal Power Plant (T2) expansion in 1999 and a 220 MW simple cycle plant was commissioned in 2000. An Addendum to the SEIS was prepared in 2001 to fulfill World Bank Group (WBG) environmental policies and guidelines in support of combined cycle conversion of T2, which will increase the output capacity by another 110 MW when completed.

The VRA, who will own and operate T3, is a statutory corporation established by RoG in 1961 and charged with the primary functions of generation, transmission and bulk supply of electricity. The VRA owns and operates two hydroelectric plants with a total installed capacity of 1180 MW, two thermal plants in and around Tema with a third scheduled for commissioning by the end of 2010 providing a total capacity of 239.5 MW and T1. T2 is operated by Takoradi International Company (TICO), a joint venture between the Abu Dhabi National Energy Company (TAQA) who own 90% of the shares and the VRA who own the remaining 10%. The VRA has demonstrated adequate environmental and social management capacity for the TTPS.

C. Environmental and Social Categorization

The project is Category B under MIGA's Environmental and Social Review procedures. Construction and operations activities are expected to impact air, water, waste, noise, land use, community, health and safety, and workers health and safety (traffic and disease control). A draft EIA, a provisional T3 Environmental Management Plan (EMP) and the TTPS EMP adequately address the negative impacts identified for T3, as well as the cumulative impacts associated with TTPS complex.

As part of due diligence, MIGA's environmental specialist visited the project site in August 2010. MIGA's review of this project also included the environmental and social information submitted by SG-CB, the VRA, Export Development Canada (EDC), the Canadian Commercial Corporation (CCC) and responses to inquiries posed by MIGA's social and environmental specialists. The evaluation of the environmental risks and impacts of the project by EDC, who adhere to the IFC/MIGA Performance Standards, and CCC, who are subject to the federal Canadian Environmental Assessment Act, have all determined that the project is acceptable from an environmental and social perspective. Also, SG-CB, who has officially adopted the Equator Principles, has categorized the project Category B as a result of consultations with EDC.

D. Applicable Standards

While all Performance Standards are applicable to this investment, our current information indicates that the investment will have impacts which must be managed in a manner consistent with the following Performance Standards:

- PS1: Social and Environmental Assessment and Management System
- PS2: Labor and Working Conditions
- PS3: Pollution Prevention and Abatement
- PS4: Community Health, Safety and Security

PS5 on Land Acquisition and Resettlement is not applicable as expansion will be undertaken on TTPS's existing industrial property, therefore, no additional land will be acquired for the project. PS6 on Biodiversity Conservation and Sustainable Natural Resource Management is not

applicable as there are no designated sites of ecological or conservation value on or around the project site. PS7 is not applicable to this project as no indigenous people, as defined by PS7, live in the project affected area. Significant effects on cultural resources are not expected, though a “chance finds” procedure consistent with PS8 will be required as part of the Environment and Social Management Plan. The World Bank Group’s Environmental, Health and Safety Guidelines for Thermal Power Projects apply to this project.

E. Key Documents and Scope of MIGA Review

The primary documents reviewed by MIGA:

- Takoradi Thermal Power Plant Expansion Project (T3) – draft Environmental Impact Assessment prepared by HPI llc (Revision 5, June 2009)
- Takoradi Thermal Power Plant Expansion Project (T2), Addendum Environmental Report prepared by Jacobs Gibb (November 2001)
- Takoradi Thermal Power Plant Expansion Project, Supplementary Environmental Statement prepared by GIBB (March 1999)
- Takoradi Thermal Power Plant, Environmental Impact Assessment prepared by Acres International Limited (May 1995)
- Review of the Environmental Assessment Report (Revision 5, June 2009) by AMEC for CCC
- Takoradi Thermal Power Station Environmental Management Plan: March 2009-February 2012 (June 2010)
- Collective Bargaining Agreement between the Volta River Authority and The Public Service workers Union of GTUC (Effective January 2009)
- Volta River Authority Service Conditions for Senior Staff (January 2009)
- MIGA’s social and environmental review of this project also included a site visit (August 15-22, 2010) by MIGA staff.

F. Key Issues and Mitigation

PS1: Social and Environmental Assessment and Management Systems

Environmental and Social Assessment: A draft EIA was prepared for the T3 expansion in June 2009, referencing the prior 1995 EIA, 1999 SEIS and 2001 Addendum prepared for T1 and T2. This report has been reviewed by GEPA who are awaiting a revised final draft in order to provide the environmental permit. The draft EIA analyzed the following issues related to both project construction and operational phases: air and noise emissions, solid/hazardous waste management (generation and disposal), socioeconomic impacts, and community and worker safety. A provisional EMP was also included that outlines mitigation measures. In addition, the VRA is mandated by their 2005 Environmental Certificate from GEPA to develop and revise an EMP for the entire TTPS complex every three years. The VRA’s EMP for TTPS, covering the period for March 2009 – February 2012, has already been finalized. A revised plan will be

developed to include T3, thereby addressing the cumulative impacts associated with stack emissions monitoring, ambient air quality monitoring and effluent discharges.

The TTPS EMP provides information on the following: i) Corporate Policy on Environment, Health & Safety, ii) Predicted Impacts, iii) Current Environmental Management Practices & Impact Assessment, iv) Environmental Action Plan (EAP), v) Occupational Health And Safety Action Plan, vi) Emergency Preparedness And Response Plan/Contingency Plan, vii) Program to Meet Environmental Requirements, and viii) Cost/Benefits of Implementation of Environmental Management Plan.

Quarterly and annual reports on TTPS environmental performance and EMP implementation are required to be submitted to GEPA and the Ghana Energy Commission in accordance with permit obligations. TTPS operating procedures also require monthly environmental reports to be submitted to VRA management for recordkeeping purposes. The VRA Environment & Sustainable Development Department exercises general oversight over the environmental performance of the station and preparation of environmental reports, in coordination with on-site environmental officers.

The environmental reports produced during implementation of the TTPS EMP for the period of 2005 – 2009 identified challenges in the areas of monitoring equipment failures resulting stack emissions monitoring and ambient air quality monitoring data gaps and the gradual exposure of TTPS to beach erosion as a result of sand collection and removal along the shoreline close to the station by individuals and groups in the community.

PS2: Labor and Working Conditions

Approximately 320 workers are required for the construction of the facility, including 300 local laborers and 20 foreign supervisors and foremen. Laborers are recruited from within the surrounding communities and expected to live locally. Most construction activity is related to site preparation, erection of buildings, assembly/interconnection of various pre-engineered components and installation of utilities and services. Approximately VRA 30 employees will be required for the permanent operation of the facility. The Labour Act of Ghana (No 651 of 2003) consolidates and updates the former legislation and includes provisions to reflect ratified ILO Conventions. The VRA's Human Resources policy includes provisions for non-discrimination, terms of employment, retrenchment and a grievance mechanism, consistent with PS2. VRA has a collective bargaining agreement with the Public Service Workers Union.

T3 will have a slight to moderate beneficial impact with regard to employment opportunities due the worker requirements for the site preparation and constructions stages (approximately 50 for site preparations and a maximum of 300 for construction). This benefit will primarily last the duration of these stages (up to 2 years in total), although some further employment opportunities will be available during operations.

Worker health and safety: Potential occupational health and safety hazards identified include: noise and hearing loss, hazards associated with unsafe machinery, accidental falls and falling objects, potential for fire hazards, hazards associated with the process of welding, poor lighting, work environment temperature, poor ventilation. These hazards are mitigated through the VRA occupational health and safety (OHS) plan, which is applicable to all contractors and employees. The OHS plan provides a framework for the administration of health and safety activities; defines health and safety responsibilities, policies and objectives; provides a process for performance measurement and reporting; establishes inspection and review protocols for identification, elimination or control of potential risks; and develops compliance and communication interfaces.

PS3: Pollution Prevention and Abatement

The expected impacts from T3 site preparation, construction and operational activities include emissions to air, water, waste and noise.

Air quality: During the site preparation, construction and operation of T3, the following key issues may arise: dust generation during site preparation and construction, emission and dispersion of pollutants from stacks during operation and fogging and salt deposition from cooling towers during operations. Potential site preparation and construction impacts were assessed in detail in the 1995 TTPS EIA. The scale and significance of air quality effects associated with the operation of T3 were modeled in the draft June 2010 EIA, concluding that maximum concentrations of NO_x, CO, SO₂, PM₁₀ and PM_{2.5} will be negligible and consistent with GEPA air quality standards and WBG policies and guidelines.

Currently, NO_x and SO₂ are the main constituents, aside from carbon, in T1 and T2 air emissions. The impact of these pollutants is mitigated through LCO specifications that restrict sulphur content to below 0.2% and nitrogen content to 120 mg/l. NO_x control technology is also utilized, which involves the injection of water into the combustion chamber to reduce emissions below allowable limits. Additionally, T3 will feature a stack height of 25m to ensure dispersion of flue gas, reducing atmospheric concentrations and impacts on vegetation, equipment and buildings.

Water and wastewater: The water requirements for the construction of T3 are minimal and will be met by the existing TTPS dedicated 6" line and Demin Water facility. During operations, T3 water usage is limited to a 473 gpm closed loop cooling water system and 80 gpm water injection for emission control of NO_x. The water supply facilities were fully evaluated in the 1995 EIA Report and impacts were defined as negligible.

During site preparation, construction and operations activities there is potential for both suspended solids and other contaminants to enter the storm water channels. Wastewater generated from surface water and equipment commissioning will be discharged via the existing T1 and T2 effluent lagoons, after proper neutralization processes at the chemical cleaning lagoon. Storm water will be discharged to the existing site storm water channel.

All effluents produced during the operation of T3 will be discharged into the Final Discharge Sump of the existing T1 and T2 blowdown system. The water/sediment sludge mix from T3 operations will be discharged to the existing oil/water lagoon, where it is treated by gravity separation, allowing clean water to be discharged to the surface water channel and the oil to be held in a waste oil tank. Disposal of oily wastes will be removed off site via road tanker by certified waste oil reuse companies.

Currently effluent from T1 and T2 operations is discharged into the marshland to the west of the plant and the sea. The marshland receives all uncontaminated effluent, including the neutralization sump, oil/water separator system and storm water from rainfall runoff. Sewage from all offices in the plant and the VRA housing complex are all discharged into sewage ponds for treatment prior to disposal into sea. The treatment facility consists of three compartment sewage ponds arranged in series to ensure that the final discharge through the seawater cooling system outlet meets the designed allowable limits for Biological Oxygen Demand and Total Suspended Solids. No significant pollution load is expected from these wastewaters, however their quality is monitored for pH, Total Dissolved Solids and hydrocarbon content to assess compliance with GEPA guidelines. Wastewater discharges were fully evaluated in the 1995 EIA and were determined to have no significant impacts.

Noise: Noise levels associated with the site preparation and construction of T3 are not considered likely to significantly affect noise sensitive receptors due to the screening afforded by T1 and T2, as well as the scale of activities. A preliminary sound level assessment performed in 2009 indicates that the operation of T3 would increase the ambient sound levels at the nearest noise sensitive receptor by 6 to 11 db(A). Steam blows resulted in noise complaints during the commissioning of T1 and T2. The frequency and number of steam blows required during the commissioning of T3 will depend upon circumstances. The likely effect of steam blowing will be adverse, but short and non-recurring.

A complete preliminary environmental sound level assessment at the nearest offsite noise sensitive area, the VRA clinic (part of the VRA complex), indicates that levels are above the required guideline of 55 db(A) up to 1000 meters from the principal sources. Necessary mitigation measures will be implemented to comply with WBG and GEPA standards. Noise levels at the nearest residential area to the T3 site, approximately 2000 meters are within acceptable limits.

Current noise monitoring data indicates that TTPS is in compliance with GEPA limits, except at the western boundary of the plant where it is slightly exceeded as a result of T2 CTG's. The TTPS Noise Monitoring Program will be extended to accommodate and monitor T3 operations and mitigate adverse impacts as necessary. Currently, noise control measures are being implemented for T1 and T2 operations to minimize the impact of noise on workers and communities. Exhaust stacks have been provided with silencers behind the exhaust gas diffusers to reduce noise levels at the plant fence line. The gas turbines, which can generate as high as 120 dBA have been placed in acoustical enclosures to reduce noise levels to the

allowable 85 dBA at 1m distances from the enclosures. Caution signs have been placed at all high noise restriction zones and reminding workers of the mandatory use of hearing protective equipment in those areas.

Soil Erosion: The impact of erosion arising from the construction and operation of T3 will be similar in nature to the impacts produced by the construction and operation of T1 and T2. The construction of T3 requires for some earthworks, specifically preparatory land raising/grading and excavation for foundations. Potentially significant issues relating to the proposed earthworks include: vegetation cover loss from the borrow areas and in the area of the earthworks; erosion around the borrow areas; and traffic movements between borrow areas and the earthworks location. It is proposed to source the material required for T3 from the existing borrow areas created for T1 and T2. Since these areas have already been cleared of vegetation, further clearance will not be required.

There is a potential for soil erosion from poorly managed borrow areas, potentially creating problems with reinstatement and also leading to impacts on the local wetland ecosystems caused by sedimentation. Potentially significant erosion impacts can also occur if rehabilitation of the borrow areas is poor. This can lead to an unsightly visual impact. The impact of earthmoving equipment transporting material between the borrow areas and the T3 site will be localized due to the close proximity of the borrow areas to the site.

Wastes: Site preparation and construction wastes produced from T3 will be similar in nature to those currently produced at T1 and T2. These will include: spoil material from excavations and earthworks; packaging materials of wood, cardboard and plastic; empty chemical, oil and paint containers; scrap metal from construction and packaging; office waste; waste oil; and domestic garbage. The potentially significant impacts of the wastes generated include: soil contamination from leached toxic chemicals; public health risks related to improper waste management, such as pests and disease; and aesthetic impacts.

Solid waste from the town site and plant operation that cannot be recycled is collected and taken to an approved off-site waste disposal facility. A contract arrangement has been made with the Shama-Ahanta East Metropolitan Authority to collect all solid waste on regular basis.

Hazardous and toxic wastes produced at the site include used or contaminated oils, used industrial solvents, industrial corrosives and acids used for cleaning, de-scaling and other related processes. These wastes are treated within the wastewater system on site; no hazardous solid wastes are produced during construction or operation. The solid wastes produced by the construction and operation activities of T3 can be integrated into the provisions that have been introduced as part of T1 and T2. Unmanaged waste materials can lead to the contamination of land and water resources, health hazards and health and safety implications.

The LCO used to operate the CTGs is delivered by ocean vessels and transferred through 4.5 km undersea pipeline via an offshore Single Point Mooring system. Both onshore and offshore

handling activities that have potential for oil spills have been identified and measures to mitigate them outlined. An Oil Spill Contingency Plan has been prepared for the management of any oil spills, either offshore or onshore, to mitigate adverse impacts. All oil storage facilities on shore have been provided with bunds of sufficient height to retain the full content of the tank capacity in case a spill occurs. Oil spill exercises are carried out in collaboration with other relevant institutions to ensure preparedness to handle oil spills in case they occur onshore or offshore.

PS4: Community Health and Safety

T3 is located on the newly created Shama District, which covers a land area of about 215 sq. km and comprises 48 settlements located next to the power station complex. The potential impacts on community health and safety are likely associated with the site preparation, construction and operations of T3 include: pressure on existing community infrastructure; traffic safety; migrant influx; and public health.

Traffic: T3 site preparation and construction activities will involve increased traffic movements along all the primary access roads to TTPS. Estimated changes in traffic levels are an average of approximately 30 trucks and 40 cars per day. The access roads to the site established during the construction of T1 and T2 are adequate for T3 construction traffic, however new access roads may be required. Additionally, the primary access routes to and from site will be maintained throughout construction, i.e. no traffic diversion or road closure will be required, however there will be no significant disruption to non-TTPS related traffic on these routes and no significant cumulative increase in traffic flows are expected.

There will be no change to the designated access routes for T3 operational traffic. During operations, it is likely that commuter traffic (either by private car or public bus services) for TTPS will be minor given that the VRA township will house the majority of the work force. However, there is still likely to be a flow of equipment, resources and waste into and out of TTPS. This flow of traffic is not expected to represent a significant proportion of the total traffic flow present on the local road network.

Pressure on community infrastructure: Impacts associated with construction were addressed in a comprehensive Community Impact Agreement (CIA). The CIA is a continuation of a mechanism that was established during the construction of T1 and T2, which included discussions between VRA and the various stakeholders, including the local government, traditional authority and opinion leaders in the community. Through this process, the VRA established a Community Relations Unit (CRU), which serves as a liaison between itself and the affected local communities.

T1 CIA activities included 5 km of road improvements, completion of an 80-ton capacity cold storage facility at Aboadze, a planning layout for Aboadze and Aboesi, the construction of five school blocks, the construction of public places of convenience and a health clinic that serves both the Aboadze community and VRA township. On the basis of informal discussions

undertaken with members of Aboadze community and Shama Ahanta District Assembly for the preparation of the draft EIA for T3, it was understood that there has been a general growth in the size of the surrounding communities since the development of T1 and an increase in community amenities.

Migrant influx: The establishment of squatter camps or informal settlements is not expected during the site preparation and construction of T3 and no significant adverse impact is expected. Workers will be recruited from the local community and those who come from outside the area will be housed within the VRA township or in nearby towns, principally Aboadze.

Public health: There are concerns relating to the potential increase in mosquito breeding areas in bodies of still water, such as retention pond lagoons, sewage lagoons and the water reservoir, which in turn may have the potential to increase the incidence of malaria. Because site preparation and construction of T3 will not produce any additional areas of standing water, no significant change to risk of malaria breeding areas over and above that associated with T1 and T2 will occur. The potential cumulative adverse impact associated with an increase to risk of exposure to HIV/AIDS and other STDs for the T3 operational workforce exists, however it is not expected to be significant given that the T3 operational workforce will be small and housed in the VRA township.

F. Social and Environmental Permitting Process and Community Engagement

The Environmental Protection Agency Act 1994 (Act 490) provided GEPA with compliance and enforcement powers, including the authority to request an EIA and EMP. The Environmental Assessment Regulations 1999 (LI 1652) sets out the requirements for environmental permitting, EIA's, preliminary environmental reports, EIS's, environmental certificates and EMP's. Construction and operation of thermal power plants is one of the undertakings for which an EMP is required.

Consultation with the local community and other stakeholders was undertaken during the EIA process for all 3 TTPS power plants, including discussion of the details of community health and safety risks related to the projects. The outcomes of the community consultation were accounted for in assessing impacts and developing mitigation measures. Consultations and community dialogue will continue with regards community health and safety including engagement with the community in revision of the CIA.

A grievance mechanism has been established as part of the work of the VRA's CRU and will maintain an ongoing dialogue with both local and external stakeholders. The CRU serves as a liaison between the VRA and the affected local communities and community relations officer has been assigned to the TTPS for this function.

G. Availability of Documentation

The draft June 2009 EIA is disclosed as an attachment to this ESRS. Once the final EIA has been approved by the Ghana EPA, it will replace the draft EIA on the MIGA's website, at the project facility and at the EPA.