Environmental and Social Review Summary

Amandi Energy Independent Power Plant, Ghana

This Environmental and Social Review Summary (ESRS) is prepared by MIGA staff and disclosed prior to the date on which MIGA’s Board of Directors considers 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 MIGA’s Board of Directors. Board dates are estimates only.

Any documentation that 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: Power
Project Enterprise: Amandi Energy Limited (AEL)
Environmental Category: A
Date ESRS Disclosed: May 22, 2015
Status: Due Diligence

A. Project Description

MIGA has been requested to provide guarantees up to approximately USD 360 million for both equity investments in and loans to Amandi Energy Limited (AEL). AEL is a power company incorporated in Ghana to construct and operate a new 190 MW dual-fuel combined cycle gas turbine power plant (the Project), capable of operating on both natural gas and fuel oils (light crude oil (LCO) and diesel fuel oil (DFO). Initially, the plant will operate on LCO until natural gas becomes available. DFO will be used as a back-up fuel in emergency situations, or for operational purposes such as start-up and shutdown, as required.

The power plant comprises of one turbine coupled with a generator, one heat recovery steam generator and one steam turbine. The LCO will be delivered by tankers to a tee off the existing Single Point Mooring (SPM) owned and operated by the Volta River Authority (VRA) and then transported via an existing 4.5 km pipeline owned by VRA to the existing VRA Takoradi Thermal Power Plant Station Complex. From there, a new 1.3 km LCO supply pipeline will be constructed to the Project site and LCO will be stored in tanks onsite. The Project also includes the construction of a 1.2 km seawater intake pipeline (buried) and 600 m discharge pipeline (buried), water treatment (demineralization) plant, approximately 2 km of site access roads, a new 330 kV substation, and up to 1.3 km 330 kV overhead transmission lines to the existing 330 kV sub-station. The transmission line will be built, owned and operated by GRIDCo, Ghana’s national transmission company. The Project is intended to produce electricity for sale solely to the Electricity Company of Ghana (ECG). The Project will also utilize existing facilities operated by the VRA such as access roads and the SPM for fuel delivery. LCO will be supplied under a Fuel Supply Agreement with Vitol. DFO will be delivered by road tankers to the site from distribution companies in Takoradi and Tema. When available in sufficient and reliable quantities, the Project will switch to natural gas. Natural gas sources include the West African Gas Pipeline, Jubilee oil field, and/or
the Sankofa gas fields. Further assessment will be required prior to switching to natural gas once this becomes a more viable option.

The Project is located in the western region of Ghana at Aboadze, approximately 12 km from Takoradi, the western regional capital. The Project site is located in one of Ghana’s power enclaves and is adjacent (to the east) to the VRA Takoradi Thermal Power Station Complex comprising of three plants with a collective generating capacity of up to 760 MW (T1, T2, and T3). The other boundaries of the site are the Anankwari River to the west, beach and Atlantic Ocean to the south, and further marshland (including forest and mangrove) with bare/scrub ground at higher elevations to the north. The Project site was selected because of its proximity to existing infrastructure; access to LCO and gas supply; ease of electricity evacuation/ transmission; access to water; and for minimizing environmental and social considerations. It is being developed on a 62 acre parcel of undeveloped site designated for industrial development, leased from the Royal Family of Aboadze.

AEL will enter into an engineering, procurement and construction (EPC) contract with an international contractor (a consortium comprising GE and Metka) to construct the power plant to connect to the grid system and to commission the plant. The contract is expected to be carried out in conformance with all relevant environmental and social requirements. The gas turbine will be a GE 9E.04 which is an upgraded version of 9E.03 turbine. The 9E.04 turbine will have limited operating experience by the time the AEL plant is commissioned. The construction period is expected to last about 28 months, and under the concession agreement, operations will be for 25 years. AEL will create separate management companies to oversee the construction, and the operations and maintenance of the Project.

B. Environmental and Social Categorization

The Project is categorized as an A under MIGA’s Policy on Environmental and Social Sustainability (2013). Key potential risks and impacts associated with the Project during both construction and operation relate to energy use and greenhouse gas emissions, land acquisition and minimal economic displacement, biodiversity impacts (terrestrial and coastal), pollution typical of thermal power plants (e.g. air emissions, water supply and effluent, noise, hazardous and non-hazardous waste), cultural heritage, and occupational and community health and safety (e.g., live electricity, explosions, increased traffic). Based on current information, most of the identified project-related impacts can be avoided or reduced to acceptable levels through the application of the proposed mitigation measures, and impacts to mangroves are expected to be mitigated through a mangrove compensation program. Potential cumulative impacts related to the construction and operation of multiple power plants in the Takoradi power enclave is also discussed in this ESRS, including induced development in the area and potential need for coordinated emergency response capabilities.

C. 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: Assessment and Management of Environmental and Social Risks and Impacts
PS2: Labor and Working Conditions
PS3: Resource Efficiency and Pollution Prevention
PS4: Community Health, Safety and Security
PS5: Land Acquisition and Involuntary Resettlement
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resource
PS 8: Cultural Heritage

The Project does not involve impacts on Indigenous Peoples and therefore PS 7 is not triggered at this time.


D. Key Documents and Scope of MIGA Review

The following documents were reviewed by MIGA:

- Amandi Energy Limited – Ghana Stakeholder Engagement Plan Supporting the Environmental and Social Impact Assessment of 190 MW Combined Cycle Power Plant at Aboadze, Ghana (undated) (draft), prepared by AEL
- Presentations prepared by AEL and its consultants on the AEL Power Project (March 2015)
- Presentation given by VRA on its SPM (March 2015)
- Land title and registration documentation for the AEL Power Project site.

In addition to reviewing the above, MIGA’s due diligence included review of draft versions of the engineering, and environmental and social due diligence reviews undertaken by an independent consultant on behalf of potential lenders. MIGA participated in a site visit in March 2015 which was attended by one of the potential lenders and the independent environmental and social consultant for that lender. The site visit included touring the project location and surrounding area; meeting with project sponsors (including the international E&S consultant); District Chief Executive and District Head of Town and Country Planning (local planning authorities); community representatives from the Aboadze community, (including the Royal Family and Assembly Men (Government representatives in the Aboadze community)), Kwaku Anlo and Nyame tease villages, representatives from the local youth NGO, and women representatives from the Aboadze and Abuesi community; and meetings with national regulators (Ghana EPA and Ghana Energy Commission). Furthermore, email correspondence among the potential lender, project sponsor, and independent consultant provided additional detail on E&S matters such as stack
emissions, ambient air quality and noise baselines, and flood risk / potential impacts related to climate change.

E. Key Issues and Mitigation

PS1: Assessment and Management of Environmental and Social Risks and Impacts

*Environmental and Social Assessment:* Although the Project has already received an environmental permit from the Ghanaian Environmental Protection Agency (Ghana EPA), the environmental impact assessment prepared by a local consulting firm was updated to meet international environmental and social requirements and to incorporate further onshore and offshore baseline and modeling findings. This updated ESIA consolidates all the environmental and social information and studies on the Project, and reflects commitments made in the national environmental impact assessment. AEL will submit a copy of the updated ESIA and a summary of new commitments to Ghana EPA for their records. Analysis of alternatives was not included as part of the updated ESIA given that the site was designated for industrial development; however, justification supporting the proposed location was included. Ambient air and noise measurements were taken as part of the updated ESIA (noting that one of the smaller existing power plants was not operational for the last part of the survey period). Requirements for carrying out continuous monitoring and to monitor short-term air emission concentrations are included under PS 3 to verify modeling results. The ESIA identified major impacts and proposes mitigation measures for construction, operations, and decommissioning. The scope of the updated ESIA is limited to assessing LCO as the primary fuel for the 190 MW power plant (which is considered the worst case scenario compared to operating on natural gas), and thus further assessment will be required prior to switching to natural gas as the main fuel source. A detailed decommissioning plan will be required two years prior to commencing decommissioning.

The updated ESIA identifies and assesses the potential risks and impacts associated with the Project and provides management, mitigation and enhancement measures in a robust draft Environmental and Social Management Plan (ESMP). This ESMP will be finalized prior to commencing construction activities to ensure consistency with the Owners’ Environmental, Social, Health, and Safety (ESHS) Requirements and will include updates to supporting management plans and systems, and further details on budget and resource allocations. AEL will provide to MIGA a final ESMP to comply with PS 1 requirements. The Owner’s ESHS Requirements will also be incorporated into key contractual agreements such as the EPC contract and other suppliers.

A pre-financial close Environmental and Social Due Diligence Review was undertaken by the lender’s independent consultant against Ghanaian Requirements, the IFC/MIGA Performance Standards and the Equator Principles. The due diligence included review of the updated ESIA, national environmental impact assessment, and E&S related project documents provided by AEL up to April 29, 2015 and a site visit. The findings of this due diligence review did not identify major E&S related issues or fatal flaws but has identified areas requiring further attention to achieve compliance (which are mentioned throughout this ESRS). In its updated ESIA, AEL has committed to comply with the Performance Standards and thus gaps to be addressed will be reflected in an Environmental and Social Action Plan (ESAP). This ESAP will be disclosed through this ESRS when it is agreed with MIGA’s Guarantee Holder and prior to MIGA presenting this Project to MIGA’s Board for approval.
Management Program and Monitoring: The primary responsibility of ensuring that environmental and social commitments are met throughout the life cycle of the proposed Project shall be retained by AEL. AEL will establish an environmental and social management system (ESMS) to support the implementation of its ESMP and supporting plans in compliance with PS 1. This ESMS will include an overarching environmental, health, safety and social policy applicable to the Project identifying its commitments to national requirements and MIGA Performance Standards. The ESMS will be based on the principles of plan-do-check-act, and will include commitments for continuous improvement. AEL is committed to providing resources essential to monitoring the implementation of the integrated ESMS and ESMP, which include hiring qualified specialists, as required. Environmental and social policies and procedures will be developed as part of the ESMS and will be disclosed to workers and communities. Supporting management plans will be further advanced and shared with contractors and MIGA prior to activities commencing on the site.

As part of its agreement for use, given the age and condition of the existing SPM, VRA will upgrade its SPM to ensure it meets current E&S requirements. AEL is committed to remaining in close contact with VRA to ensure the Project’s ESMP will incorporate relevant mitigation and monitoring measures related to AEL’s use of the SPM which are to be implemented by AEL. VRA has shared its Spill Response Plan with AEL and indicated it will review this Plan as part of its efforts to modernize the SPM. The revised plan will be shared with AEL.

As per the Ghana EPA environmental permit, AEL will supply EPA with a Construction/Works Program ahead of construction; half yearly monitoring reports and annual environmental reports during operations, an operations ESMP (including an Oil Spill Contingency Plan) and integrity check reports on the fuel receiving pipeline/storage every two years; and a Decommissioning and Site Closure Plan prior to decommissioning the plant. Contractors will be required to provide ESHS performance reporting on a regular basis to AEL and include audits in their respective Contractor ESMP. E&S monitoring reports, semi-annual during construction and annual during operations, covering compliance with Ghanaian requirements and Performance Standards will be submitted to MIGA.

Organizational Capacity and Training: Although AEL does not have direct experience in construction management of a CCGT project, Aldwych (one of the sponsors) does have experience in construction management of a diesel generator combined cycle power project in Africa. Support will be provided by the Owner’s Engineer (Parsons Brinkerhoff). AEL will establish a construction management team with qualified specialists to supervise the EPC contractor’s work. AEL will establish an Operations and Maintenance (O&M) company to carry out day-to-day O&M of the plant. GE will undertake maintenance of the gas turbine under a long-term service agreement. A detailed Project organogram will be developed which will clearly identify E&S roles and responsibilities as part of the ESMS, in line with PS 1 requirements.

GE will be the EPC contractor manager responsible for overall project management, design, equipment supply, and overall management of commissioning, start-up and testing. Metka will be responsible for detailed design, supply of the balance of plant, civil works and erection. Both parties of the EPC contractor have significant experience with CCGT plants; however experience in Ghana is limited. Contractors will be required to provide sufficient resources (including onsite supervisors during all works) to manage the E&S aspects of their work. They will be required and responsible for the training and awareness of their staff on the Project environmental and social setting, potential environmental and social impacts of their work activities, management and mitigation
measures, and the existence of, and importance of complying with, the Project’s ESMP, including relevant interfacing with contractor’s management systems. Contracting parties to AEL will be monitored by AEL on implementation of relevant Project’s environmental, social, health and safety requirements.

Emergency Preparedness and Response: Safety related systems will be designed to ensure the safe control and operation of the plant, including an emergency shutdown system; gas turbine, steam turbine, and HRSG protection systems; and fire detection and protection systems. A detailed hazard and operability study will be carried during detailed design to identify potential hazards and appropriate mitigation. The updated ESIA includes a commitment to develop and implement an emergency preparedness and response plan for construction and for operations. The EPC Contractor will develop such a Plan prior to commencing construction works and will submit the Plan to AEL and to MIGA for review. AEL will develop a Plan prior to commencing operations and will submit the Plan to MIGA for review.

An Oil Spill Response and Management Plan (OSRMP) will be developed in accordance with the Ghana EPA National Oil Spill Contingency Plan guidance documents and will be submitted to MIGA. An OSRMP will take into consideration the oil spill response plans of the adjacent VRA Complex and other future development to account for additional volumes of oil which could be stored and transported through the pipeline and identify new or increased hazards and risks associated with these changes. This Plan will include training for response and management of oil spills and suitable equipment will be available onsite to effectively respond and manage oil spills of varying scales. The Project will coordinate with the National Oil Spill Reporting Centre.

Cumulative Impact Considerations: In addition to the three units already operating, Ghana EPA have identified several other companies as having intentions to develop an independent power plant in the Takoradi Power Enclave, including:

- Takoradi 4 (VRA): 190 MW
- Ghana 1000 (GE, Endeavour Energy and Eranove), phased development up to 750 MW (phase 1 at 125 MW)
- Jacobsen IPP (Jacobsen), 360 MW
- Globelez IPP (Globelez), 400 MW

The timing of the above developments – and whether they will be developed at all – is uncertain at this time. AEL has indicated that its Project will likely be the first power project to commence construction in the Takoradi power enclave. AEL will be required as a condition of MIGA’s Contract of Guarantee to monitor these developments and, where possible, incorporate measures to mitigate potential impacts into their ESMP. Further discussion is provided under PS 3 and PS 4 in this ESRSo. Cumulative impacts will vary depending on whether construction of different projects occurs in parallel or at different times. If multiple construction projects occur in parallel, key cumulative risks include: shortage of skilled workers; increased in-migration and a large migrant workforce population; increased construction traffic and associated road congestion; and increased noise emissions. If the different projects are phased in, the cumulative construction impacts will be somewhat mitigated; however, the following potential cumulative impacts during operations are still likely to occur, including competition for skilled workers; increased demand for existing infrastructure (e.g. the SPM); and noise and air emissions.
A voluntary working group of existing and future power producers and local authorities has held several meetings over the past few months to discuss development in the Takoradi power enclave. At this time, it appears that each power project is addressing its own needs and regional initiatives are yet to be developed. It is understood that the joint development of the Takoradi Power Enclave by the IPPs / VRA will consider the outcome and the issues that arise from proposed Ghana EPA’s cumulative environmental and social assessment of the enclave.

**PS2: Labor and Working Conditions**

*HR Policy and Procedures:* Approximately 700 jobs will be created during peak construction (with an average of about 300-350 jobs) and up to 80 jobs in the operations phase. The majority of these positions will be sourced locally or within the region with less than 10% of management positions being filled by expats. Although AEL is confident that a qualified workforce exists locally in sufficient volumes and with skillsets to cover construction and operations, timing of needing such a workforce should take into account, where possible, traditional fishing activities carried out by nearby communities in case conflicts in priorities exist. As part of the Labor Management Plan (LMP), a skills matrix and hiring plan can be developed, if necessary, to identify potential skillsets which might not be readily available locally such as welding or other trades.

AEL will develop a Human Resources Policy which aligns with PS 2 requirements, including a worker grievance mechanism, and will develop labor procedures to protect core labor standards which will be submitted to MIGA for review. AEL will retain overall responsibility for compliance with PS 2 and will development management and monitoring procedures for its contractors’ human resource policies, procedures, and practices. The EPC Contract will include requirements to comply with PS 2. Mechanisms to liaise with local communities regarding workforce requirements will be reflected in the LMP, Stakeholder Engagement Plan (SEP), and specific contractor agreements. A recruiting procedure will be communicated as part of the LMP and SEP.

As the workforce is expected to be filled locally, provision of workers’ accommodations is not anticipated except for senior management and supervisory positions. AEL and its contractors will provide workers’ accommodations in line with the IFC/EBRD guidance note on “Workers’ accommodation: processes and standards”. The location for this accommodation is not yet decided but will be near the Project site.

*Occupational Health and Safety (OHS):* Separate plans will be required for occupational health and safety procedures. The draft ESMP in the updated ESIA includes a fire prevention plan; however, detailed plans addressing other aspects of OHS are yet to be developed by AEL and its contractors. These plans will be submitted to MIGA for review prior to construction. AEL will be required to monitor and audit its staff and its contractors.

*Supply chain:* AEL will conduct a primary supply chain review to identify potential risks of child labor, forced labor, or significant OHS issues in the primary supply chain.
PS3: Resource Efficiency and Pollution Prevention

The following section provides a summary of key impacts and mitigation presented in the updated ESIA (including the draft ESMP). The updated ESIA references other industry standards as well as Ghanaian and WBG requirements, and thus the Project will be required to meet the more stringent emission or effluent parameters which will be clearly identified in the revised ESMP. Robust monitoring programs for both point source and ambient concentrations will be implemented during construction and operations to assess the Project’s performance and effectiveness of the mitigation measures.

**Greenhouse gas emissions:** The Project’s greenhouse gas emissions will primarily be carbon dioxide, and are estimated to exceed 900,000 tonnes of carbon dioxide equivalent (CO2e) annually during operations. The plant is using the best available technology, and the estimated emissions are consistent with emissions typically expected from a plant with the same fuel type and plant size in this region. Where possible, energy efficiency initiatives will be implemented. As soon as natural gas becomes available, the Project will switch to natural gas as the primary fuel source, which is expected to reduce emissions.

**Resource efficiency:** Resource efficiency was considered in the ESIA for water usage. Aspects of water efficiency were applied in assessing technology between water and air-cooling condensers. A water management plan for each phase of the Project will be developed prior to starting construction to monitor consumption.

**Noise and vibration:** Noise will be generated by construction traffic; however, it will be of temporary nature and limited to daylight hours. Mitigation includes keeping construction equipment in good working order, using approved transportation routes, and installing good international industry practice (GIIP) enclosures for equipment producing high noise levels, etc. Vibration impacts during construction were considered to be negligible. Operational noise impacts are described under PS 4 given the potential impacts on a human receptor. Mitigation measures will include housing noise generating equipment (including transformers) in acoustic enclosures, fitting equipment with high performance silencers, and using low noise emission fans. Operations vibration is expected to be imperceptibly low and not to have a significant effect on structures or humans within a 1 km radius of the center of the Project site.

**Air quality:** Air emissions from the Project will primarily be dust/particulates during construction and stack emissions (sulphur dioxide, \( \text{SO}_2 \)), nitrogen oxides (\( \text{NO}_x \)) and carbon monoxide (\( \text{CO} \)) during operations. Potential construction dust impacts were based on the UK’s Institute of Air Quality Management (IAQM) “Guidance on the assessment of dust from demolition and construction” (February 2014). Based on this guidance, sensitive receptors were identified within 350 m of the site boundary and/or within 100 m of the routes used by construction vehicles on public highways and up to 500 m from the site entrance. The study concluded there were relatively few properties within the construction dust assessment study area and that closest properties were between 50 m and 100 m from the site boundary. Dust mitigation during construction may include dust suppression, installing enclosed chutes and conveyors, and spraying water where appropriate.

During operations particulate matter and CO emissions will be minimized by using advanced process control systems and monitoring the combustion process to maximize efficiency. \( \text{SO}_2 \)
emissions will be mitigated by only accepting LCO with fuel sulfur content of less than 0.2% weight and DFO with fuel sulfur content less than 0.3% weight. Nitrous oxides (NO\textsubscript{x}) emissions from the gas turbine will be reduced through water injection, which is typical for LCO operation. To meet WBG stack emissions for thermal power plants, AEL undertook a comprehensive stack height assessment, which resulted in adjusting the stack height to 65 m. After completing the updated ESIA, AEL evaluated the nitrogen content of potential fuel and realized that the fuel specifications provided may result in exceeding WBG stack emissions for NO\textsubscript{x}. Thus, AEL amended the EPC Contract and Fuel Supply Agreement to change the fuel quality specification and to source fuel to meet this specification. In addition, should continuous monitoring demonstrate that the stack emission parameter is not being met, the Project will incorporate other mitigation measures such as undertaking additional assessment, if required, and/or installing a Selective Catalytic Reduction (SCR) system within the HRSG. If an SCR system is needed, a supplier for ammonia will be identified and appropriate safety measures will be implemented for safe storage and handling.

The quantitative assessment of impacts during operations used AERMOD dispersion modeling. The results of the dispersion modeling for exhaust emissions have been compared to Ghanaian ambient air quality standards and to international standards and guidelines. Taking into consideration existing baseline pollutant concentrations and the maximum contribution from the Project, no exceedances of any ambient air quality standards were modeled. This will be verified through a continuous emissions monitoring system during operations.

Given the lack of robust background air quality data for the vicinity, AEL carried out a two week data collection program out in early February 2015 to determine existing air quality parameters. Based on the short data collection period, ambient air quality monitoring will be required to commence prior to construction and ongoing through construction and operations in order to determine the incremental impact of this Project. Data collected in February indicates that the area does not appear to be degraded.

Water quantity and quality: During construction, a small amount of water will be needed for construction works and worker personal hygiene. This water will be brought in by tanker and therefore no surface water or groundwater abstraction will be required. During operations, water will be used at the plant for make-up water in the water/steam cycle, service water (including water injection in the gas turbine to reduce NO\textsubscript{x} emissions), fire water and potable water. The overall water requirements for the Project during operation is approximately 1200 m\textsuperscript{3} /day (approx. 14 l/s), with the principle water requirement for emissions control within the gas turbine combustion chamber. Seawater will be provided through a screened intake pipeline and will be desalinated and demineralized in an onsite reverse osmosis plant. Water of sufficient purity will be produced for water injection into the gas turbine for NO\textsubscript{x} control and make-up water into the water/steam cycle. Approximately 45% of the abstracted water will be lost to evaporation and discharge as water vapor in the flue gases, and the remaining 55% will be returned to the Atlantic Ocean. Given the low loss and nature of the source of this raw water, no significant impacts to availability of water resources is anticipated.

Impacts to water quality can occur through site effluent discharges, elevated temperatures, concentrations of dissolved solids or heavy metals (cadmium, mercury), hazardous materials spills, and potential changes to surface water drainage. During construction, effluent from the Project will include sanitary waste, oily water, and stormwater runoff. To prevent impact on water quality,
Septic tanks will be installed to manage sewerage and domestic waste water, and construction works and cleared areas will be appropriately designed and rehabilitated to prevent erosion and sediment transport. Oily water will be trapped in oil/water separators and oil removed prior to discharge. The EPC Contractor will establish a water monitoring program for the construction phase.

During operations, effluent from the Project will include sanitary waste, surface water runoff, and oily water. Heavy metal contamination will be mitigated by the Project not sourcing chemicals with cadmium and mercury. A surface water drainage system will be designed to drain areas of the site unlikely to be contaminated with oil. Waste water will be treated according to its source prior to discharge. While Project-related water impacts to the ocean are likely quite small, effluent will still be required to meet the effluent discharge requirements of the WBG Thermal Power Guidelines. Potable water will be tested to ensure compliance with Ghanaian and World Health Organization parameters.

**Disturbance to soils and groundwater:** Limited soil and groundwater sampling within the Project site has revealed elevated levels of arsenic in the soil. Thus, measures based on GIIP will be implemented during construction to minimize mobilizing existing contaminants. Monitoring of soils and groundwater conditions will be carried out.

**Hazardous materials:** Oils, greases, lubricants, cleaning substances and materials, laboratory chemicals, ammonia, and other hazardous materials will be stored in appropriately bunded and secure areas within the on-site stores. Bunds will be impermeable and sized to contain 110% of the volume of stored hazardous materials. Transformers will be provided on-site to allow the plant to connect to the national grid. All transformers will be oil filled (no polychlorinated biphenyls), and will include secondary containment. Spill response plans and procedures will be developed as part of the revised ESMP.

**Waste:** Wastes generated during construction will include spoil, packaging, and scrap metals. Construction wastes will be sorted and sold to secondary users while remaining solid waste will be sent to the municipal landfill. Waste from the Project during operations (including the desalination plant) will include, for example, used gas turbine air intake filters, used ion exchange resins, used membrane systems, separated oil/sludge from oil/water separators, sludge from the LCO pretreatment equipment, used oil, chemical containers, sanitary waste and domestic waste. Wastes will be returned to the original supplier where possible, or removed by an appropriate licensed contractor for disposal in an appropriate way. Disposal of all such solid wastes will be carried out under a service agreement between the Project, VRA Power Complex, and the Shama District Assembly Waste Management Department. All hazardous waste disposals will be monitored by AEL. A waste management plan will be developed by the EPC Contractor as part of the ESMP and will be reviewed by AEL and MIGA.

**Potential impacts from climate change, including flooding:** Parts of the Project site are waterlogged due to storm water drainage from the adjacent VRA Takoradi complex and the high water table. The ESIA recommends that the site is raised approximately four (4) meters above sea level to prevent flooding and to align with the existing ground level at the Takoradi complex. Fill for the site will likely be sourced from locations within the Project site as well as licensed nearby borrow pits and inland suppliers. Approximately 360,000 m³ volume of fill will be required during site preparations. Design specifications further recommend elevating building ground floor levels about 20 cm above this general platform. These mitigation measures will be reviewed once the Flood
Risk Assessment is completed. This Assessment will take into account potential impacts related to changes in climate and will propose adaptation and mitigation measures. It will also consider the cumulative effect of proposed infrastructure/plants, including runoff of the AEL Project and others into the River. Based on the findings of this assessment, mitigation and monitoring will be updated as needed in the ESMP.

*Cumulative impacts:* There is definite potential for cumulative impacts as a result of the construction and operation of the Project in conjunction with those other developments identified in the vicinity of the Project; the main impacts identified are air quality and noise. AEL will use air quality monitoring results to ensure that the plant’s in-built mitigation is sufficiently meeting national and WBG emission parameters for the Project, including cumulative impacts from future plants and projects. Should the monitoring find that those commitments are not met, further mitigation will be considered. It is also recommended that AEL develop a strategic airshed modeling and monitoring plan in partnership with current and future power plant operators and Ghana EPA.

The updated ESIA considered qualitative data for predicting cumulative noise effects and assumed that future power plants would be using similar CCGT power generation technology. Estimates are that noise levels will increase by approximately 10 decibels above the levels modeled for the AEL plant running in isolation. Thus, further mitigation may be required by both AEL and other power plant operators. AEL will remain engaged with other project developers and local authorities to monitor and address cumulative impacts related to the Project’s activities and operations.

**PS4: Community Health, Safety and Security**

The Project will be located in the Shama District of the Western Region of Ghana. The site is located approximately 2 km west of Aboadze Township, 5 km south west of Shama and approximately 12 km from Takoradi, the western regional capital of Ghana. Other nearby towns include Esipon (1.8 km away), Abuesi (3.5 km away), and Inchaban (2 km away). The highest population center in the vicinity of the power project is Aboadze town (approx. population in 2010 was 9,471). Aboadze, together with the neighboring town of Abuesi, currently have a combined projected population of approximately 19,000.

VRA Township was developed by VRA to house its staff and their families next to the VRA Takoradi Complex and is made up of self-contained residential units to accommodate approximately 300 people. The VRA Township has an international school up to the level of high school. Amenities within the VRA Township include a club house for recreation and a hospital.

Other potential receptors in the surrounding area include a single house (Malam village, located 1.4 km away) and a small village of four thatched mud houses (Kwaku Anlo) located approximately 910 m from the northern perimeter within the proposed site of another power project; thus it is expected that the Kwaku Anlo village will be resettled by the respective power project developer. Nyametease Village, located 1.5 km away, consists of six households (population of 41) and is located close to another power project and will be resettled by the respective power project developer. An orphanage located 1.3 km north of the Project site is due to be relocated by the same prospective IPP developer. Should some of or all of these other power projects not go forward, AEL will re-evaluate potential cumulative impacts on these receptors to determine appropriate
mitigation measures (including potential resettlement carried out to meet PS 5). If the other power projects were not to go ahead, the overall cumulative impacts would likely be reduced. Therefore the need for further mitigation would be expected to be negligible. In addition, a cluster of five town houses, a single residence and beach house, and a two bedroom house are currently under construction (330m, 500m and 600m respectively away from the western boundary) on the other side of the River Anankwari from the Project site. Modelling has indicated that one nearby receptor (a house) may be impacted by nuisance noise levels; if monitoring indicates that noise limits are exceeded, appropriate mitigation will be provided for this receptor.

The Project site is located on the coast and as per national requirements, the Project will be developed in such a way to maintain a clear beach site line. A 20m exclusion zone is being observed between the River Anankwari and the site. Historically, the beach front stretch has been observed as an unofficial restricted area by the Ghana Navy to protect the West Africa Gas Pipeline and the VRA Takoradi Power Plants (1 km distance from the pipeline and plants). Therefore, there is very limited public access, although occasionally some members of the public are spotted on the beach. In the immediate vicinity of the site, the local population has full and unobstructed access to land, to the River Anankwari and to the sea (apart from security restrictions). Access to land and the sea from Aboadze town will also not be impacted. The town’s fish landing beach is approximately 2 km from the Project site, and will not be affected.

Heavy equipment and supplies are expected to be delivered to Takoradi Port and transported to site by road. At peak of construction, approximately 50 heavy goods vehicles and approximately 100 light vehicles and busses per day may travel to / from the Project site. Traffic management plans will be required to ensure that community health and safety considerations are adequately addressed and communicated as part of the SEP. Construction activities will be limited to daylight hours on a best efforts basis. Should extended hours be needed, AEL will notify the local authorities and will communicate this change in work schedule to surrounding communities.

Although Ghana has a national oil spill response plan, AEL will ensure its emergency response plan and equipment will be sufficient to address its own emergencies and will ensure coordination with local officials. The Project’s emergency response plans (including for potential explosions) will include communication protocol with nearby communities to share information and communicate risks. Mock emergency response drills will be held with all relevant stakeholders. Although there is already an existing VRA power complex near the site, capacity building with local communities will be carried out to remind of the hazards associated with fuel pipelines and operations of a power plant. Should additional IPPs and projects become operational, a coordinated and regional approach to emergency response may be warranted with a regional simulation drill.

AEL has committed to hire as many people as possible from the surrounding local villages and towns; however, due to the need for skilled labor, a large proportion of the Project’s workforce is likely to be hired from outside of the local villages. This will lead to an influx of migrant workers in the surrounding areas and thus could lead to positive and negative impacts such as additional economic advantages selling goods and services to migrant workers, increased pressure on land availability and existing facilities and services, disruption to local communities (increase in crime and anti-social behavior), and increase in prostitution leading to higher risk of sexually transmitted diseases. AEL and its EPC Contractor will ensure the revised ESMP includes measures related to protecting the surrounding villages / communities. AEL and its EPC Contractor will implement a Code of Conduct for its workforce and will work with local authorities, village Chiefs and their
staff, and municipalities to address Project-related impacts. It will also collaborate with the Metropolitan Health Directorate to increase workers’ knowledge on preventive health practices within the work site. Impacts related to influx and induced development will likely be compounded should other IPPs and projects develop simultaneously as the AEL Project.

Security Arrangements: The Project site will be fenced and access with be controlled through an attended site access gate. Closed circuit television cameras will be installed within the site. Security guards will be contracted and the requirements of PS 4 will be reflected in the Project’s security plans and procedures, which will be submitted to AEL and to MIGA for review.

PS5: Land Acquisition and Involuntary Resettlement

The Project site has been identified for industrial development. AEL signed a fifty year lease with the Royal Family of Abroadze for use of the project site on a willing lessor / lessee basis. AEL has signed a Joint Services Agreement (JSA) with VRA which covers Right of Way (ROW) for the LCO pipeline and access road passing through the VRA and T2 plant area. AEL does not have the authority to expropriate land for the Project or impose legal restrictions on land use if lease negotiations failed. A land dossier summarizing the process and documenting the meetings was prepared and submitted to MIGA which describes the negotiated and voluntary land settlements for the Project site and required rights-of-way.

As part of the lease agreement, AEL engaged the Land Valuation Division of the Ghana Lands Commission (Sekondi office) to determine the compensation for the crops (coconut, oil palm, mango, cassava, maize, okro, eggplant, tomato and peppers) and the identified infrastructure within the site, including a salt pan and an abandoned building foundation. Through consultations with direct project affected people (members of the Royal Family of Abroadze), AEL determined that they did not rely on these crops as their main source of livelihood. Valuations determined that the crop patches were past their optimal conditions and productive lifetime, nor were they being regularly tended. Compensation for lost crops was calculated based on replacement cost. Public access to the beach and to the Anankwari River will be maintained except in those areas already identified as ‘restricted areas’ due to the safety of the West African Gas Pipeline and VRA Complex. Thus, fishing is not generally carried out near the Project site and economic compensation is not required unless impacts result from a Project-related offshore oil spill.

Involuntary land acquisition and resettlement may be applicable for the 50 m right-of-way (ROW) for the 1.3 km transmission lines (one segment of 600 m and another segment of 700 m). It is possible that only the 700 m transmission line will be constructed should Gridco’s expansion of the existing substation be completed prior to the Project evacuating power. This acquisition for the associated facility will be government-led as GridCo is a government entity. AEL will be responsible for ensuring that government-led land acquisition and compensation is carried out in line with PS 5 requirements and that the (supplemental) plan for land acquisition and compensation is submitted to MIGA for review prior to commencing related activities. Current baseline information shows physical resettlement is not anticipated. Economic displacement is expected to be minor as no farming is taking place on the land and the ROWs pass between the Project site and the VRA power complex. AEL will coordinate stakeholder engagement with GridCo to ensure that land owners and users are informed of the ROW requirements and that a grievance mechanism is available and implemented for affected persons. Updates on this process will be provided to MIGA.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resource

Based on desktop research and field surveys, no known protected areas were identified in the updated ESIA within the Project site or surrounding areas. The ESIA identified potential impacts to biodiversity and ecosystem services, which are summarized below. During construction, site clearing will result in permanent and temporary terrestrial and coastal and marine habitat loss; it may also result in mortality or injury to species within terrestrial, aquatic (freshwater and marine) intertidal and marine habitats; and pollution caused by incidental release of substances, hazardous materials, and dust. During operations, potential impacts to ecology and nature conservation receptors include air and water pollution; plant equipment and personnel movement, noise and vibration; lighting; and maintenance of pipelines.

Bathymetric survey was carried out along proposed pipeline routes to determine seabed topography for design and construction, and this study is reflected in the updated ESIA, along with proposed design and adequate protection measures such as articulated concrete block mattresses above dredged areas and permanent, lit navigation buoys. Baseline coastal and marine surveys have not identified species of conservation importance. Ecology management plans will be developed and included in the ESMP for clearance work prior to pipeline installation, and design requirements will include intake velocity considerations. It is anticipated that impacts will be mitigated.

The site may be important as a wetland in flood control. The site and its immediate surrounding areas appear to be the floodplain of a number of streams flowing south which do not always have free-flowing access to the sea. Within the Project site, a small tributary will be diverted. This water course receives storm water runoff from the VRA complex. Significant impacts are not expected to result from this diversion and measures will be taken to protect the Anankwari River from erosion and pollution run off. Baseline surveys did not identify fishes of any significant abundance except the mudskippers (which are on the IUCN red list as “Least Concern”), and crabs within the mangrove strands. The fast running stream may not support higher diversity of fauna due possibly to lack of refugia and potential prey items. Nonetheless, there are potentially few fish species at the mouth of the lagoon but not of any national or international conservation concern. Fishing is not a regular activity in the River; however it was observed in the Lagoon. A 20 m buffer zone will be established and maintained around the Anankwari River and ecological supervision will ensure that hunting and fishing will not occur within the buffer zone. Light spill and noise and vibrations will be minimized through implementation of GIIP.

All the habitats and species present on the site were evaluated using a variety of methods including habitats/species diversity, species rarity, their sensitivity, legal status and ecosystem value. Where available IUCN Red List was used to complement the conservation status assigned; almost all plant species recorded within the Project site were either “yet to be assessed” (e.g., not yet evaluated against the International Union for the Conservation of Nature (IUCN) criteria) or were of “least concern” as per the IUCN Red List. Most of the plants are economic plants and/or have medicinal value; none of the medical plants are harvested at the site. In order to minimize disturbance, the Project footprint will be limited to about 40 acres of the approximately 63 acre site.

Although the three mangrove species listed are of "least concern" under the IUCN, this area has one of the few wetlands in Ghana where all three mangrove species are present. Therefore, the ESIA concludes that the study area is significant in terms of the mangrove diversity and the potential biodiversity it supports. AEL will undertake an off-set program for the mangroves that
Amandi Energy Limited (AEL) / Ghana will be disturbed (approximately 1.36 ha of a total mangrove area of 3.61 ha) during construction. The off-set will occur within AEL’s Project site and will encompass about 3.82 ha of mangrove restoration. A lag time of five years is estimated for the mangrove to re-establish. Regular monitoring and evaluation of the replanted mangrove will be carried out to ensure early growth and establishment. Further details will be presented in a mangrove restoration plan to be developed and submitted to MIGA prior to construction. This plan will assess the concept of critical habitat based on the criteria within PS 6. In addition to discussions with Ghana EPA as this impact was not presented in the national ESIA, AEL has committed to seek appropriate expertise to assist with the restoration of mangrove forests within their site.

**Cumulative impacts:** Although detailed ecological impact assessments are not available for all four additional power plants in the area, cumulative impacts on ecology are likely due to the potential loss of a further 75 ha of wetland habitats (including lagoons, streams, mangrove, and swamps) along with potential losses and disturbances of flora and fauna which may result in a change in habitat and species composition. This habitat loss may be compounded by adverse impacts associated with influx of workers in the area and increased pressures on flora and fauna (e.g., bush meat hunting and charcoal/fuel wood collection pressures, and materials needed for housing). Mitigation measures by project developers should include implementing GIIP and guidelines to avoid the most sensitive habitats and to carry out biodiversity offsetting to create habitats. Good industry practice to control pollution and provision of sufficient infrastructure for sanitation and domestic food supply should also be considered. Furthermore, during operations, some proposed power plants are upstream from the Project and thus could potentially release contaminants which would adversely affect the Project area. Following GIIP will be important to minimize pollution.

**PS8: Cultural Heritage**

The updated ESIA does not identify direct impacts on cultural heritage but does identify the Anankwari River as being considered sacred by local populations. Traditional rites will need to be performed before starting construction activities. These rituals will be planned in coordination with relevant stakeholders and will be included in the ESMP and SEP. Consistent with the requirements of PS8, a Chance Find Procedure will be developed and implemented during the construction phase.

**F. Environmental Permitting Process and Community Engagement**

In addition to registering the Project with the Energy Commission, an initial ESIA was prepared in July 2014 to meet the Ghanaian EPA Act (1994) Act 490 and associated Acts relevant to protection of the environment, social well-being and electricity regulations. The initial ESIA was preceded in July 2013 by an ESIA Scoping and Terms of Reference stage, in accordance with national Environmental Impact Assessment regulations. Ghana EPA issued the Environmental Permit for the Project, to AEL on July 23, 2014. Conditions of the Permit include submitting an Environmental Management Plan within 18 months of commencement of operations.

Ghana EPA required community consultation during the project scoping stages and subsequently a public hearing; where the project was presented (copies of ESIA made available to the public), concerns and issues raised about the project were addressed to the satisfaction of the community and Ghana EPA. Notices for the Project were published in national daily newspapers and public
comments on the ESIA were requested. These comments were included and addressed in the national ESIA prior to receiving the final approval by the Technical Committee of the Ghana EPA.

The national ESIA was updated and incorporated the results of a number of surveys and additional information to align with international environmental and social standards. Furthermore, AEL has continued engagement with identified stakeholders including the communities where the Project is located, and the relevant authorities (including national, regional and district level). A non-technical summary of the updated ESIA has been made available within the Aboadze community. Nearby communities are supportive of the Project. Community comments during the MIGA site visit centered primarily on job creation and skills training for local communities.

Stakeholder engagement has been ongoing since project inception and is being formalized as part of the Project’s SEP which is currently in draft. The SEP identifies stakeholders including the communities (including fishers) where the Project is located and the relevant authorities, summarizes key activities the Project will undertake, identifies the Project’s commitments to transparency, and describes a community grievance mechanism. As part of finalizing the SEP, stakeholders will include lenders / insurers and roles and responsibilities will be clarified within the SEP to ensure AEL has a robust mechanism to follow up grievances and to monitor its activities against those commitments contained in the SEP. The Project’s principles for supporting community initiatives will be developed and shared with nearby communities.

AEL reports also participating in voluntary working group with the VRA, Shama District Assembly, and other Independent Power Plant developers to discuss potential common concerns and developments in the Takoradi Power Enclave. This forum will be reflected as another stakeholder engagement vehicle in the Project’s SEP.

G. Availability of Documentation

The documentation listed below is available electronically as PDF attachments to this ESRS at www.miga.org:

- Amandi Energy Limited – Ghana Stakeholder Engagement Plan Supporting the Environmental and Social Impact Assessment of 190 MW Combined Cycle Power Plant at Aboadze, Ghana (undated) (draft), prepared by AEL

These documents are also available for viewing at the following locations:

- Martin Lawer Akondor, AEL, 5 Osu Badu Street, P.O. Box KIA -30408, Accra, Ghana
- Aboadze Community Center, Nana Kobena Attom III Street, Aboadze