

Revised Environmental and Social Review Summary

KivuWatt Power Project – Rwanda

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:	Rwanda
Sector:	Infrastructure - Power
Project Enterprise:	KivuWatt Ltd
Environmental Category:	A
Date of revised ESRS Disclosed:	February 17, 2011
Date of original ESRS Disclosed:	April 26, 2010
Status:	Due Diligence

A. Project Description

The proposed project for MIGA guarantees consists of the construction and operation of a single floating GEF platform supporting one 25 MW power plant for extraction of methane gas from the depths of Lake Kivu; a 13 km submerged gas transport pipeline (together the Gas Extraction Facility, or “GEF”); and an onshore Power Plant and an onshore Marine Landing Site (MLS) that will be utilized in the fabrication and launching of the GEF. The project is scheduled for commercial operation in the third quarter of 2012.

The project enterprise plans to develop the methane gas extraction from Lake Kivu for energy production in two phases: Phase I will consist of a single floating GEF platform supporting one 25 MW power plant. Phase I is considered a Pilot Project so that lessons learned will be applied to the design of Phase II activities, which is currently planned to consist of three 25MW plants.

Both phases were initially considered for MIGA guarantees, and MIGA disclosed the ESRS for both phases in April 2010. After the project design was assessed by an independent technical expert in May/June 2010, the project investor, ContourGlobal (CG), re-designed the project and re-launched the political risk Insurance (PRI) process in November 2010 by requesting MIGA guarantees for Phase I only – 25MW. MIGA is now considering offering political risk insurance to CG for its equity investment in the 25MW Phase 1 Pilot Project.

The output will be sold to the Rwandan state-owned utility, RECO, through a 25-year Power Purchase Agreement (PPA). Phase I output will be connected to the national grid via a new 1.6 km long 11 kV transmission line which was installed by RECO.

The on-shore Power Plant will comprise a series of gas engines that will convert the methane to electricity which will then be supplied to the grid. The location of the Power Plant near Kibuye is a direct function of the Gas Concession Agreement (GCA) with the Government of Rwanda (GoR) and represents the most practically feasible location from which to exploit the gas

resource available in the gas concession area. The Power Plant site was designated specifically as an industrial zone in the approved Kibuye Master Plan. The power plant site area is approximately 31,140 m².

The MLS, which will be used for construction of the four GEFs (for both phases), will consist of workshops, a slipway, a fit out platform, offices and will include a generator and water and sewage treatment facilities. The main GEF fabrication workshop will be erected over the upper portion of the slipway. The shed will be a steel portal frame with apex roof and the structure will be open on all sides for crane/plant access. Other smaller workshops will be formed from shipping containers as required. The yet to be identified site for the workers compound will be set up by the GEF fabrication contractor and will be in close proximity to the fabrication site, but outside the MLS.

Some components of the GEFs will be fabricated in Mombasa, Kenya by the contractor and transported to the site. Final erection, however, will take place at the MLS in Kibuye. Each GEF is approximately 64 metres in length, 25 metres in breadth and 4.0 metres in depth. Once the outfitting is completed, the GEF barge will be towed to its permanent mooring place where the marine outfitting or installation of the sub surface equipment will take place, including the installation and hook up of the sub surface gas pipeline that will transport the product methane gas ashore to the power plant.

Phase I will produce 25 MW of power from one GEF with a connecting semi-submerged pipeline of approximately 13km and methane fueled gas engines operating at the Power Plant. GEF construction is currently underway at the Kibuye (Rwanda) Marine Landing Site, with barge assembly now 30% complete. Overall, work on the barge is currently on schedule, with launching projected for April 2011. The completion of the GEF (including the gas pipeline to shore) is expected in June 2012, with commissioning and first gas supplied to the shore-based power plant shortly thereafter. Construction of the power plant is expected to start in the second quarter of 2011, with first power expected in late July/early August 2012.

Phase II will provide an additional 75 MW of power to give a total of 100 MW through the addition of three GEFs and a similar configuration of methane fueled gas engines at the Power Plant. The project is designed in a modular way and allows for design changes identified during the initial operation of the Phase I GEF. The current power plant site is sized to accommodate both Phase I and Phase II generation including the necessary area for a new 220 kV switch yard which will be constructed on the site to support the interconnection to the planned 220kV transmission system.

B. Project Context

Lake Kivu is located in the East African Rift Zone between Rwanda and the Democratic Republic of Congo (DRC); the border between the two countries bisects the lake. The lake contains high concentrations of naturally occurring methane and carbon dioxide gases. The highest concentrations of these dissolved gases are located in the “resource zone”, extending from a depth of 270 meters to the bottom of the lake at a depth of nearly 500 meters. The gases remain sequestered because the lake waters are stratified along stable density layers. The upper

waters of the lake, referred to as the “biozone”, are oxygenated and form a stable layer from the surface to a depth of 60 meters that supports the lake’s biology.

Lake Kivu is currently estimated to contain 300 billion cubic meters of carbon dioxide and 60 billion cubic meters of methane in its lower density layers. Without intervention, the gas concentrations are estimated to approach saturation and produce a cataclysmic gas release within a range of 50 to 200 years.

The KivuWatt Ltd concession is located wholly within Rwandan territory. Both Rwanda and the DRC have been engaged in a process of partnership and dialogue surrounding the joint exploitation of the lake since 1975. In 1990, they established SOCIGAZ, a bilateral entity responsible for governing the exploitation of Kivu’s methane reserves. In 1999, SOCIGAZ was reformed to explicitly allow both states to have the right to assign concessions for their territory. The first GCA for the extraction of methane gas from Lake Kivu for power generation was awarded by GoR in March 2005 to the Kibuye Power 1 (KP1) project. In 2007, a memorandum of understanding (MoU) was signed to form a new/additional governance structure for sharing the lake's resources.

The MoU outlined the steps to be taken in the establishment of the bilateral institutional framework for monitoring Lake Kivu, for the safety of the population and for the environment. An Expert Working Group of scientists and technicians was formed to develop rules and regulations for safe gas extraction from Lake Kivu resulting in the *Mandatory Guidelines* (Ministry of Infrastructure, Republic of Rwanda and Ministry of Hydrocarbons, Democratic Republic of Congo. *Lake Kivu Gas Extraction: Basic Principles, Mandatory Requirements and Guidelines for the Concessioning, Design and Operation of Gas Extraction Plants*. Version 10, February 18, 2008). The *Mandatory Guidelines* have since gone through a number of reviews and iterations culminating in the *Management Prescriptions (MPs) for the Development of Lake Kivu Gas Resources*. June 17, 2009 (Ministry of Infrastructure, Republic of Rwanda and Ministry of Hydrocarbons, Democratic Republic of Congo).

C. Environmental and Social Categorization

Although only Phase I is proposed for MIGA guarantees, MIGA considers potential impacts of both phases and categorized the project as Category A under MIGA’s Policy on Social and Environmental Sustainability. Without any intervention, the lake has the potential to erupt within a range of 50 to 200 years. Therefore, the overall positive effect of the project is expected to be the reduction of lake eruption risk. However, as any sort of intervention in the Lake might cause a disturbance. The project, if not carefully designed, constructed and operated, could cause a gas release from the lake or an explosion from the operation of the GEFs. The project may also negatively impact lake ecology and sustainable use of the gas resources.

Other environmental and social issues include adverse impacts on the livelihoods of 39 farmers and a local school where land acquisition was carried out in 2009 and potential adverse impacts on fisheries and fishermen’s livelihood. Construction and operations activities are expected to impact air, water, waste, noise, and workers and community health and safety.

As part of MIGA's environmental and social due diligence process, an independent technical review was undertaken given the logistical complexities of the Project (for initial 100MW plant). The independent review concluded that the Project (as designed at first) would not jeopardize the stability of Lake Kivu, and by removing gas from the Lower Resource Zone it would help to reduce the risk of uncontrolled gas outburst from the lake. However, significant concerns arising from the deepening and dilution of the Upper Resource Zone and its impacts led to the conclusion that the Project was not in compliance with the *Management Prescriptions 2009* where it related to resource management issues.

In light of these conclusions, the investor, ContourGlobal (CG), re-designed the Project and is now proposing a Phase 1 Pilot Project of 25MW with a revised discharge plume design. MIGA re-engaged the independent technical expert to review the proposed Phase 1 Pilot Project re-design. The expert's report indicates that the revised design is generally in compliance with lake stability and safety aspects of the *Management Prescriptions 2009*. While the revised design no longer risks dilution of the methane resource, there are remaining areas of concern related to modifying the density stratification in Lake Kivu in the long term (up to 10 years) and during pilot project operations.

CG's consultant engineers have provided MIGA with a response to the concerns raised by the technical expert concluding that any modification of the lake's main density gradient will be modest, and there is essentially no effect on the total change in density across the gradient. There are different approaches and models used to determine future predictions on the impact on lake stratification. As a result, the pilot phase will be critical in demonstrating what can or cannot be done in terms of safe, environmentally sustainable, and commercially viable methane gas extraction at Lake Kivu. As such, phase I (pilot) operations will be monitored diligently to inform designing of phase II.

The Phase I project would be the first to demonstrate the applicability of the *Management Prescriptions* to large scale commercial operations. During operations, MIGA will require independent technical reviews in order to assess the impacts on lake stratification. In addition to the construction and operations related mitigation measures, MIGA will ensure that the prescribed monitoring measures associated with lake stratification are in place and that modeling assessments are reviewed by independent experts to ensure continued lake stability and maintain acceptable resource management conditions. The pilot experience and data collected will shed additional light on these issues and help guide practical solutions and help both the Governments of Rwanda and DRC on further development of the *Management Prescriptions*. MIGA will require CG's cooperation in sharing information/data with relevant stakeholders. Should CG request MIGA to cover the additional 75MW, MIGA will conduct a separate due diligence at that time.

The GoR has informed CG that it has no-objections to the revised design and allows the Project to go forward. MIGA has informed the Government of the DRC on the proposed pilot 25 MW power plant and discussed the project in relation to the *Management Prescriptions 2009*. In accordance with MIGA's Performance Standard 1 which discusses transboundary/riparian issues. MIGA also plans to inform other affected countries.

D. Applicable Standards

Based on current information it is expected that the following Performance Standards are applicable:

- 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: Land Acquisition and Resettlement
- PS6: Biodiversity Conservation and Sustainable Natural Resource Management

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 before the construction starts.

E. Key Documents and Scope of MIGA Review

The primary documents reviewed by MIGA:

- KivuWatt Project Environmental and Social Impact Assessment (ESIA) including the Environmental Management and Monitoring Plan (EMMP), authored by Sinclair Knight Merz Ltd on behalf of KivuWatt Ltd., October 2009
- Environmental Impact Assessment (EIA) for Gas Extraction and Electric Power Production in Karongi District KivuWatt Project, authored by Green and Clean Consultants, Final Report, April 2009
- Ministry of Infrastructure, Republic of Rwanda and Ministry of Hydrocarbons, Democratic Republic of Congo’s Lake Kivu Gas Extraction: Basic Principles, Mandatory Requirements and Guidelines for the Concessioning, Design and Operation of Gas Extraction Plants (Version 10), “The Mandatory Guidelines”, February 18, 2008
- Ministry of Infrastructure, Republic of Rwanda and Ministry of Hydrocarbons, Democratic Republic of Congo’s Management Prescriptions for the Development of Lake Kivu Gas Resources, June 17, 2009
- ContourGlobal KivuWatt Power Project – Independent Review Report, John Boyle and Martin Schmid, June 23, 2010
- KivuWatt Power Project – Review of the impact of the re-designed project on lake stability and ecology, Martin Schmid (EAWAG: The Swiss Federal Institute of Aquatic Science and Technology, January 25, 2011)
- ARAP Abbreviated Resettlement Action Plan (November 2010)
- Technical Memorandum – Response to Dr. Schmid’s review (dated 25 January 2011) of the proposed Kivu Watt Gas Extraction Project (7 February 2011) – Prepared by Exponent Consultants.
- Ministry of Infrastructure, Republic of Rwanda letter to ContourGlobal regarding KivuWatt Design and Management Prescriptions, September 15, 2010

- MIGA’s social and environmental review of this project also included a site visit (February 8-12, 2010) by MIGA staff, and meetings with the IFC and Bank staff involved in KP1 project and TA.

F. Key Issues and Mitigation

PS1: Social and Environmental Assessment and Management Systems

Social and Environmental Assessment: An ESIA (October 2009) was prepared for the entire project for both phases. The ESIA analyzed the following issues related to both project construction and operational phases: air emissions and noise, waste management, potential impacts on fisheries, lake stability and protection, land use, economic displacement, community and worker safety.

Environmental and Social Management Program (ESMP): The Project’s environmental and social management program provides the framework for planning and implementation of activities during both the construction and operational phases of the project. It is prepared in accordance with legal and regulatory requirements of Rwanda and the MIGA/IFC Performance Standards and the World Bank Group Environmental, Health and Safety (EHS) Guidelines. The engineering design parameters of the project have been formulated to comply with the *Mandatory Guidelines*, a requirement of the GCA.

As part of the project ESMP the following action plans have been or will be prepared:

- Environmental management and monitoring plan (EMMP) that includes impacts to air, water, lake stability, fisheries, waste and noise;
- Lake Monitoring Plan (LMP);
- Fisheries Monitoring Plan (FMP);
- Abbreviated Resettlement Action Plan (ARAP);
- Supplementary Compensation Plan (SCP);
- Social Management Plan (SMP)– including community engagement and information disclosure;
- Community Development Plan (CDP);
- HIV/AIDS Framework for Action;
- Occupational Safety and Health (OHS) Management Systems and OHS Plan;
- Emergency Preparedness and Response Plans (ERP);
- Standard Operating Procedures (SOP’s);
- Hazard and Operability (HAZOP) Plan;
- Fire Safety Plan (FSP);
- Traffic Safety Plan (TSP); and
- Security Personnel Management and the Protocol.

Most of these plans will be completed 6-8 months prior to commissioning. Based on the review of available plans, representations of the investor and site visit findings, MIGA’s environmental

and social specialists believe that the proposed mitigation measures adequately address the identified risks.

Organizational Capacity and Training: KivuWatt Ltd Project Team (General Construction Manger, Marine Construction Manager, Community Liaison Officer, EHS Officer and Plant Manager) will be responsible for the implementation of the EMMP, other action plans, and training during both the construction and operational phases of the project. KivuWatt Ltd will also be responsible for ensuring that all contractors comply with EHS requirements and will do so via the following mechanisms: inclusion of EHS requirements in line with this EMMP in contracts, review of EHS reports provided by contractors, weekly inspections by the on-site management team and periodic audits during construction and operational activities. As this project will be the first of this industrial scale, there has not been much experience to date. Although CG has undertaken projects with similar levels of technical complexity, in order to strengthen their capacity, they will undertake extensive training, including the use of a process design firm to provide start up and commissioning guidance prior to the completion of the commissioning and first gas.

Information Disclosure and Community Engagement: The GoR EIA regulation of 2005 set out requirements for stakeholder consultation. REMA, in conjunction with the Rwandan Development Board, initiated a public meeting on November 27, 2009, pending the notification of receipt of an ESIA. The meeting was open to members of the public as well as governmental and other agencies, all of whom participated and commented on the ESIA and the proposed development. The ESIA Certificate, dated January 18, 2010 was issued to KivuWatt Ltd on behalf of the Rwandan Development Board.

Consultation with the local community (including local residents, fishermen, local traders, etc.) and other stakeholders (e.g. Rwandan Government officials, local businesses) was undertaken in August 2009 where the details of community health and safety risks related to the project were discussed and specific comments received. The outcomes of the community consultation were accounted for in assessing impacts and developing mitigation measures. Information presented to MIGA indicates that there is an overwhelming level of support for the project both locally and nationally and an expectation of the contribution to economic development. There are also high expectations of the project and in particular the benefits that will accrue from job creation, training and the provision of a secure supply of low cost electricity. However there is also the interest that this project be done without incurring unacceptable environmental and social impacts.

Consultations and community dialogue will continue with regards to risk and mitigation, including engagement with the community in the development of the ERP. During the site visit, MIGA's environmental specialist met with the fishermen's association. The fishermen did not have all of the details of the operation, but they were aware of the gas extraction infrastructure as they have seen this with KP1. The questionnaires provided in the ESIA seem to suggest that most people were not concerned about potential eruption of the lake, however the consultation reports suggest that the project's potential risks and mitigation measures were discussed extensively.

A grievance mechanism will also be established prior to commissioning as part of the project community consultation program. Company and community stakeholders will be involved in the

design of the program which will be part of the ongoing communications program established for both local and external stakeholders. CG is committed to ongoing community consultations and information disclosure during the construction and operation phases of the project consistent with MIGA's PS1 requirements.

Consultation with farmers affected by the project: In July 2010 and November 2010 KivuWatt conducted consultations with Project Affected Persons (PAP) on the design of a Supplementary Compensation Plan (SCP). Consultations in November involved face to face meetings with those PAPs who were interviewed in July 2010 and available for a follow up meeting and a group meeting with PAPs from the MLS site. The purpose of these meetings was to secure feedback on KivuWatt's initial plans for the SCP and solicit additional ideas. As of mid-November 2010, almost half of the PAPs have been involved in follow up consultation. Further efforts will be made to contact the rest of the PAPs for this round of consultation. Once this is completed, there will be follow up meetings to consult on detailed SCP proposals. Details of consultations and key messages from communities are contained in the ARAP.

Monitoring and Reporting: A Bilateral Regulatory Agency (BRA)¹ is currently being established and it is not yet clear when it will be fully functional. A structure and protocol for the establishment of the BRA was agreed to by the two governments of Rwanda and DRC in a conference that was held in Goma, DRC in early 2009. An interim structure detailing the specific composition, roles and responsibilities and costs was developed by both governments in October 2009. The structure foresees an Expert Advisory Group servicing the Executive Management and the Board of Directors. Currently, pending formal implementation of the BRA, the Ministry of Infrastructure for the GoR, has a fully operational Lake Monitoring Unit, and has already done baseline measurements on Barge 1 (KP1).

Roles and responsibilities for monitoring of the Project will be shared by the Bilateral Regulatory Authority (BRA) and the Rwandan governmental authorities and by the Project team. The Rwandan Environment Management Authority (REMA) is mandated by law to organize and approve EIAs and for monitoring implementation of environmental protection measures recommended by EIA studies. Both REMA and KivuWatt Ltd are responsible for environmental monitoring and auditing. It is expected that KivuWatt Ltd will undertake self-monitoring, record keeping and reporting and submit this information to REMA annually. REMA will be responsible for review and, on occasion, verification of reports and data submitted and for periodic inspections as needed.

Cumulative impacts are principally associated with lake stability, aquatic resources and biodiversity related to the Phase 2 development and potential other similar developments within

¹ Both the *Mandatory Guidelines* and the *Management Prescriptions* contain oversight requirements for the BRA. In particular, the BRA is expected to: be financed from sale proceeds and production royalties, co-operate with the governments of Rwanda and DRC to formalize the resource allocation in concessions, provide a monitoring role for methane extraction activities, develop gas harvesting plans for the lake, ensure that the public is fully informed about the gas resource, the scope and results of the monitoring program and the location and gas production of the concessions, review and approve facility design drawings prior to construction and inspect gas extraction facilities.

the remaining available gas concession areas in Rwanda and the DRC. Conclusions drawn in the ESIA based on the results of the hydrodynamic model have determined that the localized area of the discharge plumes for both the degassed water and wash water limit the effects of each plume to an isolated area below each GEF and within the respective 500 meter exclusion zone, ensuring that no mixing will occur. According to MPs and national laws, all future projects developed on the Lake will be required to assess cumulative impacts including those from KivuWatt Ltd Phase I and II development.

PS2: Labor and Working Conditions

Approximately 250 workers will be employed during peak construction activities for both the power plant and GEF construction, while a total of 116 personnel of various skill levels are expected to be employed when Phase II of the project is fully operational. Accommodations for expatriate workers will be provided in an appropriately developed workers camp to be constructed in the vicinity of the MLS that will house approximately 150 people at full capacity. A site has not yet been identified, however, it is likely that an existing training facility nearby could be used. Laborers recruited within the surrounding communities are expected to live locally.

During Phase I, opportunities will exist for local contracting and employment opportunities. It is estimated that seventeen local staff (out of a total of 61) will initially be employed. KivuWatt Ltd intends to replace expatriate staff gradually over time. An extensive training program to be developed in cooperation with both public and private educational institutions both within and outside of Rwanda will provide the basis of training to give the locally recruited workers the opportunity to obtain the necessary skills to both operate and maintain the GEF and power plant. The program is expected to be implemented in such manner to have local staff fully trained within six years of operation after Phase II. It is estimated that local staff numbers will be 103 (out of a total of 116), including eleven in management or administration, 34 in technical roles, 14 in Power Plant operations and 44 on GEFs and boat crew.

Permanent staffing of the GEF and Power Plant facilities to perform the operations and maintenance is expected to take place 6-8 months prior to the Commercial Operation Date. Prior to this time, KivuWatt Ltd and ContourGlobal LP HR departments will develop HR policies consistent with national law and PS2 that will address worker relations, terms of employment, work rules, health and safety, grievance mechanism, and non-discrimination. During the initial construction phase however, KivuWatt Ltd will not have its own employees, aside from a Marine Construction Manager.

Potential occupational health and safety hazards identified during construction activities include: falls and slips, failures of support systems and/or platforms, noise and vibration, collision with mobile plant or vehicles, exposure to dust and to hazardous materials, fire and burns, exposure to gas releases or asphyxiation, crushing by heavy plant or collapse of structures, falling debris and communicable disease. These hazards will be mitigated through a contractor implemented OHS Plan and a comprehensive OHS Management System, based on ContourGlobal Group directives, the local legal framework and the requirements of ISO and OHSAS 18001 standards and taking into account ContourGlobal's specific goals. An HIV/AIDS Framework for Action, including a workplace policy and prevention and education initiatives, will also be developed based on the IFC Good Practice Note for HIV/AIDS. These health and safety plans are expected to be

completed prior to the start of construction works beyond the site clearance which has already been done.

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. The OHS Plan will be reviewed by management every six months. Potential occupational health and safety hazards arising during operation include: lake eruption, gas release and asphyxiation, explosion, fire and burns, exposure to hazardous materials and noise. These risks will be addressed through: the OHS Management System, as well as the LMP, SOP's, an ERP, Fire Safety Plan and HAZOP analysis.

The HAZOP plan identified safety risks in project design and operation through analysis of potential deviations from the operational norm that could result in lake eruption, gas release, explosion or fire. Recommendations were developed for high priority improvements to reliability, operability, and/or safety and incorporated into project design, including instituting automated detection, warning and shut down systems in the event of gas releases or other risks and the ability to quickly shut down and restart gas extraction and pipeline systems.

Site specific SOP's will be developed within approximately 6-8 months prior to commissioning of operations that address the safe and efficient operation of both on-shore and off-shore facilities and reduce risk to employees. The procedures will include HAZOP recommendations and address all aspects of operations, including starting up, shutting down, operating under normal and abnormal conditions, and emergencies. They will also ensure that the gas extraction and power generation facilities will be coordinated and in constant communication.

The HAZOP plan also provided for recommendations for operator requirements to be implemented into the Fire Safety Plan. The Fire Safety Plan, as part of the SOP's will address specific areas of concern and methods for extinguishing fires and minimizing risks associated with the handling of hazardous materials. Current designs for the GEFs and Power Plant will incorporate provisions for fire prevention, detection and suppression. Both facilities will have equipment installed, including gas detection, heat sensors, manual pull stations and audible alarm system, in the event of fire and will include event notification systems and feature regular training.

The ERP will be developed prior to commissioning of operations and include systems for warning and safe evacuation of staff as a result of lake eruption, gas release, explosion and fire hazards. The ERP will include: the identification and location of potential risks and emergency scenarios; risk mitigation strategies; alarms and warning systems; procedures to identify and account for all workers and visitors; the establishment of escape routes and evacuation systems including regular drill practice for all staff; the establishment of an onshore emergency organization, control centre and Emergency Response Team; a search and rescue plan for workers; a manifest detailing the location, description and purpose of all emergency response equipment; training and awareness programs for workers; and regular ERP reviews. Extensive training including the use of the process design firm to provide start up and commissioning guidance will be employed prior to the completion of the commissioning and first gas.

PS3: Pollution Prevention and Abatement

Expected impacts from gas extraction activities include emissions to air from flaring and operation of gas engines, as well as potential impacts to the biozone from the routine discharge of wash water. Construction and operation of the MLS and Power Plant are expected to have impacts on air, noise, soil, waste and water.

Impacts arising from operation of the GEFs have been assessed in the HAZOP Plan, evaluated through modeling and mitigated through project design.

Flaring and gas engines: The GEFs will each contain two gas engine driven compressors, two gas engine driven electrical generators and a diesel engine driven black start generator. The gas engines will be operated from the produced high purity methane gas. The engines will be subject to World Bank Group EHS Guidelines air emission limits. Flaring is also expected during extraction process start up and shut down and upset conditions. The flue gas emissions are expected to be relatively small and disperse over the lake. Although the system has been designed to avoid flaring where possible, limited flaring is expected to occur from a 25 meter high vent. These emissions have been determined to be negligible and were not assessed. Continuous or unplanned flaring can be halted through the closure of the production separator gas outlet valves.

Wash water: Wash water is used to remove the impurities (mainly carbon dioxide and hydrogen sulfide) from the methane gas. As a result, the discharge of hydrogen sulfide and carbon dioxide containing wash water into the lower biozone could create conditions of oxygen depletion and acidification. However, the potential impact is mitigated by several factors. Hydrology modeling results indicate that any plume dispersion of the gas laden stream essentially remains at or near the same elevation as the discharge depth of 60 meters, and is not expected to impact areas in the upper bio-zone. The discharge plume is also contained within the GEF exclusion zones of 500 meters. Additionally, fish populations in the vicinity of the GEFs will be monitored per the EMMP.

Expected air, noise, soil, waste and water impacts from construction and operation of the MLS and Power Plant are addressed in the EMMP.

Air: Fugitive dust from construction related vehicles and equipment and emissions of nitrogen oxides, particulate matter and carbon dioxide from Power Plant operations will be mitigated through: best practices for dust mitigation and compliance with World Bank Group EHS Guidelines air emission limits, developing an ambient air quality management plan and instituting a monitoring program for Power Plant emissions. Power Plant carbon dioxide emissions will be calculated on an annual basis.

Noise: The project will comply with the World Bank Group EHS Guidelines noise limits. Noise impacts from construction and operation of the Power Plant and MLS are expected to be small due to the distance and acoustic screening between the project site and nearest residences. Construction noise levels will be monitored at the property boundaries and mitigated through equipment selection, maintenance and abatement devices. Noise from Power Plant operation will be mitigated through incorporating noise reduction measures into the building design. Noise levels will be monitored every three years.

Soil: The project site is immediately adjacent to the lake. Construction activities are expected to be completed during the dry season, minimizing soil erosion and runoff. Proposed mitigation measures, should construction continue into the rainy season or during heavy rainfall, include: limiting excavation to shallow soil removal during the dry season; replacing soil as quickly as possible; halting excavation during heavy rain; and identifying high erosion risk areas of the project site.

Waste: There are presently no waste disposal sites in Kibuye. Construction activities are expected to generate significant volumes of waste and debris, while operations are expected to generate waste oil, sludge, filters and hazardous waste streams. A Waste Management Plan will be developed to identify waste streams, re-use and reduction strategies, on-site storage requirements, accidental release mitigation measures, available carriers and transport, and final waste treatment requirements and standards. Hazardous wastes will be stored in secondary containment and transferred to a company that specializes in the recycling, regeneration or disposal of those materials.

Water: Water used during construction will be extracted from the lake, during operation water will either be extracted from the lake or received from the public network. Phase I construction peak water demand is expected to be 45 cubic meters per day. Operational demand for the GEFs and Power Plant is expected to be approximately 145 cubic meters per day, with about 1 cubic meter per day expected of oily, sanitary and sewer wastewater discharges. Construction and operation impacts are expected from surface runoff, groundwater seepage, hazardous material spills, vessel maintenance and discharges of wastewater from concrete mixing, equipment washing, dust suppression, oily water and sanitation. All discharges will meet World Bank Group EHS Guidelines effluent limits. Sanitary wastewater will be treated in septic tanks followed by biological treatment, while potentially contaminated wastewater will be treated in the oily water treatment unit. Low risk equipment refueling and maintenance areas will be designated. Hazardous materials storage and generators will have secondary containment to avoid risk of spills. Monitoring will be performed in compliance with World Bank Group EHS Guidelines. Ongoing audits and reviews will be conducted.

Expected impacts from gas extraction activities include emissions to air from flaring and operation of gas engines, as well as potential impacts to the biozone from the routine discharge of wash water. Construction and operation of the MLS and Power Plant are expected to have impacts to air, noise, soil, waste and water.

Impacts arising from operation of the GEFs have been assessed in the HAZOP Plan, evaluated through modeling and mitigated through project design.

PS4: Community Health and Safety

Potential community health and safety impacts are principally associated with the risk of lake eruption, gas release, explosion and fire related to operation of the GEFs, gas pipeline and Power Plant. The independent technical expert report for the re-designed Phase 1 project indicates that the revised design is generally in compliance with lake stability and safety aspects of the *Management Prescriptions 2009* up to 10 years. CG's consultant engineers' assessments predict a much longer timeframe as their analysis indicates that the degree of saturation of the water in

the lake will be decreased, thereby, in fact, increasing the safety of the lake. CG's assessments conclude that this is equally true for four 25 MW facilities operating for 25 years.

Monitoring results during the pilot phase will provide a more robust basis to allow for more accurate predictions and to inform future phases/projects. Additional expected community health and safety impacts related to construction and operation include fugitive dust, water quality, air quality, noise, waste management, traffic and communicable disease.

The approved Kibuye Master Plan (2002-2016) sets the project site as an industrial zone with specific intention of using part of the zone for power generation utilizing methane from the lake. While there are no communities directly at the project site, a weekly market is held on land adjacent to the MLS and close to the road between the MLS and the Power Plant site. The nearest communities are approximately 2 km away from the Power Plant site.

The principal community health and safety hazards identified in the HAZOP Plan relate to possible impacts on lake stability as a result of reverse flow in production separators or discharges of gas and water at the wrong depth. The majority of risks identified relate to potential changes in the level or direction of flow through extraction, separation and reinjection processes. Other potential identified risks could arise from loss of liquid levels or corrosion effects. Risk reduction and mitigation measures incorporated into project design in response to the HAZOP analyses include: project design and operating manual changes; the implementation of a maintenance and inspection programs; the deployment of gas detection systems; and the use of appropriate materials.

Additional safety measures incorporated into project design include: instituting automated detection, warning and shut down systems in the event of gas releases or other risks; creating 500 meter exclusion zones around each of the GEFs and reinjection points; and marking the location of the submerged pipeline with buoys and lights.

The ERP, prepared as part of the operational procedures, will provide systems for warning and safe evacuation of local people as a result of gas release, explosion and fire hazards. Lake monitoring, to be incorporated as part of the operations, will provide for early detection of potential problems related to extraction of water from the lower resource zone, and the reinjection of the degassed water or wash water. Specific measures addressed in the ERP will include: alarms and warning systems including warning lights, sirens, loud speaker system and wind socks. As appropriate with the local authorities, a 24-hour hotline will be established for all relevant persons, including local government representatives and emergency services. The power plant will serve as the onshore emergency control centre and be equipped with an Emergency Response Team; constant communication between the GEF and Power Plant will be established and used to coordinate any needed search and rescue plan for lake users. Communications protocols will be set up for initiation of contact with local authorities, communities, government and media. There will be the establishment of an emergency contact phone number for public information; as well as training and awareness programs for fishermen and other lake users that will be working within the vicinity of the GEFs.

Security forces and community safety: For security, the GoR will take the overall responsibility of security outside of the permanent facilities. They are, through the Rwanda army, in a process of acquiring necessary facilities for this purpose. KivuWatt Ltd will develop a protocol with GoR for security purposes. Inside the fence, KivuWatt Ltd will contract private

unarmed security personnel. The facilities will be properly fenced with a security gate and a posted guard 24 hours per day. During the construction of the facilities, the various contractors will arrange for security inside their fenced construction areas including a guarded entry gate. A protocol between the GoR and KivuWatt Ltd will be developed on security principles and procedures consistent with MIGA's PS4 and Voluntary Principles

The EMMP has identified additional community health and safety risk reduction and mitigation measures.

Traffic: Traffic impacts during construction include circulation and road safety, particularly related to expected frequent heavy truck movements between the MLS and Power Plant site. Community safety measures will include the implementation of a Traffic Safety Plan to identify traffic, parking and pedestrian zones; vehicles inspections; limiting vehicle speeds on public roads; and using safety stewards at crossing points during busy times. Heavy hauls or the transportation of large size loads will be coordinated with local authorities, as applicable.

Disease: An HIV/AIDS Framework for Action will be developed that defines the scope of the problem, identifies risk factors and includes an HIV/AIDS policy and education and awareness programs. The community initiatives will focus on long-term HIV/AIDS mitigation and reduction strategies through supporting local organizations and initiatives that can provide sustainable efforts. Program success will be gauged through a monitoring and evaluation program.

Other impacts associated with water and air quality are discussed under PS3.

PS5: Land Acquisition and Resettlement

The project enterprise does not plan to undertake, any physical or economic resettlement. However, in 2009 project related land acquisition was conducted by the GoR on the sites that have been leased to KivuWatt Ltd. As a result of land acquisition thirty-nine farmers and one primary school were economically displaced. Compensation was paid in 2009 by the GoR for this economic displacement.

During the land acquisition process the GoR consulted with PAPs in relation to the expropriation as required by Rwandan law. This included a process under which PAPs formally signed off on the schedule of compensation and the amounts of cash compensation they were to receive. KivuWatt Ltd. surveyed all the people displaced from the MLS in 2009. In mid-2010 KivuWatt undertook a follow-up sample survey of economically displaced PAPs from the power plant and MLS site in order to assess the impact of displacement and compensation and to determine whether a supplementary compensation program (SCP) would be necessary. The conclusion based on the survey is that livelihoods of those economically displaced have not improved after losing access to the land. On this basis, KivuWatt has developed the ARAP and is committed to develop a Supplementary Compensation Programme (SCP) for people economically displaced from the two sites that KivuWatt has leased. The ARAP sets out the principles of the SCP and presents available information. The SCP will provide one-off, targeted assistance designed to assist PAPs improve their livelihoods on a sustainable basis.

The budget for the ARAP is estimated at \$300,000, excluding KivuWatt management and staff time. The budget comprises \$200,000 for implementation of the Supplementary Compensation

Plan and up to \$100,000 for consulting fees for development and monitoring of the ARAP. The Community Development Programme (CDP) will operate under a separate budget. Where PAPs are provided with supplemental compensation through participation in the CDP, this will be financed out of the CDP budget.

Because of the scarcity of available land, making land replacement unlikely, potential options include: improving productivity and added value at the farmers other land holdings; supporting alternative livelihood options; and providing job opportunities on the project itself. KivuWatt Ltd will inform MIGA if any additional land acquisition is required and will be conducted in compliance with PS5.

PS6: Biodiversity and Resource Management

Potential Impacts on Fisheries. The primary water resource impacts are to lake fisheries. There are currently 104 registered fishing boats in the district of Karongi, according to MINAGRI (Ministry of Agriculture and Animal Resources). Boat owners generally join one of five existing fishing cooperatives, with a total of 353 registered fishermen in these cooperatives. 94 operate small fishing boats, generally dugouts, while the remainder operates the larger fishing boats. Fishermen in the dugouts use gillnets and operate close to shore targeting tilapia. Fishermen on the larger boats operate offshore, using large purse seine nets to target isambaza (*Limnothrissa miodon*).

A large share of all isambaza caught within and around the project area is landed in Kibuye, making the local economy greatly dependent on the lake's fisheries. However, because fishery management on Lake Kivu is still nascent, there is presently a scarcity of reliable information concerning catches and landings at the various locations around the lake. Fisheries monitoring will commence during the construction period with the establishment of a baseline. CG consultants are currently preparing the baseline program and the first surveys will commence approximately a full year prior to mooring the barge. In the unlikely case of adverse impacts on fisheries directly related to the project, KivuWatt Ltd will compensate fishermen for livelihood restoration consistent with national law and principles of PS5.

Currently, all earth works are completed for both the power plant site and MLS with no effect on the water quality in the lake. Erosion control gabions are in place at the power plant site to prevent soil erosion. Proper erosion control measures will be implemented by the power plant contractor during the building of this facility. As for the MLS construction for GEF fabrication shed and quay, impacts are expected to result from concrete and fill work behind sheet piling structures and could result in dispersion of sediments into near shore lake waters, especially during the construction of the slipway. The resulting increase in turbidity around the construction area could impact the near shore ecosystem, affecting tilapia. While no modeling has been conducted of sediment behavior, the lack of strong currents in the lake supports a relatively fast settling rate for suspended particulate material making this impact likely to be limited in both time and extent. While the effects are considered minor in the context of the lake fishery, the planned implementation of the fisheries monitoring plan will address future impacts.

Additional near shore construction impacts will consist mainly of potential spills of products used during the assembly of the GEFs or any other structures/equipment. The contractors will be required to implement the necessary anti-spill policy and disposal rules.

During gas extraction operations, impacts resulting in changes to the chemistry of the biozone are of concern due to the potential effect on fisheries, either as a result of impacts to primary food sources (phyto and zooplankton) or directly to the fish species themselves. The potential acidification of the biozone as a result of the discharge of wash water would create conditions that reduce the availability nutrients for phytoplankton. Additionally, while isambaza are considered a robust and adaptable species, they are not known to occur in lakes with acidic waters. These impacts are not considered significant, because modeling results indicate that any pH effects would be extremely localized to the area immediately around the discharge pipe and inside the GEF exclusion zones and there is also the potential for seasonal mixing within the biozone itself.

The accidental release or ingress of deep waters from the resource zone into the biozone would be expected to result in nutrient enhancement from ammonia, iron and phosphates, causing eutrophication. The design of the gas extraction process mitigates the risk by returning degassed water from the lower resource zone to the upper resource zone. Restratification of the degassed water in the upper resource zone is confirmed by modeling results. Risks of accidental release scenarios, such as reverse flow and rupture of the raw water riser, have been reduced and mitigated through project design such as conformance to strict material specifications by the suppliers of the riser and downcomers pipes; implementation of strict QA/QC plans during the assembly of the pipes; and the incorporation of a LMP to detect leaks which then provide for shut down of the systems by both automatic and manual means. The real time LMP will also include monitoring of key parameters, including vertical nutrient profiles as called for in the EMMP. Additionally, operational procedures will address emergency shutdown and notification provisions.

It is possible that light emitted from the GEFs and gas pipeline could attract a large number of fish. The GEF exclusion zones could also act as Fish Attracting Devices because of the prohibition on fishing. The overall effects of this impact must be investigated further to determine if light will affect the dynamics of the fish populations. This could also have human impact as fishermen could see reduced catches due to the lower availability of the fish in surrounding areas. Conversely, the exclusion zones could provide positive benefits through assisting in the conservation of lake fisheries.

Noise and vibration may also be considered stressors to which fish could potentially be sensitive. Similarly an artificial magnetic field may also impact the ecosystem dynamics. Further investigation should be carried out into this issue in order to quantify the potential overall effects.

A water resources protection and management plan will be implemented to verify the compliance of discharges from the site into the natural environment. A fisheries monitoring program will be implemented on surveys and the results of these surveys will be used to produce biomass estimates for specific fish species. The program will: meet GoR lake fishery monitoring requirements; monitor Phase I and pipelines impacts; monitor whole project impacts; and combine fisheries catch and landing data collected by the government. Additionally, there are no protected areas within the site itself or in close proximity to the site with the exception of the 10 meter riparian exclusion zone along the shoreline of Lake Kivu.

F. Social and Environmental Permitting Process

The Framework for environmental law in Rwanda is the Organic Law on Environmental Protection, Conservation & Management (2005), supported by a series of statutory instruments and subsidiary legislation as follows:

- REMA General guidelines and procedures for EIA (2006)
- REMA Environmental Impact Assessment Regulations (2007)

Environmental conditions are also imposed in the PPA and GCA. These apply to emissions, waste management, gas flaring, noise, the ESIA and permitting requirements and local sourcing of goods and services.

The GoR EIA regulation of 2005 set out requirements for stakeholder consultation. In particular REMA, in conjunction with the Rwandan Development Board, initiated a public meeting on November 27, 2009, pending the notification of receipt of an ESIA. The meeting was open to members of the public as well as governmental and other agencies, all of whom participated and commented on the EIA and the proposed development. The ESIA Certificate, dated January 18, 2010 was issued to KivuWatt Ltd on behalf of the Rwandan Development Board. Details and results of the consultations conducted are included in Section F.

G. Availability of Documentation

The October 2009 ESIA is disclosed as an attachment to this ESRS. The Green and Clean Solutions (GCS) April 2009 ESIA with information from the SKM ESIA October 2009 are also available at the Rwanda Development Board.

Environmental and Social Impact Assessment Report
Environmental and Social Impact Assessment Report – Appendices B - E
Environmental and Social Impact Assessment Report – Appendices F - L
Environmental and Social Impact Assessment Report Figures
Abbreviated Resettlement Action Plan (ARAP)