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 GeoScience Consultancy PLC

FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

Environmental and Social Impact Assessments for the Proposed Mini-Grid Solar Power Plant Project in Lelicho, Shebedino Woreda, Sidama Region

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Prepared by Veritas Consulting and Geoscience PLC



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Executive summary

1. Introduction

RVE.SOL ETH Energy Generation Solutions PLC is a solar company newly incorporating in Ethiopia. RVE.SOL intends to deploy Solar mini-grid solutions in Lelicho, Shebedino Woreda, Sidama Region in line with the DREAM projects described herein.

RVE.SOL ETH Energy Generation Solutions PLC is a subsidiary of RVE.SOL Soluções de Energia Rural, S.A., a global solar developer with its headquarters in Leiria, Portugal. African subsidiaries of RVE.SOL currently operate 14 solar mini-grids in Kenya, with over 12 years' experience developing solar projects in East Africa. Expansion of the company to Ethiopia will begin with 2 pilot projects under the DREAM project and in close partnership with the relevant Ethiopian Ministries.

2. Overview of the Project

Ethiopia depends on electric power generated from large hydropower stations to propel its economic growth and provide energy for domestic uses. To meet the rising demands for energy in rural areas where access is limited, the National Electrification Program 2.0 (NEP 2.0) suggests off-grid electrification. This is particularly important for Ethiopia's rural settlements which are often dispersed and inaccessible.

The DREAM project has proposed Lelicho village, Asrado Mero Kebele, Sidama region for mini-grid system development. The size of the mini-grid is currently estimated to be around 600 kW in Lelicho. The potential deviations in size estimates will not have a significant impact on any of the ESIA recommendations.

The stand-alone AC coupled solar photovoltaic (PV) mini-grid will provide a reliable power supply to the community and to an irrigation system that will replace the diesel pumps currently used by farmers for irrigation. Once completed, the Project is expected to go into commercial operation in January 2024 and supply electricity to smallholder farmers for irrigation purposes. The impacts of the mini-grid system project are identified and addressed in this Environmental and Social Impact Assessment (ESIA) report for Lelicho site in Sidama region.

Goals and Specific Objectives

The broad goal of the Environmental and Social Impact Assessment (ESIA) is to provide decision-makers and project proponents with information on potentially significant environmental and social impacts and risks associated with the proposed mini-grid solar power plant and irrigation project at Lelicho site, Sidama region. The specific objectives are to identify potential positive and negative impacts of the proposed project, to suggest mitigation and enhancement measures for the identified significant adverse and beneficial impacts, to provide management and monitoring plans, and to ensure that the proposed project complies with the national environmental regulations and African Development Bank's integrated safeguards system.

Project components and main activities

The mini-grid solar systems include the following components: a mounting system that will be used to mount PV modules on structures made of aluminum or hot-dip galvanized steel. While the mounted PV panel modules absorb the sun's rays as a source of energy to generate electricity, inverters will be used to convert the Direct Currents (DC) produced by PV modules to grid-exploitable Alternative Currents (AC). Then, transformers will change voltage levels from low voltage (230V) to medium voltage (15kV or 33kV) and vice versa. Finally, overhead distribution lines mounted on wooden poles will be used to transfer power from the solar power plant to households and irrigation pumps.

Project Alternatives

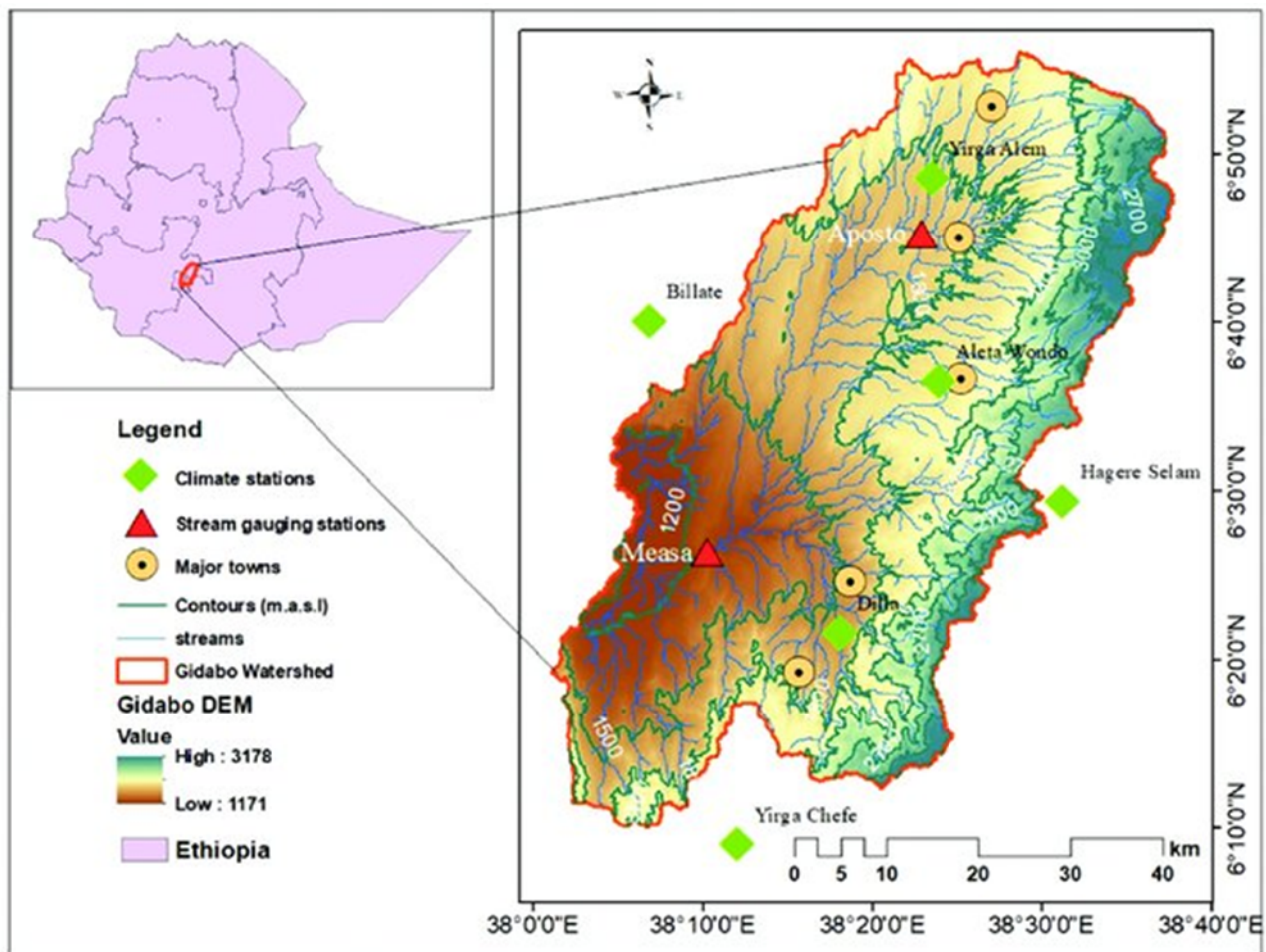
Several project options were examined to select the feasible alternative considering biophysical, social, economic, and technical factors. The alternatives considered were as follows:

- No project alternatives,
- Project location alternatives,
- Other sources of power (Hydro, Fuel, and Wind), and project implementation options.

After comparing the above-mentioned alternatives based on technical feasibility, economic viability, and environmental acceptability, solar energy was selected because of the numerous project advantages it can present to the local community and the low negative impacts of the project on the social and biophysical environment.

3. Description of the Project Area

The proposed project site, i.e., Lelicho, is in Sidama national regional state, 50km southeast of Hawassa city. Lelicho site can be accessed through an asphalt road from Hawassa to Leku (32 km) and then from Leku town (Shebedino Woreda) on an 18 km gravel road through a mountainous landscape.



4. Baseline conditions of the proposed Lelicho site

Lelicho site has a reported mean annual rainfall of about 2400mm with two rainy seasons interrupted by a long dry season. The main rainy season (Kiremt) lasts from June to October and the short rainy season (Belg) is from April to May. The topography of the area is relatively rugged due to its location at the edge of the eastern escarpment of the rift valley and extending the highlands. The soils are generated from rift valley related pyroclastic flow parent material. The clay soils, likely kaolinite, in Lelicho area contain dark grey to dark-brown soil gradients in color. During

the field survey, the ESIA team collected soil samples from the area to characterize the important macronutrients and micronutrients of soil in the area. Soils in Lelicho are acidic (pH 4.61). According to FOA information, a soil with pH value between 6-7.5 is conducive for most plants because most nutrients are available in this pH range. Acidification which is the result of long-term rain is developed by a buildup of H⁺ and Al³⁺ in the soil and the leaching of bases (like Ca²⁺, Mg²⁺, K⁺ and Na⁺). The concentration of exchangeable elements in the target area is relatively good for the health and productive growth of plants (e.g. Na, Ca, Mg and K are available in sufficient amounts). The concentration of both phosphorus and sulfur (85.03mg/kg and 108.55mg/kg) in the area are lower than the FAO recommended level hence may require the application of fertilizers. Regarding the natural vegetation, due to wide range of altitudes different kinds of plants are found in the target area. Some of the predominant species include *Culturnia aurea*, *Phoenix reclinata*, *Sansieveria sp.*, *Croton machrostachys*, *Vernonia auriclifolia*, Coffee arabica, *Afrocarpus falcatus*. However, none of them are of concern for conservation or their threat levels are quite low. There are so many small streams which cross Lelicho and feed the Gidabo River and finally drain to Lake Abay. A drinking water sample was collected from the spring, which is currently being used by the community and was sent to a laboratory for physico-chemical analysis. The results show that only sodium concentration and turbidity are beyond the WHO maximum limit for drinking water in Lelicho.

With regard to the socio-economic baselines: a recent projection by the Ethiopian Statistical Agency in collaboration with USAID has indicated that Shebedino, where Lelicho site is found, has a total population of 317,202. Livelihood is largely dependent on agroforestry, particularly Enset (*Ensete ventricosum*), coffee and Khat (*Catha edulis*). However, vegetables are grown to supply huge market demands in Hawassa and beyond. The health facilities in Shebedino Woreda include health centers, clinics, and health posts. There is one hospital in a nearby Leku town. Lelicho village has only a primary school and education services appear to be poor. Lelicho is not connected to the national grid and hence does not have electricity to fuel energy for domestic services and irrigation. There were no evidences of any archeological/historical heritages that would potentially be affected by the project implementations. Nevertheless, as always, there is a risk that cultural heritage objects are unexpectedly uncovered during construction activities. Hence, excavation works should be done carefully as per World Bank Guidelines - OP 4.11 and chance find procedures would be prepared.

5. Institutional and Legal Frameworks

As part of the ESIA study, a review of the policies, laws, and institutional arrangements that govern environmental protection and the ESIA system in Ethiopia has been carried out. The ESIA study also considered the African Development Bank Integrated Safeguard System and applicable Safeguard Policies.

Concerning institutional arrangements for the implementation of ESIA, the Ethiopian Environmental Authority (EPA) is mandated to formulate or initiate and coordinate the formulation of strategies, policies, laws, and standards as well as procedures and upon approval monitor and enforce their implementation. It is also responsible for the synergistic implementation and follow-up of international and regional environmental agreements. EPA is mandated to review, approve ESIA reports and issue the environmental authorization. The EPA also undertakes the role of certification of ESIA practitioners. The EPA has its tentacle office at regional levels as well. Moreover, regional bureaus of Agriculture, irrigation and pastoral development, Women's office, and mines and energy were reviewed.

About the policies, proclamations, regulations, and guidelines issued by the government of Ethiopia and the AfDB, the ones outlined below, *inter alia*, are relevant to the proposed projects and were reviewed:

Constitution of The FDRE, National Energy Policy of Ethiopia, Water Resources Management Policy, National Conservation Strategy of Ethiopia (CSE, 1997), Environmental Policy of Ethiopia (1997), Ethiopian Women's Policy, Health Policy of Ethiopia, Environmental Impact Assessment (Proclamation No. 299/2002): Environmental Pollution Control (Proclamation No. 300/2002), Public Health Policy (Proclamation No. 200/2000): in addition, the ESIA team has also reviewed the African Development Bank Operational Safeguards Policy.

Concerning the AfDB safeguard policies five Operational Safeguards (OS) were established and are summarized here as extracted from the AfDB ISS Policy Statement 2013.

- **OS1 Environmental and Social Assessment:** This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements. The proposed projects are Category 3 projects as they are less likely to have site-specific environmental and/or social impacts. Likely negative impacts are site-specific, largely reversible, and readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards.
- **OS2: Involuntary Resettlement: Land Acquisition, Population Displacement, and Compensation:** This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements. As the risk category of the project falls under category 3 the project does not trigger OS 2 and hence resettlement action plan and livelihood restorations are not needed.
- **OS3: Biodiversity and Ecosystem Services:** The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of natural resources. This safeguard could be triggered due to trade-offs of ecosystem services where the availability of solar energy may result in increased withdrawal of water for irrigation (to increase agricultural production) at the cost of regulatory services such as draining wetlands which are carbon sinks and biodiversity hotspots.
- **OS4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials, and Resource Efficiency:** This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed on international conventions and comprehensive industry-specific standards that other multilateral development banks follow. The solar mini-grid power plants are meant to curb pollution which is already underway through diesel pumps for irrigation.
- **OS5 Labour Conditions, Health, and Safety:** This safeguard establishes the Bank's requirements for its borrowers or clients concerning workers' conditions, rights, and protection from abuse or exploitation. It covers working conditions, workers' organizations, occupational health and safety, and avoidance of child or forced labour. Construction and decommission of mini-grid power plant may temporarily attract a medium sized labour force. Unfortunately, workers may not be properly informed of their rights and work conditions.

6. Project Impacts

Solar mini-grid power plants are generally considered to have low environmental and social risks and impacts compared to many other energy or industrial developments due to their short construction phases and insignificant emissions to air, water, and soil during operations. The major positive impacts of the mini-grid project includes:

- Employment opportunities for skilled and non-skilled labour,
- Provision of reliable electric power supply to farmers,
- Reducing greenhouse emissions to the atmosphere by replacing diesel pumps,
- Enhancing agricultural production and productivity,
- Improving local livelihoods by supplying electricity to communities.
- Enhance women's empowerment and gender equality

The project's main impacts on the biophysical environment in the proposed site include clearing of vegetation for the solar mini-grid power plant installation, particularly at Lelicho site where the multistoried agroforestry system

could be negatively affected. The risks of contamination of water and soil from the disposal of hazardous wastes (including PV panels) in Bu'a in Lelicho.

The project's main adverse impacts on the socio-economic environment may include increased prevalence of HIV/AIDS and other infections/diseases and Covid 19 due to the influx of workers. Similarly, temporary labour influx, especially during construction phase, may result in gender-based violence (GBV) and sexual exploitation risks for women and girls. In addition, the employment of children below 15 years of age could be an issue requiring monitoring protocols and administrative mechanisms. However, GBV and associated impacts will likely be minor during the operation phase since the minigrid will only be providing electricity to clients and does not involve an external labor force.

Finally, fire hazards, workplace accidents and injuries, and traffic accidents to workers and local communities were among the identified negative impacts of the proposed mini-grid solar power project during the construction and decommissioning phases of the project.

7. Public Consultation

Consultations were conducted with Woreda officials and local people in the project area. Public Consultation meeting was undertaken in the proposed project site during which the attitude of the community was assessed. It was very helpful to obtain basic information on the socio-economic, socio-cultural, and biophysical impacts of the project, and the associated measures to be taken. The discussion was participatory, in which the participants expressed their views, concerns and suggestions without any reservation on the proposed solar project. The public consultation minutes are annexed to the main report of this document.

Date of meeting: 06/10/2021

Venue: Lelicho Kebele office

Number of participants: Men 20, Women 5

| Name of participant | Issues raised | Responses by the ESIA team |
|--------------------------|---|---|
| Ato Dawit Bosholo (M) | Are you related with the GIZ since we have heard about solar energy from them, and we have been promised to have access to off grid household energy? | The ESIA team explained that this was a separate project aimed at providing energy for the community and irrigation purposes |
| Ato Beyene Hariso (M) | Land is a scarce resource here and how much land it will take to set up the solar panel and generate energy? | The ESIA team clarified that land take will be minimal since there is flexibility in the design to avoid productive land for solar panel installations. In addition, any land being taken away from farmers will be compensated according to the provisions of the law of the land |
| W/ro Asnakech Chinko (F) | How will this project ease women's burden? | The ESIA team responded that this project, if materialized, will help solve problems related to irrigation and improve farm productivity which directly or indirectly empowers women |
| Gosooma Shite (M) | Does the government pay compensation for land taken for Panel construction? | The ESIA team responded that the government pays appropriate compensation for any land intake before the commencement of the project. |
| Ato Tesfaye Mussie (M) | How do I know that my land is taken for the purpose of solar panel construction? Will I be informed about the details of compensation? | All potentially affected persons will be informed ahead of time about the particular/suitable land for PV panel construction. There will be committee for compensation purpose drawn from local elders, PAPs, Kebele and Woreda. |
| W/ro Shenbe Rafessa (F) | When is this project going to be implemented? | For this question, we clarified that this is an initial study, and it may take some time until all the project related issues are secured. |
| All participants (M & F) | All the above respondents raised any potential source of gender-based violence including sexual exploitation of women for short term benefits | The ESIA team responded that gender-based violence is a serious offense and the potential project proponent will have a protocol including training manuals to sensitize and monitor it. If it happens in some way, there will be administrative and disciplinary mechanism to address the offenses |

8. Environmental and Social Management Plan (ESMP)

The minigrid power plant, generation and distribution, and customer connections will be managed by the Minigrid Developer, with construction done by the Minigrid Contractor. The local government and municipality bodies will be involved as well as and where appropriate.

This ESIA seeks to address all potential impacts and risk mitigation activities that any of the above entities may be involved in. The following table seeks to delineate which entity will be responsible for impacts and mitigation. The cost estimates provided in the below reflect expected costs over the 20-year estimated lifetime of the minigrid project.

| Phases | Category of impacts | Main Identified Impacts | Mitigation Measures/enhancement | Responsible bodies | Estimated cost |
|--------------------|---------------------|---|--|--|--|
| Construction Phase | Human environment | Public health | Conduct public health awareness campaigns addressing issues of behavioural change, HIV/AIDS, etc. Prepare training manual and conduct regular training about STDs Provision of materials useful for the prevention of HIV/AIDS | Community /woreda labour and women affairs office Minigrid Contractor | Awareness-raising and training 25,000 birr For internal half day training 15,000 birr |
| | | COVID 19 | Workers shall follow strictly Covid19 prevention mechanisms such as temperature measurement at the gate of the compound, washing of hands, wearing of masks, avoid hand shake, and keep social distance as much as possible. | Minigrid Contractor /EHS unit of the project proponent | 30,000 birr for purchase of PPE |
| | | Gender- based violence and child labour | Provision of training for workers and families, Community sensitization, regular monitoring for EHS compliance | Woreda labour and women's affairs office | 100,000 for training, and regular monitoring |
| | | Traffic Accident | Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages) Mandatory speed limits not exceeding 30km per hour Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns) | Minigrid Contractor in collaboration with Woreda traffic police | Training cost for awareness creation for community and workers 20,000 |
| | | Impacts on cultural, historical and archaeological site | If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual | Minigrid Contractor supervised by Sidama regional state culture and tourism office | Supervision cost 20,000 birr |

| Phases | Category of impacts | Main Identified Impacts | Mitigation Measures/enhancement | Responsible bodies | Estimated cost |
|------------------------|--------------------------------|---------------------------------------|---|---|--|
| | Biophysical environment | Generation of solid Wastes | <p>Hazardous waste should be disposed of in accordance with best industry practices. Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean.</p> <p>Solid waste from packaging materials like fertilizer & seed bag should be disposed at appropriate place. Bottles and containers of pesticides and herbicides should be stored and removed following best industrial practices</p> | <p>Minigrad Contractor</p> <p>Woreda agriculture office</p> | Estimated cost for disposal of solid waste 40,000 birr |
| | | Generation of liquid Waste | <p>Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills</p> <p>The wastewater from sanitary and construction works should be collected through a channel in a plastered pond or reservoir and can be recycled for construction, green area, and other purposes after proper filtering and treatment</p> <p>Very minimal amount of wastewater for Minigrad, very limited amount of fuel or hazardous material</p> | Minigrad Contractor | For construction of plastered pond and other storage structure is 60,000 |
| | | Soil erosion | <p>Avoid excavation during the rainy seasons</p> <p>Heap the excavated soil in the selected area and reuse it to fill undulating areas</p> | Minigrad Contractor | Labour cost to pile up soil is 30,000 |
| | | Noise pollution | <p>Noisy activities shall be scheduled to daytime hours</p> <p>Noise disturbance and impact can be reduced by also administration and management deciding to work on a shift basis, work rotation and work time reduction for workers to reduce workers exposure to noise, etc.</p> <p>Personal protective equipment such as ear muffers/plugs should be used</p> | Minigrad Contractor | PPE cost already included above. |
| | | Air pollution | Workers assigned in the construction should wear a dust mask. Water shall be sprayed on all internal roads to minimize dust dispersion when necessary | Minigrad Contractor | PPE included above, and water spray is 20,000 birr |
| Operation Phase | Human Environment | Occupational health and safety | <p>Use of appropriate PPE during installation and maintenance</p> <p>The solar PV plant shall be equipped with fire-fighting tools</p> <p>Ensuring all electrical equipment and machinery are properly grounded</p> <p>Maintenance should be conducted by trained professionals only</p> | Minigrad Developer | Estimated cost to purchase lifetime PPE is 60,000 birr |

| Phases | Category of impacts | Main Identified Impacts | Mitigation Measures/enhancement | Responsible bodies | Estimated cost |
|------------------------------|--------------------------------|--|---|--|--|
| | | Fire hazards | The solar PV plant should be equipped with proper fire extinguishers The technician should regularly inspect Solar PV components | Minigrid Developer | fire protection systems 40,000 |
| | | Impacts on cultural, historical and archaeological site | If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual | Minigrid Contractor supervised by Sidama regional state culture and tourism office | No cost is implied |
| | Biophysical Environment | Liquid waste | Construct a septic tank inside the premise and collect sanitary waste and finally dispose it off at permitted area | Proponent | Septic tank is expected to be constructed during construction phase |
| | | Loss of farm and grazing land | Landowners shall be compensated as per the new proclamation No. 1161/2019 before the construction activities started Provide job opportunity priority for those projects affected people (PAP) during construction and implementation phases | Minigrid Developer, Woreda Agriculture offices, Woreda administration | The cost will be estimated later by Woreda experts |
| Decommissioning phase | Human Environment | Loss of employment | Transfer permanent workers to other active projects or be absorbed into other government offices Pay compensation (severance) fee for permanent workers | Minigrid Contractor /regional government | Compensation payment for workers should be paid by the project proponent TBD |
| | | Gender-based violence/Child labour | Provision of training for workers and families, Community sensitization, regular monitoring for EHS compliance | Community / Woreda labour and women's affairs office | 20,000 for training, and regular monitoring |
| | Biophysical Environment | Generation of solid Waste | Hazardous waste, including broken PV panels, used batteries, shall be disposed of in accordance with best industrial practices | Minigrid Contractor and Irrigation Contractor | Waste disposal cost 150,000 |
| | | Air pollution | Workers assigned to the demolition should wear dust masks. | Minigrid Contractor and Irrigation Contractor | PPE purchase and water spray cost 40,000 |
| Total | | | | | 670,000 |

9. Environmental and Social Monitoring Plans (ESMP)

ESMP has been prepared for addressing all adverse impacts pertaining to the implementation of the mini-grid and projects. The ESMP presents in detail parameters to be monitored, their mitigation measures, institutional responsibility, and indicative budget. The proposed management and monitoring measures can easily be implemented with available resources and expertise. The proponent is largely responsible for financing and coordination of the ESMP for the solar project. The Minigrid Developer, Minigrid Contractor, Irrigation Developer, Irrigation Contractor should be among the main actors, especially during the construction phase when they are required to act as agreed on the contract document and this ESIA study. The Federal Environmental Authority is the regulatory body responsible to review ESIA, monitor, audit, enforce and guide its implementations.

| Parameters to be monitored | Mitigation Measures | Responsible for monitoring | Monitoring schedule | Monitoring indicators | ESM cost in ETH Birr |
|--|---|---|--|--|--|
| Contract management | Make sure the contractor has prepared ESMP for approval for the client | Proponent | Pre-construction and construction phases | Copy of the approved ESMP and implementation of it | Cost internal to developer to get approvals |
| Social support to vulnerable people | Job opportunities for project-affected people (loss land), Landowners should be compensated as per proclamation No. 1161/2019 | Proponent | Throughout operation phase Note: selected land is expected to be community land, not individual | Interview vulnerable people, and field visit, Check the amount of money paid out from finance | Supervision cost 5,000 birr |
| Employment opportunity | Hire workers from local people depending on their education, preparedness, and skill level during construction | Proponent & Woreda | At the beginning and annually | Number of local workers from construction company human resource office | Supervision cost 2,000 |
| Solid waste | Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean | Proponent | Quarterly during construction and operation | Annual site visit to determine if any hazardous waste is on site Disposal of hazardous waste in compliance with waste management procedures | Supervision cost 5,000 |
| Liquid waste | Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills The wastewater from sanitary and construction works should be collected through channels in a plastered pond or reservoir and should be recycled for reuse during construction | proponent | Beginning of construction and annually each year of Operation | Annual check that the necessary are in place Constructed plastered pond/ reservoir if required Amount of water recycled | Supervision cost 5,000k to be done in conjunction with above annual visit |
| Noise pollution | Noisy activities shall be scheduled to daytime hours personal protective equipment such as ear muffers/plugs will be used | Proponent in collaboration with Woreda Health experts | Weekly during the construction phase | Noise level should not exceed the World Bank standard (55dBA and 45 dBA during day and nighttime, respectively) | Cost for regular checking of noise level 5,000 |
| Air pollution | Workers assigned in the construction should wear dust masks. The supervisor should strictly follow and make sure this procedure is in place before starting their job. Water should be sprayed on all internal roads to minimize dust dispersion when necessary | Proponent collaboration with Woreda Health experts | Periodically during the construction and operation phase | Check air quality measurement, air emission shouldn't exceed WHO standards Supervise workers proper use of PPE's Complaints from the local governor, and community | Expert cost for regular check emission level 5,000 to be done together with noise checks |

| Parameters to be monitored | Mitigation Measures | Responsible for monitoring | Monitoring schedule | Monitoring indicators | ESM cost in ETH Birr |
|---|--|---|--|---|---|
| Loss of farm and grazing lands | Landowners should be compensated as per the new proclamation No. 1161/2019 before the construction activities start Provide priority for a job opportunity for those projects affected people (PAP) during construction and implementation phases | Proponent | Before commencement of construction work | Check the amount of money paid for PAP Contractor's personnel office documentation | No cost |
| Traffic accident | Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages) Mandatory speed limits not exceeding 40km per hour Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns) | Proponent collaboration with Woreda traffic police | Every three months at all phases of the project | Number of accidents on the site Speed limits put at appropriate places Erected traffic sign | Supervision cost 2000, to be done together with above checks |
| Sexually transmitted diseases like HIV | Health promotion: sensitization of both community and workforce Provision of materials useful for the prevention of HIV/AIDS Having in place appropriate signposts to educate the workforce and community about the Project's HIV policy | Woreda health office | Every month during the construction and operation phase | Number of distributed condoms Check the number of trainings conducted | Training cost 100,000 |
| Covid 19 | Train workers to follow strictly Covid-19 prevention mechanisms Temperature measurement checkup each day at the gate of the compound Provision of materials necessary for prevention and detection of COVID 19 | Proponent in collaboration with Woreda health experts | Regularly during construction and operation | Number of infected people with covid 19 | Expense already included in construction and operations No cost to report # of cases |
| Occupational Health and safety | Use of appropriate PPE during installation and maintenance The solar mini-grid plant shall be equipped with a fire-fighting system Ensuring all electrical equipment and machinery are properly grounded | Proponent | Regularly during construction and operation | Total recordable incidence rates | for provision of first aid a lump sum of 5,000 |
| Fire hazards | The solar mini-grid plant should be equipped with a fire-fighting system The technician should regularly inspect Solar PV components | Proponent | Every three months during the construction and operation phase | Number of incidents and reported cases | Part of project and operation cost |
| Impacts on historical, cultural heritage | Excavation work should be done carefully as per World Bank Guidelines - OP 4.11 and prepare chance find procedures | Contractor | During construction work | Number of discovered heritage sites or artifacts | Part of supervision cost |
| Total Minigrid Developer / Contractor Only | | | | | 34000 |
| Total other parties | | | | | 100000 |
| Total Monitoring | | | | | 134,000 |

10. Grievance redress mechanisms:

It is expected that no major grievance issue will arise. However, to ensure that stakeholders have avenues for redressing their grievances related to any aspect that may result from the project, procedures of redress of grievances have been established. They are as follows:

- The community will be informed about the procedures in their local language. All information about grievance mechanisms will be available in public areas and with the community leaders
- The client/contractor will accept all comments and complaints associated with the project from any stakeholder either in person, via email, post, telephone, or any other appropriate communication channel. The client/contractor will then arrange for an officer to further listen to the complaints, then summarize the grievances in a complaints/comments logbook which would contain the name of the commenter, date of receipt, brief description of issue, proposed corrective actions, and date of response sent to the complainant
- All grievances will be registered and acknowledged within 6 working days then responded to within 15 days. All responses will be done either in writing or verbally, according to the preferred method of communication of the complainant.

11. Roles and responsibilities

- Project proponent- manage and monitor the environmental and social impacts
- Environmental Protection agency- is responsible for evaluating and approving ESIA study reports as well as for providing environmental approval licenses
- Environmental protection Agency of the SNNPR is expected to be involved in monitoring the environmental performance of the solar power PV and irrigation project in the region
- Community water use associations/ cooperatives are responsible to oversee fair water sharing among farmers

The estimated overall budget for the implementation of all environmental and social measures is 804,000 birr or approximately 15,00 USD (assuming 1 USD = 53.65 Birr).

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List of Abbreviations

| | |
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| AC | Alternative Currents |
| AfDB | Africa Development Bank |
| ADLI | Agricultural Development Led Industrialization |
| AIDS | Acquired Immunodeficiency Diseases |
| dB | decibels |
| CBD | Convention on Biological Diversity |
| CEP | Community Engagement Plan |
| Covid-19 | Coronavirus Disease 2019 |
| CRGE | Climate Resilient Green Economy |
| CSA | Central Statistical Agency |
| CSE | Conservation Strategy of Ethiopia |
| DC | Direct Currents |
| EFCCC | Environment, Forest and Climate Change Commission |
| EHS | Environment, Health and Safety |
| EPA | Environment Protection Authority |
| EIA | Environmental Impact Assessment |
| ESIA | Environmental & Social Impact Assessment |
| ESMP | Environmental and Social Management Plan |
| ESS | Environmental and Social Standards |
| FDRE | Federal Democratic Republic of Ethiopia |
| GTP | Growth and Transformation Plan |
| GHG | Green House Gas |
| IFC | International Finance Corporation |
| ILO | International Labour Organization |
| ISS | Integrated Safeguards System |
| IUCN | International Union for Conservation of Nature |
| HIV | Human Immunodeficiency Diseases |
| PHCU | Primary Health Care Unit |
| PPE | Personal protective Equipment |
| PPM | Parts per million |
| PV | Photo Voltaic |
| STDs | Sexually Transmitted Diseases |
| STI | Sexually Transmitted Infection |
| TDS | Total Dissolved solids |
| WB | World Bank |
| WHO | World Health Organization |

1. Introduction

1.1. Background of ESIA study

Ethiopia has shown an impressive two digits GDP growth in the last couple of decades. This economic growth brings with it an enormous demand for energy for households and industries. Nevertheless, the country depends largely on hydropower-generated energy to propel its economic growth and provide energy for domestic uses. To meet the rising demands of energy for development and meet the challenges of climate change, Ethiopia designed the Climate Resilient Green Economy strategy (CRGE). This strategy was well aligned with Ethiopia's ambitious plan to become a lower-middle-income country by 2025 (GTP II). The alignment of the two policies (GTP II and CRGE) is instrumental for Ethiopia's broad economic planning and has proven to be particularly central in the design of Ethiopia's power development strategy (Veritas, 2020).

The same document stipulates that a mini grid powered by renewable energy directly addresses two NDC [Nationally Determined Contribution] components: (i) reduction of greenhouse gas (GHG) emissions and (ii) reduction of the impact of climate change on Ethiopia's population, environment, and economy. Mini-grid development also helps to deliver on key CRGE objectives viz: (i) ensuring economic development is sustainable by limiting GHG emissions, (ii) creating green job opportunities, and (iii) protecting the economy and people from the adverse effects of climate change" (Veritas, 2020, p. 7).

Given this, solar-powered mini-grids are favorably considered for small-scale projects in different regions of Ethiopia; namely, Amhara, Oromia, Sidama, and SNNP. According to the Environmental Impact Assessment (EIA) proclamation 299/2002, projects that may likely have adverse environmental and social impacts are required to carry out a full impact assessment. In response, this ESIA has been conducted for the proposed DREAM mini-grid solar power project. The purpose of the ESIA study is therefore to identify, predict and analyze the nature and magnitude of environmental impacts and propose enhancement and/or mitigation measures for environmental impacts that are likely to arise from the various activities of the project implementation.

In the study process, various ESIA tools were employed for the identification, prediction, and analysis of impacts. To this end, a biophysical resources survey (vegetation, soils, air, and water quality measurements) was conducted to establish baseline conditions, and socioeconomic assessments were carried out. In addition, secondary data sources were consulted to augment field observations and measurements. The assessment followed the national and international guidelines to comply with the best ESIA practices such as the environmental impact assessment procedural guidelines of Ethiopia and that of AfDBs operational safeguards. The potential positive and negative project impacts have been identified for the construction, operation, and decommissioning phases. On top of this, environmentally sound and socially acceptable impacts enhancement and management options were also suggested.

1.2. Objectives of ESIA Study

The main objective of carrying out the Environmental and Social Impact Assessment for the proposed mini-grid solar power plant is to improve project planning by ensuring that environmental and social considerations are taken care of in all stages of project planning and implementation- these phases include construction, operations, and decommissioning. The ESIA study is particularly aimed at ensuring the environmental and social impacts of the proposed solar mini-grid project's potential impacts are clearly identified and the corresponding mitigation measures are appropriately addressed before decisions are made to implement the project.

Specifically, the ESIA study is to:

- Establish the baseline conditions of the project areas.
- Assess and report on the likely magnitude and significance of impacts, both positive and negative
- Conduct stakeholders and community consultations
- Propose mitigation actions to reduce negative impacts and enhancement mechanisms for positive impacts
- Propose ESMP and a monitoring plan for significant impacts.

1.3. Approaches and Methods

1.3.1. General

This ESIA report was conducted between September and October 2021. The data used for the ESIA were collected from both primary and secondary sources. Primary data were collected through a field survey, expert interviews, and focus group discussions with the communities, while secondary data were obtained from relevant sources including literature and archives from project area government offices. The assessment process incorporates several key steps and constitutes a systematic approach to evaluating the proposed project in the context of the natural and socio-economic environment of the mini-grid pilot site. In addition, the ESIA team has reviewed compliance with the relevant national and international policies, laws, standards, and guidelines

1.3.2. Review of Relevant Documents

Policies, legislation, and guidelines pertinent to environmental and social protections were reviewed to assess the relevant laws and regulations related to the expected environmental and social impact of the proposed projects. In addition, existing documents on previous studies related to mini-grid solar power plants were obtained and reviewed to get insights into important data for the baseline description and background information for the proposed projects (FDRE constitution, 1994; EPA, 1997; CSE, 1997; EPA/EIA, 2002; 2003).

1.3.3. Field Survey

Field surveys and observations are critical to understanding the likely impact of a given project on the environment. The ESIA study team conducted a field survey of the project site in October 2021. The team made observations in and around the project site and gathered essential field data. During site observations, information on physical, biological, and socioeconomic environments has been collected. In addition, noise level, air quality, carbon monoxide, and ambient temperature measurements were conducted. Moreover, the team has also collected soil and water samples and subjected them to physio-chemical analysis in the laboratory to establish baseline conditions.

1.3.4. Stakeholders and Community Consultations

To elicit the views of stakeholders about the potential impacts and effects of the project, stakeholders and public consultations were conducted. The ESIA team followed two stages for public and stakeholders' consultations. First, we identified and mapped potential stakeholders (details are provided in section 5.2) based on the nature of the project (e.g., off-grid solar power plant) and the end users or communities. The stakeholders were identified by segmenting across the following groups: directly and indirectly affected persons, institutional stakeholders including government and organizations likely to be involved in project implementation, regulation, and monitoring.

Following stakeholders' identification, the ESIA team separately engaged the relevant government offices. Official letter communications were made to all the identified government offices and then key informant interviews or focus group discussions were conducted as appropriate. For community consultations, the ESIA team carried out focus group discussions at the proposed project site in Lelicho. The focus group constituted of local resource users (farmers), church leaders, elders, youth, and women. The above segment of the community is thought to be directly affected by the proposed mini-grid solar power plant project. Moreover, church leaders and elders can exert

influence on the community and hence of vital importance for the successful execution of the project. Community consultations were conducted with local communities in Sidama languages and local assistants made translations to the ESIA team (following AfDB's requirement to conduct consultation in a language the communities are comfortable with) at Lelicho localities. The community level stakeholder engagement activities targeted entire communities within the project's area of influence including the indirect impact zones. Two approaches were adopted at this level, the first was to have general community meetings targeting residents of Lelicho and thereafter to conduct interviews with community representatives such as community leaders and social influencers. During the consultation, the ESIA team has disclosed about the project and presented project objectives, the likely benefits, and adverse impacts. Then participants were allowed to express their concerns and expectations regarding the project and likely social and environmental impacts that would likely happen during construction and operation phases of the mini-grid solar power plant project.

1.4 ESIA Report Structure

The ESIA report is structured into 10 chapters. Chapter one provides introduction to the project background, scope, and objectives; whereas chapter two deals with reviews of relevant national policies and strategies, international conventions, lenders guidelines and safeguard standards.

Project descriptions such as proposed project locations, justifications, power, and material requirements were presented in chapter 3. In Chapter 4, we present the details on baseline environmental and social conditions of the proposed project area. After having established the baseline environmental and social conditions. We present details of public consultations in Chapter 5. Potential environmental and social impacts of the proposed mini-grid solar power plant activities are presented in Chapter 6; this is followed by discussions of project alternatives in Chapter 7. Chapters 8 and 9 present the proposed ESMP and monitoring plans, respectively. In chapter, 10 conclusion and recommendations, based on the findings of ESIA study, were presented. Finally, references and annexes are provided at the end of the document.

1.4. Limitations

The data collected (particularly secondary data) at Kebele and Woreda levels may often be incomplete and fragmented. In some instances, data were not compiled in organized form (e.g., yield per year, land under farming or grazing, etc.). To rectify the constraints and limitations the study team conducted key informant interview with concerned stakeholders and further substantiated them through community consultations.

2. Policy, Legal and Administrative Frameworks

This chapter provides an overview of the relevant legislation, policies, standards, and guidelines applicable to the proposed DREAM mini-grid solar power plant. Thus, the chapter reviews applicable national legislations, policies, strategies, and proclamations particularly related to energy, environmental protections, and others. In addition, the chapter provides a brief discussion of African Development Bank Operational Safeguards which are pertinent to the proposed projects.

2.1. National Laws, Policies and Strategies

2.1.1. The Constitution of Federal Democratic Republic of Ethiopia (FDRE)

The constitution of the Federal Democratic Republic of Ethiopia, Proclamation No. 1/1995 is the supreme law of the land. Article 40 sub-article 3 states that “The right to ownership of rural and urban land, as well as of all natural resources, is exclusively vested in the State and the peoples of Ethiopia. The land is a common property of the Nations, Nationalities, and Peoples of Ethiopia and shall not be subject to sale or other means of exchange.”

Article 44 stipulates in sub-article 1 that “All persons have the right to a clean and healthy environment.” Sub article 2 of article 44 informs on resettlement action planning. It states that; “All persons who have been displaced or whose livelihoods have been adversely affected as a result of State programs have the right to commensurate monetary or alternative means of compensation, including relocation with adequate State assistance.”

Article 36 on rights of children states that every child has the right not to be subject to exploitative practices, neither to be required nor permitted to perform work that may be hazardous or harmful to his or her education, health, or well-being.

The right of the public and the community to full consultation and participation as well as to the expression of their views in the planning and implementation of Environmental Policies and development projects that affect them is enshrined in the constitution (Articles 92.3 and 43.2).

2.1.2. National Energy Policy of Ethiopia

The Federal government of Ethiopia formulated an energy policy in 1994, which was the first ever comprehensive energy policy in Ethiopia. The main objectives of the policy are

- To provide reliable, timely, and affordable energy to foster the nation’s agricultural and industrial development
- To ensure and encourage the gradual shift from traditional energy sources to modern one
- To remove institutional and other bottlenecks for energy development and utilization and streamline the development of indigenous energy sources for self-sufficiency
- To increase energy use efficiency and reduce wastages
- To ensure that the development and utilization of energy are not detrimental to the environment

The policy document has indicated many options for energy development (in chapter 4 of the policy document) to attain the national energy policy objectives. Among them the most relevant for this mini-grid solar project are provided below:

- To provide alternative energy sources for the household, industry, agriculture, transport, and others
- To ensure the compatibility of energy resource development which promotes ecological and environmental sustainability
- To facilitate and encourage the participation of the private sector in energy development
- Encourage women’s participation in planning, development, and utilization of energy

Even though the energy development plan is heavily reliant on hydropower development other sources of energy are also being considered. The main among them is geothermal, solar, wind, and other energy sources and exploration of fossil fuels (e.g., natural gas), afforestation, and increasing efficiency of agro-residues as sources of energy.

2.1.3. National Conservation Strategy of Ethiopia (CSE, 1997)

The Federal Government of Ethiopia has undertaken several initiatives that aim to develop regional, national, and sectoral strategies to conserve and protect the environment. One of these strategies was the conservation strategy of Ethiopia (CSE, 1996). This document provides a strategic framework for integrating the environment into new and existing policies, programs, and projects. It is also an important policy document, which views environmental management as an important component of development. It recognizes the importance of incorporating environmental factors into development activities from the outset.

The major environmental and natural resources management issues facing Ethiopia are well documented in the CSE (FDRE, 1997). The CSE sets out detailed strategies and action plans as well as the institutional arrangements required for the implementation of sectoral as well as cross-sectoral interventions for the management of Ethiopia's natural, man-made and cultural resources.

The most important areas that are addressed by the CSE include the following:

- Management of forest and woodland resources
- Land resource use policy and strategies; physical land-use planning
- Integration of social, cultural, and gender issues in sustainable resources and environmental management
- Promotion of participation in the sustainable development of natural, artificial, and cultural resources, and environmental protection
- Development of environmental education, public awareness, and human resources

2.1.4. Environmental Policy of Ethiopia (1997)

The Environmental Policy of Ethiopia (EPE) was approved by the Council of Ministers in April 1997 (EPA/MEDAC 1997). It is based on the Conservation Strategy of Ethiopia (CSE), which was developed through a consultation process over the period 1989-1995. The policy has the broad aim of rectifying previous policy failures and deficiencies, which in the past have led to serious environmental degradation. It is fully integrated and compatible with the overall long-term economic development strategy of the country, known as Agricultural Development Led Industrialization (ADLI), and other key national policies like the National Population Policy and the National Policy on Women.

EPE's overall policy goals may be summarized in terms of the improvement and enhancement of the health and quality of life of all Ethiopians and the promotion of sustainable social and economic development through the adoption of sound environmental management principles.

Specific policy objectives and key guiding principles are set out clearly in the EPE and expand on various aspects of the overall goal. The policy contains sectoral and cross-sectoral policies and has provisions required for the appropriate implementation of the policy itself.

2.1.5. Ethiopia's Climate Resilient Green Economy (CRGE) Strategy

The Climate Resilient Green Economy (CRGE) is Ethiopia's overarching framework and a national strategy toward a green economy with the main objective to protect the country from the adverse effects of climate change and to build a green economy that will help realize Ethiopia's ambition to reach middle-income status before 2025. This strategy was highly synchronized with Ethiopian Growth and Transformation Plan II (2015/2020) which was aimed to bring about structural transformation in Ethiopia's major economic sectors. The objective of the strategy is to identify green economy opportunities that could help Ethiopia reach its ambitious growth targets while keeping greenhouse gas emissions low. The CRGE strategy has identified four pillars: Agriculture and forestry, power and industry, transportation, and buildings as instrumental in supporting Ethiopia's developing green economy and for

reaching middle-income status by 2025. The CRGE strategy had designed specific objectives to address issues related to water and energy sectors to climate. These objectives include:

- To identify the economic and social impacts of current climate variability and future climate change on water and energy in Ethiopia
- To identify priority ways that the water and energy sectors can build climate resilience and reduce the impact of climate variability and climate change
- To map the necessary steps to finance and implement measures in the water and energy sectors to build climate resilience in Ethiopia and deliver an integrated climate-resilient green economy

2.1.6. Ethiopian National Energy Policy 2012

Policy objectives concerning environmental impact are in place to ensure the production, delivery, and utilization of energy without affecting or threatening the environment and society. One of the Policy Instruments in this respect is the introduction of mandatory environmental and social impact assessment on new energy and non-energy investment projects to assess the level of emissions of pollution and determine whether the project will have to be realized and on the type of necessary mitigation measures to be adapted.

2.1.7. National Social Protection Policy of Ethiopia

The main objectives of the Social Protection Policy of Ethiopia are the following:

- Protect poor and vulnerable individuals, households, and communities from the adverse effects of shocks and destitution
- Increase the scope of social insurance
- Increase access to equitable and quality health, education, and social welfare services to build human capital thus breaking the intergenerational transmission of poverty
- Guarantee a minimum level of employment for the long term unemployed and under-employed
- Enhance the social status and progressively realize the social and economic rights of the excluded and marginalized
- Ensure the different levels of society are taking appropriate responsibility for the implementation of social protection policy
- To make practical the above listed objectives social protection policy, the project proponent or developer should abide by the policy prescriptions

2.1.8. Ethiopian Women's Policy

The then transitional government of Ethiopia 1993 adopted the first National Policy on Ethiopian Women (NPEW). This was the first such move to give an institutional approach to address gender equality and enhance women's development aspirations through policy measures. Indeed, it was a great stride in focus moving away from the welfare approach to that of realization/recognition of women's role and contribution to the national socio-economic development. The policy has a three-fold objective. The first one is to ensure women's access to basic services such as health, education, and employment opportunities and avoid barriers such as social norms, and cultural and traditional practices which may hinder women's full participation in the socio-economic development of the nation. Second, the policy gives special attention to eliminating all forms of discrimination against women and creating awareness of women's legal rights. Finally, it was intended to create the appropriate structures within the government offices to establish and monitor the implementation of different gender-sensitive and equitable public policies. Following the policy recommendations of creating an appropriate institutional structure at the various tiers of government, there is now a ministry of Gender and Social Affairs /regional bureaus/district offices of women's and children's affairs. At the federal level, one of the duties and responsibilities of the ministry of Gender and Social Affairs is conducting and monitoring gender-related issues and activities at the national level and creating an environment for the implementation of the NPEW in different sectors (even though the policy needs to be updated to match with the current institutional set up). At regional, zonal, Woreda, and Kebele levels, there are respective

offices (at the Kebele level, usually individuals are assigned in place of an office). On the other hand, those situated in line sectors/ministries are mandated to identify issues of gender gaps and develop strategies to address inequalities in the respective line ministries and their sub-sectors. The Gender and Social Affairs Offices are formally accountable to their respective councils, many of which have women's affairs or social affairs committees that are engaged in oversight activities. The plans included steps to enhance rural women's access to and control over productive resources like land, extension, and credit services.

2.1.9. Violence against Women

A declaration on the Elimination of Violence against Women Proclaimed by General Assembly resolution 48/104 of 20 December 1993 is talking about recognizing the urgent need for the universal application to women of the rights and principles concerning equality, security, liberty, integrity, and dignity of all human beings. This under this declaration article 2 states that battering, sexual abuse of female children in the household, dowry-related violence, marital rape, female genital mutilation and other traditional practices harmful to women, non-spousal violence and violence related to exploitation; psychological violence occurring within the general community, including rape, sexual abuse, sexual harassment and intimidation at work, in educational institutions and elsewhere, trafficking in women and forced prostitution; and Physical, sexual and psychological violence perpetrated or condoned by the State, wherever it occurs. In this the same declaration it is stated that women are entitled to the equal enjoyment and protection of all human rights and fundamental freedoms in the political, economic, social, cultural, civil, or any other field.

2.2. National Proclamations

2.2.1. Environmental Impact Assessment Proclamation No.299/2002

This proclamation made Environmental Assessment a mandatory legal prerequisite for the implementation of major development projects, programs, and plans. The proclamation also provides a legal base for the effective means of harmonizing and integrating environmental, economic, cultural, and social considerations into the planning and decision-making processes thereby promoting sustainable development. Moreover, it serves as a basic instrument in bringing about administrative transparency and accountability, to involve the public and the communities, in the planning and execution of development programs that may affect them and their environment.

2.2.2. Environmental Pollution Control Proclamation No.300/2002 and Industrial Pollution Control Regulation No.159/2008

This proclamation is aimed at eliminating or, when not possible, mitigating pollution as an undesirable consequence of social and economic development activities. It also states that the protection of the environment and safeguarding of human health, as well as the maintaining of biota and the aesthetic value of nature, are the duty and responsibility of all citizens. It further considers other important issues such as control of pollution; management of hazardous waste, chemical and radioactive substances; the importance and need to respect environmental standards; and punitive and incentive measures. The Ethiopian regulatory body such as the former Environment, forest, and climate commission (now reconstituted as Environmental Protection Agency) may make surprise monitoring visits, without any prior notice, to ensure that the environment is protected from any serious pollution effects.

2.2.3. FDRE Rural Land Administration and Land Use Proclamation No. 456/2005

The Rural Land Administration and Use Proclamation (Proclamation No. 456/2005) provides entitlement to property produced on the land of the occupant, rights of intergenerational transfer, and limited leasing rights. Provisions are made for the registration and certification of tenure rights. Part Three of the Proclamation presents regulations relating to the use of rural land, particularly as it relates to soil and water conservation and watershed management. The rural land administration and land use laws are to be implemented by the regional states. Landholding right

gives the right to use the land for agricultural purposes as well as to lease it and, while the right remains in effect, bequeath it to family members.

Article 7 sub-article 3 of the proclamation reinforces the rights of land users to compensation for the development they have made on the land. It also states that when the landholder is evicted by the federal government, the rate of compensation would be determined based on the federal land administration law. When the rural landholder is evicted by regional governments, the rate of compensation would be determined based on the rural land administration laws of regions. It is envisaged that the Proclamation will create a sense of ownership among most of the rural population and enable them to take initiatives and collectively engage in environmental management activities.

2.2.4. Expropriation of Land Holdings for Public Purposes and Payment of Compensation Proclamation No. 1161/2019

The federal proclamation on expropriation of landholding for a public purpose, payments of compensation, and resettlement (Proclamation No.1161/2019) replaced "Expropriation of Landholdings for Public Purposes and Payment of Compensation, Proclamation No. 455/2005". This new proclamation has been formulated to address, *inter alia*, the fast-growing urban population in major cities of Ethiopia and associated land acquisition for residential and infrastructure development needs. Rural areas also define the powers and responsibilities of authorities, which oversee property valuation, payment of compensation, and resettlement. This proclamation was made to correct past misgivings due to gaps seen during the implementation of the previous proclamation 455/2005. Considering these gaps, it envisions providing fair compensation and expedites decision-making for those whose land has been expropriated for development purposes. Moreover, it envisions putting in place a grievance redress mechanism to address complaints related to land appropriation and compensation. The proclamation states that the landholder whose land has been expropriated shall be paid compensation for the property on the land and the permanent improvement made on the land. The amount of compensation for the property on the land shall cover the cost of replacing the property anew. The proclamation requires compensation and resettlement for land expropriation to sustainably restore and improve the livelihood of displaced people.

2.2.5. Payment of Compensation for Properties Situated on Landholdings Expropriate for Public Purposes (Regulation No.472/2020)

This regulation repealed the Council of Ministers Regulation on Payment of Compensation for Property Situated on Landholdings Expropriated for Public Purposes (Regulation No. 135/2007). This Regulation contains property valuation and compensation methods and formulae that should be used in calculating compensation for various properties. It also contains lump sum compensation to be paid for severed social relationships and moral damages. The regulation also sets the provision of land expropriation procedure, proprietary right to develop the land to be expropriated, provision of substitution of land, housing and resettlement, and shareholder rights of the displaced. This regulation was issued for the purpose of not only paying compensation but also assisting displaced persons to restore their livelihoods. The Council of Ministers Regulation No. 472/2020 was issued to facilitate the proper implementation of proclamation No. 1161/2019.

2.2.6. Labour Proclamation No.1156/2019

The Labour proclamation states requirements regarding employer-employee relationships including requirements for the provision of contracts of employment (Articles 6 & 7) and the need for employers to take all the necessary occupational safety and health measures and to abide by standards and directives to be given by the appropriate authorities in respect to Occupational Safety and Health (OSH) measures.

2.2.7. FDRE federal Civil Servants Proclamation No. 1064/2017

Article 8 states that all positions of equal value shall have equal base salary and any Government office shall, at the end of every month, make payments of salary to civil servants or their legal representatives.

Article 14 presents that civil servant shall not be civil servant:

- a) Person under the age of 18 years
- b) Any person who has been convicted by a court of competent jurisdiction for offences of corruption, breach of trust, theft, fraud, or rape unless five years have lapsed from the date the penalty is served or is barred by limitation or remitted by pardon
- c) A person having no certificate of competence
- d) Any person who is unwilling to take oath of fidelity in accordance with Article 17 of this proclamation

2.2.8. Proclamation for the Establishment of Environmental Protection Organs No. 295/2002

This proclamation established a system that fosters coordinated but differentiated responsibilities among environmental protection agencies at federal and regional levels. It clarifies the mandate and responsibilities of the Federal EPA and the Regional Environmental Authorities (REAs) within the governments of the regional states. The proclamation stipulates that each sector office shall establish an environmental unit to assess and evaluate environmental performance by the sector.

2.2.9. Other strategies and legislations

Other legislation and strategies that may be of relevance to the proposed projects include but are not limited to:

2.2.9.1. Research and Conservation of Cultural Heritage (ARCCH) Proclamation

Proclamation No. 374/2003 (Proclamation to Ratify the Convention on the Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property) requires developers to conduct a cultural resources survey to identify and assess cultural sites that may be affected by the development activities. The Proclamation defines cultural heritage broadly as “anything tangible or intangible which is the product of creativity and labour of man in the prehistory and history times, that describes and witnesses to the evolution of nature and which has a major value in its scientific, historical, cultural, artistic and handcraft content.” Prior approval from the Authority for Research and Conservation of Cultural Heritage (ARCCH) is required to remove immovable (Article 21/1) and movable cultural heritage (Article 21/2) from its original site, during the execution of the project. Proclamation No. 209/2000 (Research and Conservation of Cultural Heritage Proclamation) allows the use of cultural heritage sites for economic and other purposes if and only if such use is not detrimental to its preservation and does not impair its historical, scientific, and artistic values (Article 22). It specifies that the protection and conservation of cultural heritage is the duty and responsibility of the Authority for Research and Conservation of Cultural Heritage (ARCCH). Proclamation No. 484/2006 (Proclamation to Ratify the Convention for Safeguarding of the Intangible Cultural Heritage) formalizes the adoption of the Convention for the Safeguarding of the Intangible Cultural Heritage in Ethiopia at the General Conference of the United Nations Educational, Scientific and Cultural Organization in Paris on 17 October 2003. The Ethiopian Government ratified the said Convention on 24 January 2006.

2.2.9.2. Hazardous Waste Management and Disposal Control Proclamation No.1090/2018

This Proclamation shall have the following objectives:

- Create a system for the environmentally sound management and disposal of hazardous wastes
- Prevent the damage to the human or animal health, the environment, biodiversity, and property due to the mismanagement of hazardous waste

2.2.9.3. National Health policy

Ethiopia issued its first-ever health sector policy in 1993. The policy was intended to reorganize the health services delivery system to contribute positively to the overall socio-economic development effort of the country. Major aspects of this policy focus on fiscal and political decentralization, expanding the primary health care system, and encouraging partnerships and the participation of non-governmental actors. The policy and other health-related programs of the country highly promote the preventive approach to health services. Hence, the project proponent is also required to act in conformity with this strategy for the occupational health and safety of its workers and the environmental health of the community in the area.

2.2.9.4. National HIV/AIDS Policy 1998

The overall objective of the policy is to provide an enabling environment for the prevention and control of HIV/AIDS in the country.

The specific objectives are:

- To establish effective HIV/AIDS preventive and control strategies to curb the spread of Covid 19
- To promote a broad multi-sectoral response to HIV/AIDS epidemic, coordination of the activities of different sectors, and mobilization of resources for the control of epidemic
- To encourage government sectors, NGOs, and communities to take measures to alleviate the social and economic impacts of HIV/AIDS
- To safeguard the human rights of people living with HIV/AIDS
- To empower women, youth, and other vulnerable groups to take action to protect themselves

2.2.9.5. Proclamation for Wildlife Development Conservation and Utilization proclamation 541/2007

This Proclamation has the following major objectives:

- To conserve, manage, develop, and properly utilize the wildlife resources of Ethiopia
- To create conditions necessary for discharging government obligations assumed under treaties regarding the conservation, development, and utilization of wildlife
- To promote wildlife-based tourism and encourage private investment

This proclamation clearly stated that under article 8 no person, other than the Ministry or the concerned regional organ in the discharge of their duties, may hunt any game animal unless he owns a hunting permit.

2.2.10. FDRE, Pesticide Registration and Control Proclamation No.674 /2010

The main purpose of this proclamation is to enact a comprehensive legislation to regulate the manufacturing, formulation, import, export, transport, storage, distribution, sale, use and disposal of pesticides and other matters by laying down a scheme of control. These control measures were aimed to minimize the adverse effects that pesticide use might cause to human beings, animals, plants, and the environment. The details on legislation of

pesticide are presented in this proclamation in 37 articles. To mention some, article 14 of this proclamation states about pesticides registration and the Ministry (Ministry of Agriculture) shall maintain a separate central database or archive containing the inventory of all pesticides to track the movement and use of pesticides according to each stage of the pesticide life cycle within the country and containing other relevant information etc.

Article 17 (pesticide import and export permit), in sub-articles 1 and 5, states that no person shall make any import and export of any pesticide without obtaining an import or export permit issued by the Ministry. Similarly, sub-article 3 also states that (a) no pesticides consignment shall be imported if it has been manufactured before six months from its date of entry into the country. Moreover, article 21 (sub-article 1) states that no person shall dispose of any pesticide or pesticide waste in a manner that may harm human or animal health or the environment.

2.3. International Treaties Ratified by Ethiopia

2.3.1. The United Nations Framework Convention on Climate change (UNFCCC), 1992

Article 3(1) of the Convention states that Parties should act to protect the climate system based on "common but differentiated responsibilities", and that developed country Parties should "take the lead" in addressing climate change. Under Article 4, all Parties make general commitments to address climate change through, for example, climate change mitigation and adapting to the impacts of climate change. Ethiopia being a member state of the United Nations, therefore, ratified the convention and must abide by the principles of the convention.

2.3.2. Convention for the Safeguarding of the Intangible Cultural Heritage, 2003

The convention sets out the duties of States Parties in identifying potential sites and their role in protecting and preserving them. Each member country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. The States Parties are encouraged to integrate the protection of the cultural and natural heritage into regional planning programs, undertake scientific and technical conservation research and adopt measures that give this heritage a function in the day-to-day life of the community.

2.3.3. International Labour Organization Core Labour Standards

Labour, working conditions, health, and safety are the subject of numerous international agreements, conventions, policies, and standards. Core labour standards formulated by the International Labour Organization (ILO) include forced labour, child labour, and workmen's compensation among others.

2.3.4. The Stockholm Convention

This is a global treaty to protect human health and the environment from persistent organic pollutants (POPs). POPs are chemicals that remain intact in the environment for long periods, become widely distributed geographically, accumulate in the fatty tissue of living organisms, and are toxic to humans and wildlife. POPs circulate globally and can cause damage wherever they travel. In implementing the Convention, Governments will take measures to eliminate or reduce the release of POPs into the environment. Over 150 countries Ethiopia inclusive signed the Convention. Concerning the proposed mini-grid solar power plant and irrigation projects, POPs could arise from open-air combustion of waste, disposal of electronic waste such as used batteries, and degradation of components within the storage.

2.3.5. The Convention on Biological Diversity (CBD)

A major objective of this convention is in-situ and ex-situ conservation of biological diversity. Parties to this convention are required to undertake ESIA for projects likely to have significant adverse effects on biodiversity and are required to develop national plans and programs for the conservation and sustainable use of biodiversity

2.3.6. African Convention on the Conservation of Nature and Natural Resources-1982

This convention was signed by the Heads of State and Governments of independent African States, assembled at Algiers, Algeria on 15th September 1968. Under this convention in Article II, the contracting States shall undertake to adopt the measures necessary to ensure the conservation, utilization, and development of soil, water, flora, and faunal resources per scientific principles and with due regard to the best interests of the people.

2.4. African Development Bank Operational Safeguards

The African Development Bank (AfDB) has an Integrated Safeguards System (ISS). The ISS consists of an Integrated Safeguards Policy Statement, Operational Safeguards (OSs), a set of Environmental and Social Assessment Procedures (ESAPs), and Integrated Environmental and Social Impacts Assessment (IESIA) Guidance Notes.

The Bank's Integrated Safeguards Policy Statement sets out the Bank's commitments to and responsibilities for delivering the ISS while Operational Safeguards establish operational parameters, delineates the roles and responsibilities of the Bank and its borrowers or clients in implementing projects, achieving sustainable outcomes, and promoting local participation. Operational Safeguards are also intended to prevent projects from adversely affecting the environment and local communities or, where prevention is not possible, minimize, mitigate and/or compensate for adverse effects and maximize development benefits.

Five Operational Safeguards are established and are summarized here as extracted from the AfDB ISS Policy Statement 2013:

- **OS 1: Environmental and Social Assessment:** This overarching safeguard governs the process of determining a project's environmental and social category and the resulting environmental and social assessment requirements

The proposed projects are Category 3 projects as they are less likely to have serious site-specific environmental and/or social impacts. Likely impacts are very few, site-specific, largely reversible, and readily minimized by applying appropriate management and mitigation measures or incorporating internationally recognized design criteria and standards. \

Category 3 investment projects do not require a RAP but may have an ESMP plan to manage and mitigate minor environmental and social risks of projects in compliance with the African Development Bank's safeguards.

- **OS 2: Involuntary Resettlement: Land Acquisition, Population Displacement, and Compensation:** This safeguard consolidates the policy commitments and requirements set out in the Bank's policy on involuntary resettlement, and it incorporates refinements designed to improve the operational effectiveness of those requirements. As the risk category of the project falls under category 3 the project does not trigger OS 2 and hence resettlement action plan and livelihood restorations are not needed.
- **OS 3: Biodiversity and Ecosystem Services** – The overarching objective of this safeguard is to conserve biological diversity and promote the sustainable use of natural resources. This safeguard could be triggered due to trade-offs of ecosystem services where the availability of solar energy may result in increased withdrawal of water for irrigation (increase production) at the cost of regulatory services such as draining wetlands which are carbon sinks and biodiversity hotspots.
- **OS 4: Pollution Prevention and Control, Greenhouse Gases, Hazardous Materials, and Resource Efficiency** – This safeguard covers the range of impacts of pollution, waste, and hazardous materials for which there are agreed on international conventions and comprehensive industry-specific standards that other multilateral development banks follow. The solar mini-grids power plants are meant to curb pollution which

is already underway through diesel pumps for irrigation. These operational safeguards are triggered because irrigation activities, especially the use of pesticides, may result in water and air pollution. It is noted that pesticide-related activities are pre-existing within the baseline of farmer activities at the site. Irrigation activities, especially the use of pesticides, will result in air pollution.

- **OS 5: Labour Conditions, Health, and Safety** – This safeguard establishes the Bank’s requirements for its borrowers or clients concerning workers’ conditions, rights, and protection from abuse or exploitation. It covers working conditions, workers’ organizations, occupational health and safety, and avoidance of child or forced labour.

2.5. Institutional Framework

2.5.1. Institutional Arrangements for Environmental Protection

The definition of powers and duties of the executive organs of the Ethiopian Environmental Protection Authority (EPA) was established by proclamation 295/2002. The EPA has been subsumed under the former ‘Environment, Forest & Climate Change Commission until 2021. However, recently the commission was dissolved and renamed EPA (where the forest sector) was merged into the ministry of Agriculture). The objective of the newly re-established Environmental Protection Authority is to formulate policies, strategies, laws, and standards which foster social and economic development in a manner that enhances the welfare of humans and the safety of the environment and to spearhead ensuring the effectiveness of the process of their implementation.

Part three of Proclamation No. 295/2002 states that every competent agency shall establish or designate an environmental unit that shall be responsible for coordination and follow-up so that activities of the competent agency are in harmony with the proclamation and other environmental protection requirements. Each national regional state is also required to establish an independent regional environmental agency or designate an existing agency for coordinating the formulation, implementation review, and revision of regional conservation strategies and environmental monitoring, protection, and regulation.

2.5.2. Environmental Protection Authority of Ethiopia (EPA)

The former Environment, Forest, and Climate Change Commission (EFCCC) are now renamed as the Environmental Protection Authority. This federal institution is entrusted with managing the Environment of Ethiopia. The EPA is responsible to ensure the realization of the environmental rights, goals, objectives, and basic principles enshrined in the Constitution. As well as the Environment Policy of Ethiopia through coordinating appropriate measures, establishing systems, and developing programs and mechanisms for the welfare of humans and the safety of the environment.

It is mandated to formulate or initiate and coordinate the formulation of strategies, policies, laws, and standards as well as procedures and upon approval monitor and enforce their implementation. It is also responsible for the synergistic implementation and follow-up of international and regional environmental agreements. EPA is mandated to review, approve ESIA reports and issue the environmental authorization. The EPA also undertakes the role of certification of ESIA practitioners.

2.6. Regional Government Offices

The regional government based on the constitution of the federal republic of Ethiopia established relevant executive organs. The following executive organs will be relevant for the proposed project:

2.6.1. Sidama Bureau of Agriculture and Natural Resources

The Sidama bureaus of agriculture have wide ranges of duties to improve agriculture activities in their respective Regions. The most relevant to the proposed project include the following:

- Provide agricultural training and extension services. They are responsible for agronomic issues and agriculture conservation practices. Improve agronomic practices in the proposed project area such as crop rotation, intercropping, Land preparation, planting method, and Planting materials
- Provide agriculture information and extension services to the community and shall be giving similar support to the targeted farmers in the project.
- Support by training the full package and scaling up best practices to all farmers. for such cases, farmers training centers (FTC) are mandated to train farmers on different agricultural technologies.
- Administer the land resource of the region and prepares land use plan
- Encourage farmers to undertake crop protection to control crop damage or yield reduction caused by insects, diseases, weeds and other destructive animals
- Follow the implementation of recommended fertilizer rates and time of fertilizer application for the proposed crops of this project

2.6.2. Sidama Bureau of Water, Irrigation and Energy

The Bureau of Water, Irrigation and Energy Development was reorganized as the Bureau of Water, Minerals and Energy Resources Development in accordance with Proclamation No. 178/2011 of the SNNP (Sidama has become an independent region after enactment of this proclamation but still uses it until it crafts its own) Regional State Council. The Bureau in Sidama region is empowered with wide ranges of duties related to irrigation activities in the regions, the most relevant to the activities proposed include

- Assigning irrigation experts in the project area to advise and assist irrigation users providing training for irrigation users for the wise use of the water resource
- Forming and following Irrigation Water User Associations to facilitate and manage fair distribution of waters for irrigation

2.6.3. The Sidama Environmental Protection and Forest Authorities

The Authorities are entitled with the power and wide ranges of duties related to environmental protection. The most relevant to the proposed project include the following:

- Formulate policies strategies and standards pertinent to land and environmental protection.
- Administer the land resource of the region and prepare land use plan.
- Undertake cadastral survey register land holding and prepare land holding certificate.
- In collaboration with concerned organs determine compensation to a person whose land holding has been expropriated for development work.
- Regulate and follow up that any development shall conduct ESIA prior to the project implementation.
- Undertake environmental auditing of establishments for the safe disposal and management of liquid and toxic wastes

3. Project Descriptions

3.1. Project location

Lelicho is found in Sidama National Regional State, Shebedino Woreda at about 18 km southeast of Leku town, at Asrado Mero Kebele. The area can be accessed by the 306km road connecting the capital city of Addis Ababa with Mojo-Ziway-Shashemane-Awasa-Leku asphalt roads. The remaining dry weather road from Leku to Site with local village named “Lelicho” is about 18km.



FIGURE 1: LOCATION MAP OF PROJECT AREAS

3.2. Project justification and Key information

Mini-grid solar power plants are proved to be more environmentally friendly compared to other sources of energy and other types of power generation projects. The importance of renewable energy, including solar power technology, is also highlighted in the national Growth and Transformation Plan (GTP) II and is compliant with Ethiopia’s Climate Resilient Green Economy Strategy (CRGE). The purpose of the planned solar mini-grid project is mainly to substitute diesel irrigation pumps with solar-powered irrigation, which would intensify the existing irrigation activities at the project site (see Table 1 for specifications). Consequently, farmers will have access to reliable electricity which would help them increase agricultural production/productivity, ensure food security, and help to mitigate and adapt to climate change.

TABLE 1:PROJECT KEY INFORMATION

| Particulars | Description |
|---|--|
| Project developer/owner | Will be identified later |
| Type of business | Renewable energy activities |
| Plant type and capacity | 600kW at Lelicho solar PV based AC mini-grid |
| Location | Lelicho, Sidama |
| Manpower requirement implementation phase | 7 |
| Project land area | |
| Area required for PV panel installation | 0.6 ha |
| Total area required for PV panel installation | 0.72 |

3.3. Project components

The major project components are discussed hereunder. However, this section is expected to be revised and updated once the project feasibility report is completed.

- **Mounting system:** PV modules will be mounted on structures made of aluminum or hot-dip galvanized steel. Footing design and type will be decided during design work.
- **PV Modules:** PV modules absorb the sun’s rays as a source of energy to generate electricity.
- **Inverters:** Inverters convert the Direct Currents (DC) produced by PV modules to grid-exploitable Alternative Currents (AC).
- **Transformers:** Transformers will change voltage levels from low voltage (230V) to medium voltage (15kV or 33kV) and vice versa.
- **Distribution grid:** overhead distribution lines mounted on wooden poles will be used to transfer power from the solar power plant to households and irrigation pumps.

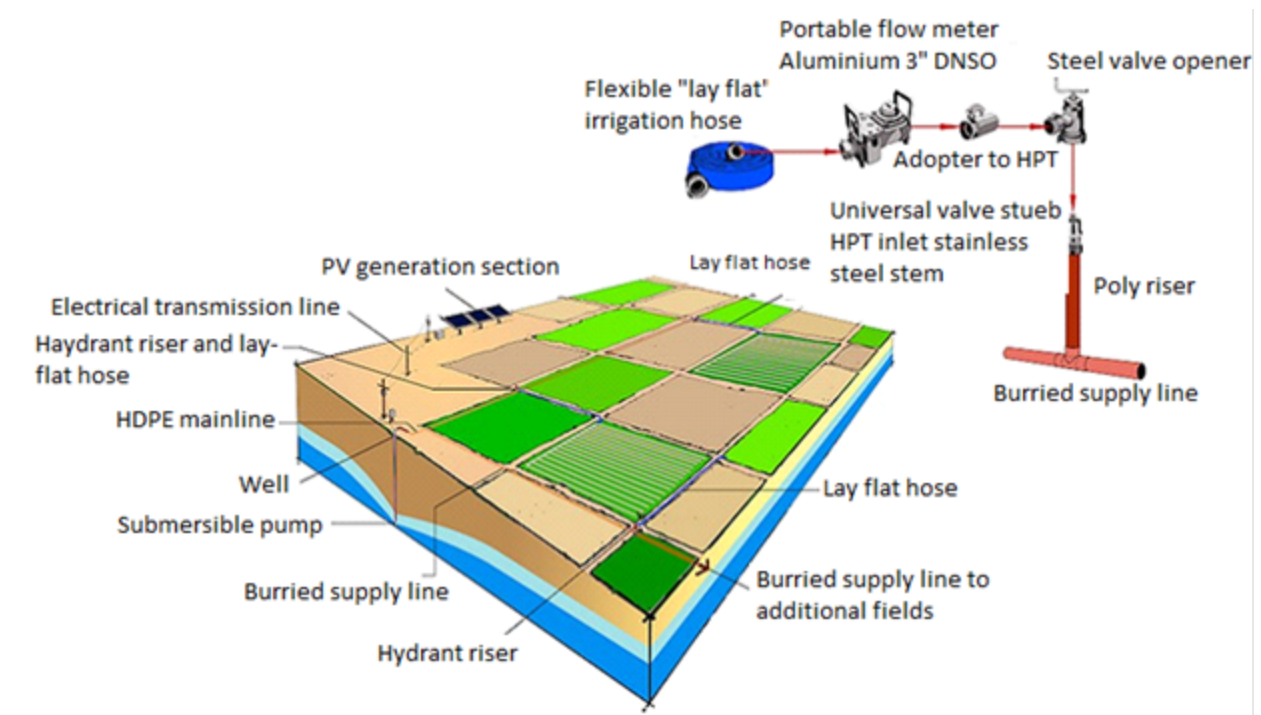


FIGURE 2: IRRIGATION SCHEME DESIGN

3.4. Civil works

Civil works related to the solar PV construction include land excavation and leveling, foundations for the installation of the mounting system for the PV modules, building of access roads, fencing, as well as construction of the light buildings (operation and administration building, security posts, storage, etc.).

3.5. Manpower requirement

During the construction phase, installation of solar PV, and installations of distribution grids are labour intensive and hence the project is expected to hire 100 skilled and 50 non-skilled workers. However, the implementation phase manpower requirement is minimal, it is likely to create jobs for 5 -7 per site and a total of about 14 jobs will be created. Similarly, during the decommissioning phase about 6 skilled manpower and over 50 labourers per site are required to dismantle solar panels and other equipment.

The non- skilled workers should be hired from the nearby communities. Some skilled manpower may come from other parts of the country and will rent housing in the nearby towns. Therefore, there is no need to construct camps or homes during the construction phase for temporary workers.

During construction phase construction machinery such as an excavator, dump trucks, a mixer and roller will be used.

3.6. Land requirements

The land required for Solar PV modules installations is 0.6ha for Lelicho. The total area required, including internal roads, and light buildings, is estimated to be 1 ha.

The area stated was calculated based on an assumption of 12sq.m per kW.

3.7. Implementation schedule

Following submission of final ESIA report, the major activities are tentatively scheduled as follows:

- Construction starts in May 2023
- Construction lasts for approximately 3 months for the power station
- Operation will resume in November 2023

4. Baseline Information for the Proposed Project Areas

The primary objective of identifying and describing existing environmental conditions is to provide an understanding of the baseline conditions prior to undertaking any development activities. Data were collected from secondary sources for the macro-environmental setting like climate (temperature, rainfall, humidity, and wind speed), physiography, geology etc. Primary data have been collected to record the micro-environmental features within and adjacent to the project area.

The following section describes the baseline environment into three broad categories:

- **Physical Environment**- factors such as geology, topography, land cover, climate, air quality and hydrology.
- **Biological Environment**- factors related to biotic life such as flora, fauna, and ecosystems; and
- **Socio-economic Environment**- population and demographics, land use and sources of livelihoods, social services, and infrastructure.

4.1. Physical and Biological Baseline Information

4.1.1. Geology

4.1.1.1. Regional Geological Setup

Regionally the project areas fall in the Main Ethiopian Rift (MER). Volcanic activity in the southern MER is divided into three major episodes: Pre-rift volcanic deposits, Syn-rift volcanic deposits and post-rift volcanic deposits. The description for each subunit is given below:

Pre-rift volcanic deposits:

- **Amaro–Gamo Basalts:** basalts to trachy-basalts with minor basaltic pyroclastic deposits are exposed mainly along the road cut close to the Lake Abaya. Amygdaloidal and partly also massive basalt lavas and pyroclastic deposits are the oldest rocks.
- **Shole Ignimbrite:** rhyolitic ignimbrite and minor rhyolite are densely welded to non-welded rhyolitic ignimbrite and the pyroclastic fall deposits are exposed on steep slopes of an escarpment. Columnar jointing mainly occurs in moderately to densely welded facies of ignimbrites. Moderately to strongly welded ignimbrite displays a distinct lateral and vertical variation in the degree of welding and clasts abundance. The fine-grained, strongly welded, yellowish to reddish rhyolitic ignimbrite is abundant.

Post-rift volcanic deposits:

- **Nech-Sar Basalt:** basaltic lava and pyroclastic deposits including several scoria cones are mainly exposed in the Nech Sar National Park between the lakes Abaya and Chamo. These basalts have a vesicular texture, also containing abundant volcanic bombs and lapilli.

Sedimentary deposits of Upper Pleistocene to Holocene:

- **Colluvial sediments** represent wide-spread gravitationally driven deposits occurring at the foot of escarpments by mass wasting processes (landslides, rock falls, debris flows). These deposits represent heterogeneous material in sediments of different grain sizes.
- **Alluvial sediments** are exposed in lowlands of Lelicho area.
- **Lacustrine sediments** are exposed in narrow rims along the shores and adjacent swamps of the Lake Abaya and consist of unconsolidated fine-grained deposits – mud and silt. Lithology of these deposits is thought to be controlled by sediment transport and river flow rates of streams emptying into the lakes so that alluvial sands alternate with gravels.

4.1.1.2. Local Geology

Lelicho site

The Lelicho local geology is dominated by the red brown clay texture soil and the road cut exposure of Silicic pyroclastic deposits of phreatomagmatic tuff (Figure 3), and non-welded ignimbrite were observed. Non-welded facies are yellowish or greyish tuffs representing pumice-ash flow deposits and co-ignimbritic ash-fall deposits.



FIGURE 3: OUTCROP OF PHREATOMAGMATIC TUFFS ALONG ROAD CUTS IN THE VICINITY OF LELICHO SITE

4.1.2. Soil

As the projected site (Lelicho) is in the region of the main Ethiopian rift valley, the soil is a weathering product of rift valley related pyroclastic flow and alluvial lacustrine deposits. The clay soil in the area contains dark gray to dark-brown soil gradients in color. Texturally, the soil in the rift valley area is rich in clay and loam with slightly acidic pH and higher concentrations of micronutrients such as manganese, iron and zinc in Lelicho site. This is particularly the case because of the higher amount of rainfall from the prevailing southeast trade wind.

Meanwhile, Lelicho project area is located within the main Ethiopian rift valley, the type and distribution of soil in the area is highly dependent on lithology (parent source), geomorphologic and climatic condition of the rift valley. Based on the previously conducted studies, field observation and landsat TM band satellite images, the type of soils in Lelicho area is dominated by red brown clay texture soil, which is originated mainly from silicic pyroclastic deposits of phreatomagmatic tuff, non-welded ignimbrite, and organic decays.

During the field survey, the ESIA team has collected soil samples from the area to characterize the important macronutrients and micronutrients of soil in the area. The soil sample, which was collected from the Lelicho site, is analyzed at the Laboratory of Ethiopian Construction and Design Supervision Works Corporation, in Addis Ababa and the results are provided in annex 5. The analytical result of the pH in the area is 4.61 suggesting that the soil in the area is acidic. According to FOA information, a soil with pH value in between 6-7.5 is acceptable for most plants because most nutrients are available in this pH range even if some plants have soil pH requirements above or below this range. Acidification which is the result of long-term rain is developed by buildup of H⁺ and Al⁺ in the soil and the leaching of bases (like Ca⁺, Mg⁺, K⁺ and Na⁺).

The analytical results of exchangeable Na, K, Ca and Mg are 1.2meq/100g, 0.31meq/100g, 12.14meq/100g and 5.67meq/100g respectively. The content of these nutrients in the soil are classified by the Food and Agriculture Organization (FAO) of the United Nations under bulletin 2006 for the purpose of interpretation of exchangeable

cation in the soil (Table 2). Based on the information in the table below, the concentration of exchangeable elements in the target area are at high concentration level for Na, Ca and Mg and at medium concentration level for K. As indicated in annex 5 the concentration of available phosphorus and sulfur is 85.03mg/kg and 108.55mg/kg, respectively. Concentration of available P and S in the FAO standard of phosphorus and sulfur concentration are 1000mg/kg-5000mg/kg and 500mg/kg -5000mg/kg. Therefore, the concentration of both phosphorus and sulfur in the area are lower than the normal standards of FAO classification and the soil in the target area requires treatment for these elements.

Similarly, the laboratory results of micronutrients concentration of Fe, Mn, Cu and Zn in the area is 56.99mg/kg, 40.98mg/kg, 0.71mg/kg and 2.01mg/kg correspondingly. Based on FAO classification, healthy and productive soil should contain Fe from 50-1000mg/kg, Mn from 20-200mg/kg and Cu from 2-20mg/kg and Zn from 10-100mg/kg. Therefore, the concentration of Cu and Zn in the target area is lower than the range of FAO essential micronutrient concentration in soil and the soil should need treatment for these elements to get good crop products.

TABLE 2: RANGES OF EXCHANGEABLE CATION (CMOL/KG=MEQ/100G) IN SOIL FOR INTERPRETATION OF CATION EXCHANGE DATA (TAKEN FROM FAO BULLETIN, 2006)

| Rating | FAO Classification | | | | Laboratory result | | | |
|-----------|--------------------|----------|---------|----------|-------------------|-------------|-------------|------------|
| | Exch. Ca | Exch. Mg | Exch. K | Exch. Na | Exch. Ca | Exch. Mg | Exch. K | Exch. Na |
| Very high | >20 | >8 | >1.2 | >2 | | | | |
| High | 10-20 | 3-8 | 0.6-1.2 | 0.7-2 | 12.14 | 5.67 | | 1.2 |
| Medium | 5-10 | 1-3 | 0.3-0.6 | 0-0.7 | | | 0.31 | |
| Low | 2-5 | 0.3-1 | 0.2-0.3 | 0-0.3 | | | | |
| Very low | <2 | <0.3 | <0.1 | <0.1 | | | | |

4.1.3. Topography and Landscapes

The project area lies in the Rift Valley, the adjacent escarpments, and parts of the western Ethiopia and Eastern Ethiopian Plateaus that are dissected by deep river valleys (Gidabo River in Sidama). The Shebedino Woreda, where the Lelicho site is located, has a relatively rugged topography and the altitude of the Woreda ranges from 1800 - 2800m. The irrigated land is gentle to flat topography.

4.1.4. Climate

There are no meteorological stations near the Lelicho site. As the agro-ecology and altitude are much closer to the Sidama highlands, we referred to the works of Belihu et al. 2008 for Gidabo basin which originates from Arbegona and Shebedino mountains and drains towards L. Abaya. As stated by Belihu et al. 2018, climatically, the upper watershed including the tributaries of Gidabo such as Boa and Gambuto (Crossing Lelicho village), the reported mean annual rainfall of the Gidabo watershed is about 2400mm having with two rainy seasons. The main rainy season (Kiremt) lasts from June to October and the short rainy season (*belg*) is from April to May. Rainfall in Lelicho is generally reliable.

4.1.5. Water Resources

Water resources in the Shebedino Woreda area depend mainly on rainfall and other climatic conditions (e.g., potential evapotranspiration, Figure 4) as well as on the hydrological, geological, and topographical settings. Local people at Lelicho site depend largely on surface water especially Sille stream emanating from Boa and Gatamo (tributaries of Gidabo) for Lelicho village. Water is however a bit challenging for Lelicho since there is no Lake.

A drinking water sample was collected from the spring, which is currently being used by the community and sent to a laboratory for physico-chemical analysis. The results show that only sodium concentration and turbidity are beyond the WHO maximum limit for drinking water in Lelicho in Table 3.

TABLE 3: SELECTED PARAMETERS OF WATER QUALITY TESTS FOR LELICHO SITE

| No | Parameters | Unit | Lelicho | WHO maximum limit | Remark |
|----|--------------------------|------------------------|---------|-------------------|--------------|
| 1 | Turbidity | NTU | 34.08 | 5 | Unacceptable |
| 2 | EC | uS/cm | 66.8 | 2000 | |
| 3 | PH | log10 | 6.92 | 6.5- 8.5 | |
| 4 | TDS | ppm | 33.5 | 1000 | |
| 5 | Nitrate, NO ₃ | mg/l | 0.75 | 10 | |
| 6 | Total hardness | mg/l CaCo ₃ | 10 | 300 | |
| 7 | Sodium | mg/l | 11 | 200 | Unacceptable |

4.1.5.1. Surface Water resources in Lelicho, Shebedino Woreda, Sidama region

The perennial rivers that cross the potential irrigable area include Getamo and Boa, which flow into the Gidabo River. These two rivers originate from Arbegona highlands and cross Lelicho village to finally join Gidabo River and drain together to Lake Abaya (Figure 4).

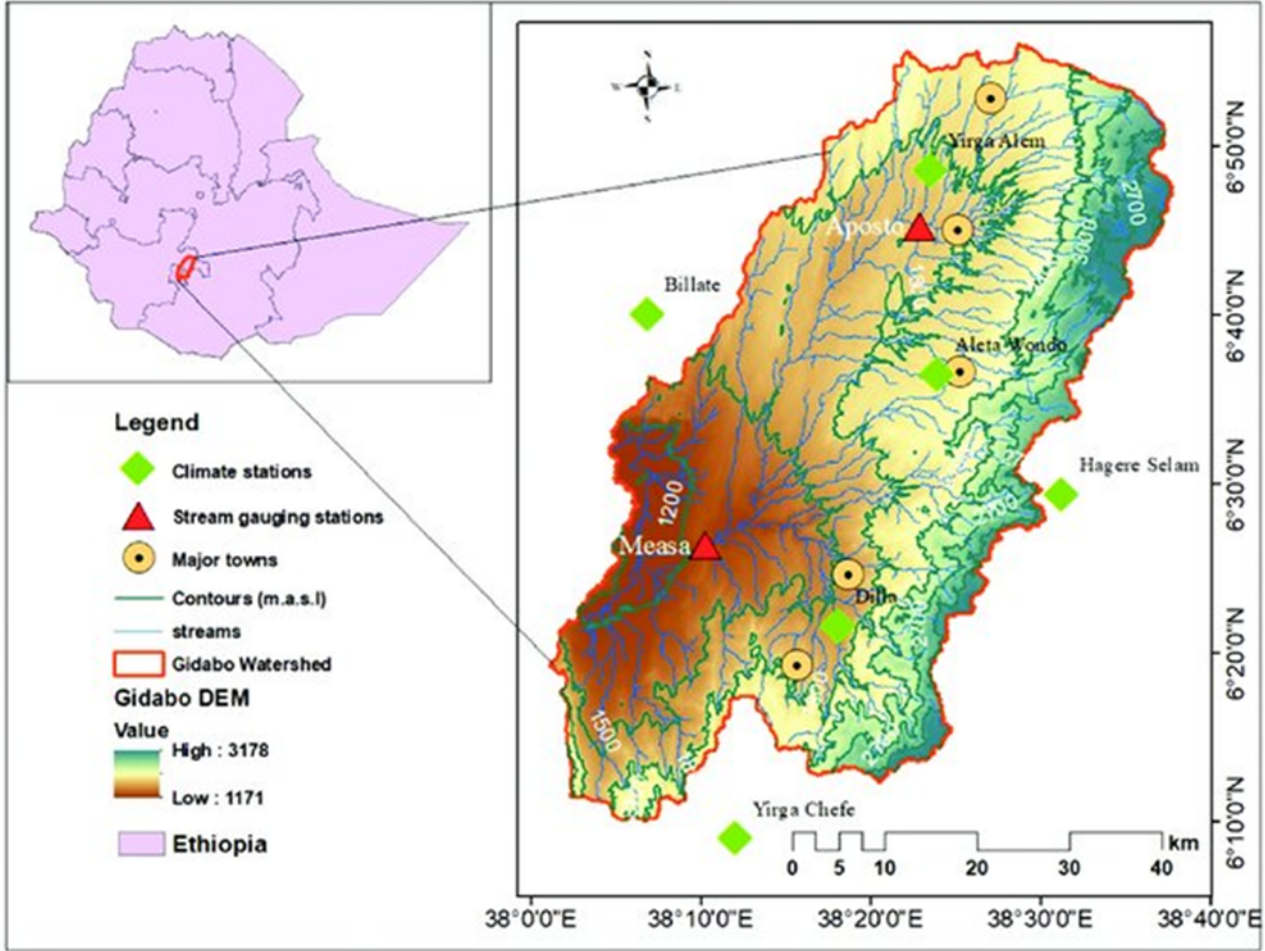


FIGURE 4: DRAINAGE MAP OF GIDABO BASIN (MAP AFTER HENOCK ET AL., 2021)



FIGURE 5: GATAMO RIVER GORGE IN THE NORTHWEST OF LELICHO VILLAGE

The intended primary source of water supply for the proposed project is Boa & Gatamo streams which flow throughout the year (Figure 5). Even though these streams collect large amounts of water from the agroforestry-covered highlands, their volume decreases during intermittent dry seasons (Figure 5). People have reported that they face water shortages for irrigation during dry seasons.

4.1.6. Air and Noise baseline conditions

Air pollution is one of the serious environmental and social problems, which create several adverse effects on human health due to their nature and residence time in the atmosphere. In addition to their negative effect on human health, they exert a strong effect on local and global climate change. Air pollution is often intensified in connection with development activities such as agriculture (irrigation) and industry. Hence, the source of air pollution and its mitigation measures should be understood and analyzed in advance prior to the commencement of any project development and implementation. The ESIA team conducted air quality measurements in the center of the receptor environment where the project is expected to operate. The parameters measured in the field were particulate matter and carbon monoxide. Accordingly, the average air quality measurements for PM2.5 was 0.0055 and 0.0067 for PM10, respectively (Table 4). Thus, currently both categories of particulate matter are not of concern (PM2.5<0.075 ppm is generally considered as good quality).

TABLE 4: AIR QUALITY MEASUREMENT RESULTS AT LELICHO SITE

| Site | Location UTM | Elevation | CO | PM2.5 ppm | | | Pm10 ppm | | | Date & Time |
|---------|--------------------|-----------|----|-----------|-------|-------|----------|-------|--------|-----------------------|
| | | | | Min | Max | Av | Min | Max | Av | |
| Lelicho | 446646E 754955N | 1898 m | 0 | 0.021 | 0.025 | 0.023 | 0.029 | 0.030 | 0.0295 | 15/10/2021. 1:00pm |

During the construction phase, some noises could be generated from construction machinery (such as excavator, loader, bulldozer, mixers, dump trucks, compactors, generators, etc.) movements. This may disturb workers of the project and the nearby villagers to some extent. Noise by nature is a nuisance and may bring about annoyance, sleep disturbance and interference with communication and cause hearing loss if the level is beyond the acceptable limit (WHO prescribes 55dB for residential areas). However, the construction related noise will last for a short period of time and is not expected to cause a significant nuisance to the public, at least not with standard mitigation measures in place (see Table 5 for baseline conditions).

TABLE 5: NOISES MEASUREMENT RESULTS OF LELICHO SITE

| Site | Location UTM | Elevation (m) | Noise in dB | | | Date & Time |
|---------|--------------------|---------------|-------------|------|----|------------------------|
| | | | Max | Min | Av | |
| Lelicho | 446646E 754955N | 1898 | 41.2 | 39.8 | 40 | 15/10/2021; 1:00 pm |

4.1.7. Land Use in Shebedino Woreda

Land use in Shebedino and as such in Lelicho is completely dominated by agroforestry. The local people's livelihood is largely dependent on agroforestry crops, particularly Enset (*Ensete ventricosum*), coffee, and Khat (*Catha edulis*). Coffee and Khat are cash crops and Enset is a staple food (Figure 6). Coffee is the main income source and has a major contribution to the nation's export market. The rainfed agricultural system is the mainstay of the economy (87.8%) and about 12.2 % of the land is under irrigation (2090 ha). Shebedino has one of the highest population densities in Ethiopia. Thus, there is no land left uncultivated and there is no visible grazing land. Local people rear animals on their homestead and provide feed from crop residues and cut grass instead of open grazing.



FIGURE 6: AGROFORESTRY AT LELICHO SITE (NEARLY ALL LAND IS COVERED BY MULTIPLE STORY OF TREES AND CROPS)

4.1.8. Flora

In Lelicho area, there is no natural forest except agroforestry trees and shrubs along farm boundaries and hedges. Some of the species include *Culturnia aurea*, *Phoenix reclinata*, *Sansiveria sp.*, *Croton machrostachys*, *Vernonia auriculifolia*, *Coffea arabica*, *Podocarpus falcatus*. However, hills are occupied by *Eucalyptus* plantations, which are used as construction materials and exported to the local market in Hawassa town.

4.2. Socio-Economic Baseline Information

4.2.1. Administration Structure

Lelicho site is in Shebedino, which is about 27 km from Awassa, and 302 km from Addis Ababa. Shebedino Woreda is bounded in the north by Hawela (Hawassa Zuria Woreda), in the south by Dale Woreda, in the east by Goriche Woreda and in the west by Boricha Woreda (Sidama Zone Socio-economic Profile, 2019). The Woreda consists of 35 kebeles and its capital town is Leku, which is located 18 km from Lelicho village (irrigation area). The total area of the Woreda is 235 sq km. Shebedino is one of the several woredas in Sidama National Regional State. It was difficult to get a clear picture of the administrative structure beyond the regional level since the former Sidama zone has

recently attained a new National Regional State status. There has been several restructuring and former woredas are now about to assume zonal status but not yet implemented. Owing to such dynamics, Shebedino is now divided into two Woredas and there is a high expectation that it would be named as Shebedino Zone soon.

4.2.2. Population and settlement pattern in Shebedino Woreda

Sidama is one of the densely populated areas in the nation. The average density is over 500 persons/km² and the average landholding size is 0.25ha. A recent projection by the Ethiopian Statistical Agency in collaboration with USAID has indicated that Shebedino has a total population of 317,202. Most of the people settle in rural areas (95%) and only 5% of the total population lives in urban centers such as Leku (Figure 7).

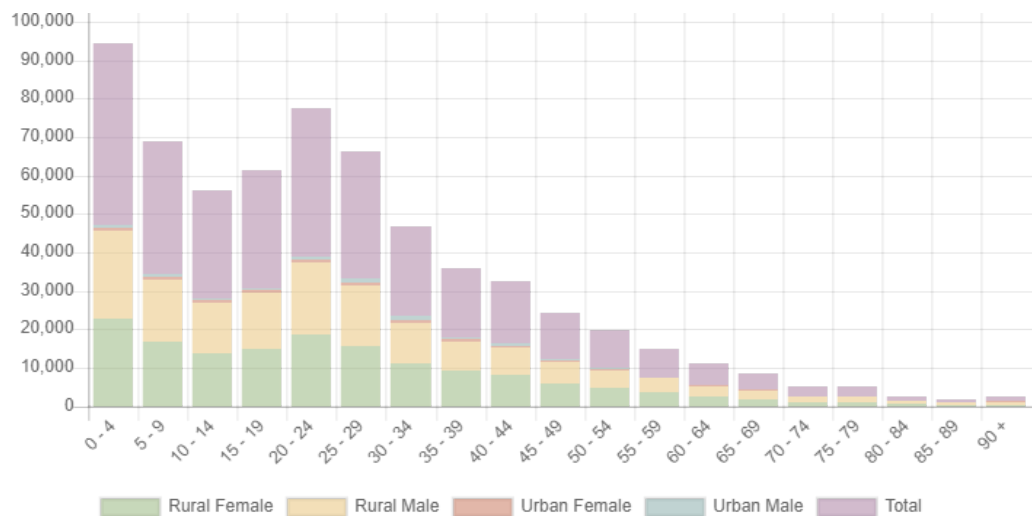


FIGURE 7: POPULATION BY AGE AND SEX IN SHEBEDINO WOREDA, SIDAMA REGIONAL STATE

4.2.3. Economic activities and local livelihood in Shebedino Woreda

In Shebedino Woreda, agroforestry crops dominate the livelihoods. The whole highland part of Sidama including the current proposed project area is densely populated and their livelihood is largely dependent on agroforestry, particularly Enset (*Ensete ventricosum*), coffee and Khat (*Catha edulis*). Coffee and Khat are cash crops and Enset are a staple food. Coffee is the main income source and has a major contribution to the nation's export market. Even though they produce nearly all crops with rainfed agriculture, recent trends show that farmers opt to use irrigation to produce high value crops such as vegetables. As one can see from Figure 8, in the last five years the land occupied by vegetables has increased substantially. However, farmers and the Shebedino Woreda agriculture and natural resources office report indicate that crop disease and pests are the major challenges behind ensuring food security in the area. Crop diseases such as micrococci, yellow rust, rust disease, early blight, and late blight occur frequently and damage crops (Table 6).

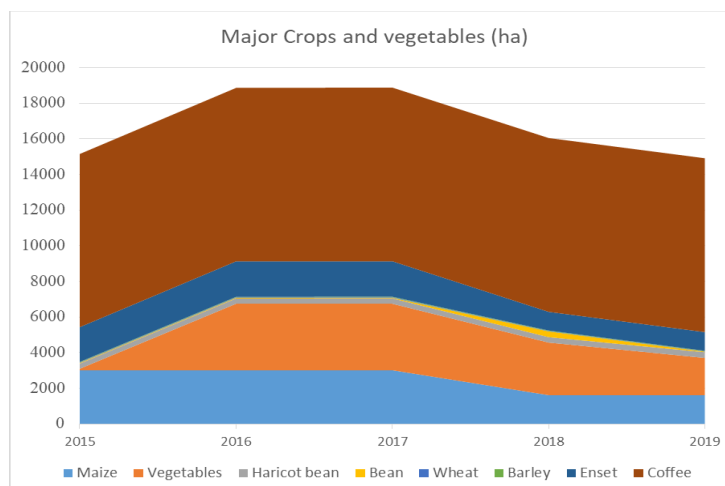


FIGURE 8: MAJOR CROPS AND VEGETABLES

TABLE 6: MAJOR CROP DISEASE IN SHEBEDINO WOREDA (SHEBEDINO WOREDA AGRICULTURE OFFICE, 2021)

| Disease type | Crop type | A.A(ha) | A.A(ha) | A.A(ha) | A.A(ha) | A.A(ha) |
|--------------|-----------|---------|---------|---------|---------|---------|
| Micrococci | Corn | 1613 | 1620 | 1625 | 1630 | 1635 |
| Yellow rust | Wheat | 18 | 20 | 22 | 24 | 26 |
| Rust disease | Barley | 19 | 20 | 23 | 25 | 27 |
| Early Blight | Tomato | 135 | 140 | 143 | 145 | 147 |
| Late Blight | Potato | 25 | 30 | 35 | 40 | 45 |

Discussion with Woreda experts and farmers indicate that crop disease starts to appear recently due to climate change impacts. There are also common pests such as Stalk borer, Aphids, Tuta-absolute and African full which attack different crops and vegetables alike.

4.2.4. Education Service in Shebedino Woreda

Secondary data on the education status of the Shebedino Woreda was not attainable, yet the ESIA team was informed by the Woreda administration and the community that a high school can be found in Leku town (only grade 9-10) and Lelicho village has a primary school. When students complete grade 8, they must go to Leku to attend grades 9-10 and/or Hawassa to pursue their higher education (Figure 9). There is no preparatory school (grades 11-12), which means pupils must travel a long distance to get an education. This may have an impact on any potential dropouts when they proceed to higher grades such as grades 11-12 (Figure 9).

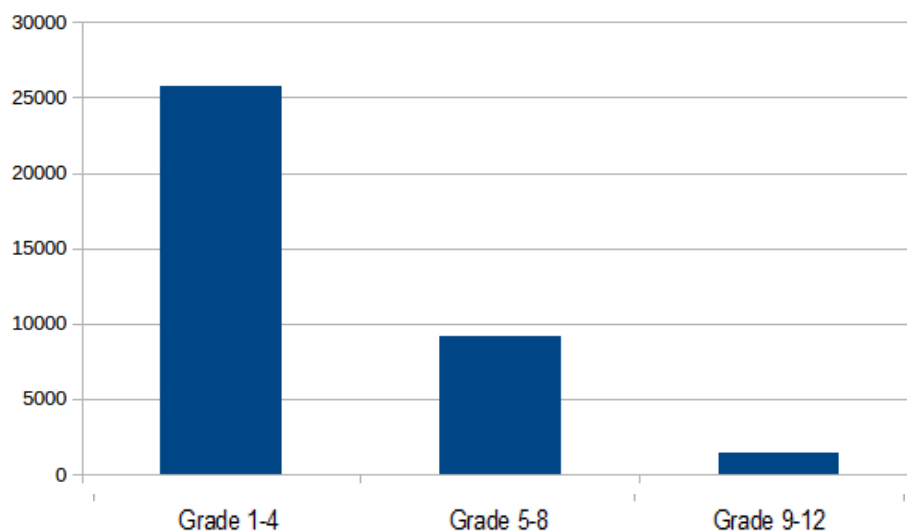


FIGURE 9: GENERAL ENROLMENT OF STUDENTS AT DIFFERENT GRADES IN SHEBEDINO WOREDA

4.2.5. Public Health Facility in Shebedino Woreda, Sidama

Despite its proximity to Hawassa town, there are very few health infrastructures in the Lelicho area. There is only one poorly equipped and staffed clinic for the entire community. There is one primary hospital in Leku town which is about 18 km. Many residents expressed their worries about the lack of health infrastructure in their kebele and reaching Leku town to seek medical services is often difficult due to lack of transportation. The health facilities in Shebedino include health centers, clinics, and health posts. There is one hospital in Woreda in Leku town. The tables below show the number and type of health institutions that are found in Woreda. Most prevalent diseases in Lelicho are related to lack of potable water, hence waterborne diseases affect the community. The top ten diseases reported by the community and health officer of Asrado Mero kebele are presented in Table 7 below:

TABLE 7: TOP TEN DISEASES OCCURRING IN LELICHO SHEBEDINO WOREDA

| No. | Type of Diseases |
|-----|-----------------------------------|
| 1 | Pneumonia |
| 2 | Acute febrile illness |
| 3 | Helminthiasis |
| 4 | Typhoid fever |
| 5 | Trachoma |
| 6 | Non bloody diarrhea |
| 7 | Trauma and Injuries |
| 8 | Acute upper respiratory infection |
| 9 | Urinary tract infection |

4.2.6. Energy supply

There is no main grid passing through Lelicho village and the communities do not get any electric supply from the main grid. Thus, the main sources of energy for Lelicho residents are firewood, animal dung, crop residue, charcoal and kerosene.

4.2.7. Road Infrastructure in Lelicho areas

Shebedino Woreda has a total perimeter length of 87.759 kms and an enclosed area of 235 sq.km. The Woreda is sub-divided into 35 kebeles. It has about 51,044 residential houses with an average household family size of five to seven. Roads are also badly maintained and difficult to travel during rainy seasons (Figure 10). People use motor bicycles to travel to Leku town.



Figure 10: ISUZU TRACK LOADED WITH BANANA BUNCHES READY TO BE TRANSPORTED TO ADDIS ABABA (LEFT) AND ROAD SITUATION IN LELICHO AREA, SIDAMA (RIGHT)

4.2.8. Historical, cultural, religious, and archaeological resources

4.2.8.1. Physical cultural properties of Lelicho/Shebedino Woreda

The Sidama Regional State in general has a variety of physical and cultural resources which have value to the entire nation. In particular the agroforestry landscapes present a spectacular scenic beauty. In this regard, the region has registered about five natural caves in karst topography and several hot springs. In addition, the Sidama's have traditional judicial and worship sites which are usually undertaken in the vicinity of the burial places of clan leaders or ancestral spirits (Table 8).

Telamo Traditional Judicial Place

Telamo is in Shebedino Woreda in the Telamo Kantse Kebele, where the 'Yemerero' tribe's father, Tumano, is buried and the ancestral sacrifices are made each year. Like Telamo, it is surrounded by old native trees (*Junipersus procera* and *Podocarpus falcatus*) (Figure 11). The Tumano tribe, Songo, regularly gathers here for worship. Recently, however, Mero, the tomb of Faqisa, who was the son of Tumano, is more popular than the Telamo worship. Mero is in the Asrado Mero Kebele of Shebedino Woreda. During our discussions with the local communities and stakeholders, they have noted that these areas are located away from potential farming areas and might not be affected by any potential investments such as irrigation.



FIGURE 11: TELAMO AND MERO WORSHIP SITES (ASRADO MERO KEBELE)

Lokka National Park

Lokka Abaya National Park is located 73 km from Hawassa in Lokka Abaya Woreda in Sidama Regional State. It was designated as a national park by the regional government in 2011. The park contains a variety of rare animals. Examples include deer, ducklings, wolves, warthogs, rabbits, lizards, lions, and monkeys. The water features of Lokka National Park include the Gedwa River, which drains into Lake Abaya. It is also reported that the park contains several hot springs because of its location in the rift valley and hence has enormous potential for tourism services. Nevertheless, the park is located very far from the current project site and there would not be any project-induced impacts.

Gidabo hot spring

The Gidabo hot spring is located around Yirgalem town. It’s particularly associated with the Gidabo River, which collects water from many streams, including from the uplands of Shebedino Woreda. The site provides hot water for tourists and locals alike.

Besides, there are cultural heritage sites - in the Woreda, specifically at Asrado Mero kebele. Such monuments serve the community when conflict happens. The people gather at such a place and solve the problems by traditional means which is called “CHEMESA”. We provided cultural property sites within the kebele in the table below.

TABLE 8: CULTURAL PROPERTY SITES WITHIN THE KEBELE

| SN | Cultural Site | Kebele |
|----|---------------|-------------|
| 1 | Fekasa | Asrado Mero |
| 2 | Gegena | Asrado Mero |
| 3 | Arbegena | Asrado Mero |
| 4 | Sege | Asrado Mero |
| 5 | Bonee | Asrado Mero |

4.2.9. Gender Relations

Gender relationships have always been dominated by men; especially productive assets such as land and oxen are owned by men. However, women own animal products such as dairy products. The main source of income for the families is agriculture, mainly irrigation farming and to some extent rearing animals. According to locals, poor people are defined as those who have no fixed assets such as farmlands. According to our discussion with the local people in the proposed project areas of Lelicho, widows or divorced women are more vulnerable to poverty compared to adult men. Poor people in the locality work on Banana farms. These poor people often get sick because of malnutrition and malaria outbreaks.

5. Public consultations and stakeholders' engagements

5.1. Objective of stakeholder consultation

Public consultation and stakeholders' engagement are crucial components of environmental and social impact assessment. Such efforts are believed to provide opportunities for people who are potentially affected by the intended solar power plant and irrigation projects to contribute and improve the design and implementation of the project activities. In addition, public consultation will enable project proponents to identify or mitigate any potential adverse impact that might arise due to project implementations. Furthermore, public consultation ensures the enhancement of positive impacts of projects and contributes towards sustainable development of the target area and beyond.

A stakeholder is defined as "any individual or group who is potentially affected by the proposed initiative or can themselves affect the proposed initiative'. Stakeholder engagement is a crucial component of environmental and social impact assessment.

The main objectives of public consultations and stakeholder engagement are to:

- **Identify:** all those affected by or interested in the project to ensure that they are included in the engagement process.
- **Understand:** the views of the key stakeholders and make sure that stakeholders adequately understand the positive and negative impacts of the Project
- **Inform:** the ESIA, including local benefits and partner opportunities
- **Relationships and Trust:** build relationships through supporting open dialogue and engagement with stakeholders. Establish transparency in activities being undertaken and build trust with stakeholders
- **Engage with all Stakeholders:** by having an inclusive approach to consultation and participation. This may include the use of differential measures to maximize the effective participation of stakeholders that might not be easily reached through conventional methods
- **Manage Expectations and Concerns:** by providing a mechanism for stakeholders to engage with the project about their concerns and expectations and provide a mechanism for receiving, documenting and addressing comments received
- **Compliance:** with both national regulations and international best practice

Project details were disclosed to all stakeholders and the host community. The team also undertook to consult with administrative stakeholders to identify their views on the proposed project and perceived impacts.

5.2. Stakeholders Analysis

The ESIA is considered to have engagement with the community; directly affected and indirectly affected persons, institutional stakeholders including government and organizations likely to be involved in project implementation, regulation, and monitoring.

A list of stakeholders consulted to date is included in Table 9. The input from stakeholders obtained during the ESIA has informed the identification of important issues and potential sensitivities that merit further stakeholder engagement.

TABLE 9: STAKEHOLDERS IDENTIFIED, THEIR ROLES AND STATUS OF CONSULTATION IN SIDAMA

| Stakeholder | Role and interest/ influence | Status of consultation | Outcome |
|--|---|---|---|
| Sidama region water, mine and energy office | Regional government | Letter sent, meeting conducted to introduce the project and project team. | Project disclosure was made, data and information were collected |
| Shebedino Woreda Water, mine and energy | Local government | Letter sent from the zone and meeting was conducted to introduce the project and project team. | Project disclosure was made, data and information were collected |
| Community from Lelicho village | Host communities, all have an interest in electric power and irrigation, and some have an interest in new job opportunities | Meetings were conducted to disclose the project to communities | PAPs may be identified later when the exact location of the project is known, and the developers are identified |
| Sidama region and Gamo Zone Culture and tourism offices | Regional and local government | meetings were conducted to disclose the project and identify any cultural and archaeological sites in the proposed project area | Discussions were made, data were obtained regarding culture and tourism sites |
| Shebedino Woreda Agriculture and Natural Resources Offices | Local government | Letter sent, a meeting was held to introduce project and request data | Project disclosure was made, data on irrigation was obtained |

5.3. Outcomes from Community and major institutional stakeholders' consultations

5.3.1. Lelicho Community

The ESIA team arrived on the 6th of October 2021 in Lelicho village and held a focus group discussion to deliberate on the proposed project and its likely impacts on the community. The participants of the focus group (25 members), albeit a large group, were traditional leaders, farmers, Keble officers, a development agent, and women (among them a nurse was present). Except few (e.g., a nurse and development agent), all of these members practice irrigation and rainfed farming. The ESIA team then disclosed the project objectives including its benefits and any setbacks that might happen due to project implementations (Figure, 12). The session was conducted in Sidama language so that each participant will have a clear view of the project's intentions and likely impacts. The communities very much welcomed the idea of a power generation system.



FIGURE 12: CONSULTATION WITH LELICHO COMMUNITY IN ASRADO MERO KEBELE, SHEBEDINO

TABLE 10: PUBLIC CONSULTATION WITH LELICHO COMMUNITY

| Date of meeting: 06/10/2021 Venue: Lelicho Kebele office Number of participants: Men 20, Women 5 | | |
|---|---|---|
| Name of participant | Issues raised | Responses by the ESIA team |
| Ato Dawit Bosholo (M) | Are you related with the GIZ since we have heard about solar energy from them, and we have been promised to have access to off grid household energy? | The ESIA team explained that this was a separate project aimed at providing energy for the community and irrigation purposes |
| Ato Beyene Hariso (M) | Land is a scarce resource here and how much land it will take to set up the solar panel and generate energy? | The ESIA team clarified that land take will be minimal since there is flexibility in the design to avoid productive land for solar panel installations. In addition, any land being taken away from farmers will be compensated according to the provisions of the law of the land |
| W/ro Asnakech Chinko (F) | How will this project ease women's burden? | The ESIA team responded that this project, if materialized, will help solve problems related to irrigation and improve farm productivity which directly or indirectly empowers women |
| Gosooma Shite (M) | Does the government pay compensation for land taken for Panel construction? | The ESIA team responded that the government pays appropriate compensation for any land intake before the commencement of the project. |
| Ato Tesfaye Mussie (M) | How do I know that my land is taken for the purpose of solar panel construction? Will I be informed about the details of compensation? | All potentially affected persons will be informed ahead of time about the particular/suitable land for PV panel construction. There will be committee for compensation purpose drawn from local elders, PAPs, Kebele and Woreda. |
| W/ro Shenbe Rafessa (F) | When is this project going to be implemented? | For this question, we clarified that this is an initial study, and it may take some time until all the project related issues are secured. |
| All participants (M & F) | All the above respondents raised any potential source of gender-based violence including sexual exploitation of women for short term benefits | The ESIA team responded that gender-based violence is a serious offense and the potential project proponent will have a protocol including training manuals to sensitize and monitor it. If it happens in some way, there will be administrative and disciplinary mechanism to address the offenses |

5.3.2. Institutional stakeholders

The ESIA team arranged a consultation meeting with the relevant offices that may influence the project in the Sidama region, particularly the water, mines, and irrigation offices, and Sidama culture and tourism office. After securing a letter from the regional offices, the ESIA team organized meetings to disclose the project and request them the required socio-economic data. Accordingly, Shebedino Woreda's relevant offices were identified, and stakeholders' meetings were conducted. In both Woredas, the ESIA team contacted experts from water, mines, and energy offices, culture and tourism offices, and agriculture and natural resources offices. With all identified office experts, the ESIA team discussed details about the projects, their scope, and target area.

Shebedino Woreda agriculture and natural resources office head (Figure 13) reiterated the potential for irrigation is so high and until now the Woreda could exploit only 12% of the land under irrigation. The sole limitation is lack of energy where diesel pumps are not only expensive, but fuel shortage presents an enormous problem. However, some of the stakeholders, in both Woredas, raised a question that most of the time these kinds of project proposals came by but then had not been materialized. "Would this be like its predecessors?" The ESIA team explained that this is a new business model and hoped that it would succeed given the demand is high and it falls squarely with the national development goal.



FIGURE 13: INSTITUTIONAL CONSULTATION WITH SHEBEDINO WOREDA AGRICULTURE AND NATURAL RESOURCES OFFICE

5.4. Grievances and Redress Mechanism

The mitigation and management plans will be carried out properly. Thus, it is expected that no major grievance issue will arise. However, to ensure that stakeholders have avenues for redressing their grievances related to any aspect that may result from the projects, detailed procedures of redressing grievances should be established. The objective is to respond to the complaints of stakeholders in a timely and transparent manner without resorting to complicated formal channels to the extent possible. The procedure covers stakeholder grievances generated during construction and operation activities. Anyone will be eligible to submit a grievance to the project office if he/she believes a practice is having an adverse impact on the community, the environment, or on their quality of life.

5.4.1. Grievance Handling Procedure

Disclosure of the Grievance and redressing Mechanism (GRM)

The Community will be fully informed about the Grievance procedures in their local language. Information about the grievance mechanism will be tailored according to the community to ease communication. Community leaders, social entities and the governmental units will be informed about the GRM. All information about grievance mechanisms will be made available in public areas and with the community leaders.

5.4.2. Mode of Grievance

The proponent will accept all comments and complaints associated with the project from any stakeholder. Comments can be made via email, post, fax, telephone, or in person. The proponent will arrange an office to entertain complaints who want to report in person within the project compound. The comments and complaints will be summarized and listed in a complaints/ comment's logbook, which contains the name/group of the commenter/complainant, the date the comment was received, a brief description of the issues, information on the proposed corrective actions to be implemented (if appropriate), and the date of response sent to the commenter/complainant.

5.4.3. Response to Grievances

All grievances will be registered and acknowledged within 6 working days and responded to within 15 days. The project management will keep a grievance log and report on the progress of grievance management as part of the annual project progress reports, which will be available on the company website. All comments and complaints will then be responded to, either verbally or in writing, in accordance with the preferred method of communication specified by the complainant.

6. Potential Environmental and Social Impact Identification and Significance

6.1. General

Identification of all project-induced impacts is an essential output of environmental and social impact assessment (ESIA). ESIA is a process of addressing potential positive and negative impacts of a to design a management action plan prior to project construction, development, and implementation phases. It is part of the project planning process and as such helps to prevent and/or mitigate the adverse impacts and enhances a project's beneficial outcomes. In addition, ESIA provides information for decision-makers for better planning and resource management and helps them avoid the negative consequences of the project.

To this end, potential impacts of the proposed projects were identified in this document and categorized as biological, physical, and socio-economic. The main impacts and their likelihood as well as their levels of impact and severity were identified based on the projects' main activities.

The ESIA team addressed some of the identified impacts based on:

- Identification of the main environmental and social resources and receptors from the baseline data collection from project sites
- Literature review of impacts of solar generation project
- Results of the stakeholders and community consultations

During the ESIA study, in addition to including some more impacts (based on additional information from the site), a brief description and analysis were made for each impact identified. Accordingly, the proposed project's potential impacts (positive and negative, large, or small, direct or indirect, reversible and irreversible, and significant and insignificant) on the existing biophysical and socio-economic environment and significance are outlined in the next section. Parameters such as Land environment, Water Environment, Air Environment, Noise Environment, and Socio-Economic Environment are of significance in the Environmental Impact Assessment and are being discussed in detail below.

6.2. Beneficial Impacts

6.2.1. Economic and environmental benefits

The main purpose of this project is to provide electricity to the community for their irrigation pumps and for household use from mini grid solar power plants. The project will have several beneficial impacts both at the national and regional levels. Some of the major positive impacts include the replacement of diesel pumps with electric pumps, which will reduce dependence on diesel and, thus, the reduction of greenhouse gasses emission into the atmosphere. In addition, the project will also increase agricultural yield/production, create an employment opportunity for skilled and semi-skilled workers, create an opportunity for knowledge transfer in utilizing best irrigation and agricultural practices, improve social infrastructures, and economic development to the nation at large. The following are some of the positive impacts of the developing project.

6.2.1.1. Increasing agriculture production

During the field visit, it was observed that the selected Lelicho site is favorable to implementing modern irrigation activities. However, the farmers are dependent on imported fuel and its cost has been rising over time, in addition they must go long distances to get fuel and its availability has been a challenge for farmers. The planned project, generating energy from solar power, is expected to solve many of the farmers' problems. It will provide and/or increase access to water for many farmers and can have significant effects on agricultural productivity and generated

income. There will be a sustainable and diverse food supply throughout the year. Furthermore, the project will increase opportunities to produce market oriented or high value horticulture crops for urban centers.

6.2.1.2. Employment opportunity

Unemployment is a huge problem in many developing countries including Ethiopia. The development and implementation of this project will undoubtedly be very significant in creating job opportunities for trained, semi-trained local youths during the construction and implementation phases. During the public consultation, one of the community's concerns was in hiring technicians for maintenance not to interrupt the middle of cultivation. The project developer will hire trained experts for repairing and maintenance. This proposed project is expected to generate employment opportunities for 7 people on a permanent basis during operation and 100 to 120 workers during construction work. This will have a significant impact since unemployment is currently quite high in Woreda and the country at large. Moreover, unemployed youths in the community will form associations and participate in irrigation activities.

6.2.1.3. Alternative source of energy

Ethiopia has the potential to generate a huge amount of energy from renewable sources like Water, Geothermal, Solar, and Wind. The solar energy that is friendly to the environment, clean, and requires limited maintenance is an alternative renewable energy source, especially for countries like Ethiopia having a high amount of annual solar irradiation rate. Besides, for Ethiopia's rural areas where people live in scattered villages, mini-grid solar energy is preferable to develop. Among the various forms of renewable energy technologies Solar photovoltaic (PV) technology is perhaps the most used one to generate electricity, especially in rural areas all over the world. Currently in Ethiopia some rural areas people use solar energy for household uses. During field visits to project areas, it is observed people use solar for charging mobiles and light at home.

6.2.2. Social Benefits

6.2.2.1. Gender equality

Irrigation interventions can also affect women's empowerment (or disempowerment) depending on gender roles in agriculture, which vary from case to case. Improved access to the water supply may release women from water-collection chores and might allow women to invest more time in income-generating activities, such as agricultural production. If women are farming their own plots and have access to irrigation technologies, then the productivity of female-managed plots may increase, and income from the increase in productivity may also grow.

6.2.2.2. Knowledge transfer

The project will play a great role in transferring (development) knowledge and skills in utilizing best irrigation agricultural practices and solar technology. The youths in the project area will acquire knowledge from construction to operation of solar mini grid projects. The irrigation users will be organized in an irrigation users' association (cooperative) which can help to disseminate information effectively and efficiently. Peoples from other parts of the country will visit the pilot project and initiate them to implement in their localities.

6.3. Potential Adverse Impacts and Mitigation measures

6.3.1. Adverse impacts during preconstruction phase

Before the commencement of construction, only data collection for feasibility study and environmental and social impacts assessment study were conducted. Baseline data collection and public consultation have been conducted at the site. These activities don't have any significant impact on the environment.

6.3.2. Adverse impacts during construction

Environmental impacts of the construction phase are expected to be temporary and minimal as all the construction works will be carried out within the site boundary of the project land, for a short period of time and will be controlled via mitigation measures.

6.3.2.1. Generation of solid waste

The major solid waste expected from this project is damaged solar PV modules during construction. These modules can contain potentially hazardous materials and result in soil and water contamination. Other wastes from the construction site will be mainly residues of the construction material. These include pieces of concrete, heaps of sand and aggregates, bits and pieces of various pipe types, pieces of electrical materials, cans and bags of paint and plastering, packing materials, pieces of timber, scrap and pieces of metal sheet and iron bar (metals) among others scattered within the project site

These waste materials create adverse impacts on the biophysical environments of the area if proper avoidance and mitigation measures have not been taken in place and on time.

Mitigation measure

- Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice
- Waste will be kept in a dedicated storage container until the recycled materials are sold and the unwanted materials to be transported to a designated disposal site
- Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean

6.3.2.2. Generation of liquid waste

During the construction phase, liquid wastes like oil spills from machinery, grease, and petrol in the garage from vehicles are expected to pollute the environment in addition to water wastes from concrete rationing and water sprinkling water wastes from different sanitary uses are expected to increase. Moreover, the accidental release of other hazardous materials from equipment used in the solar panel installation process will likely create liquid waste. If these wastes are not properly managed and mitigated, they can seep into the soil, kill plants, pollute surface and subsurface water, destroy natural habitats and cause biodiversity loss (especially the microbes and small invertebrates) in the area. Furthermore, such continued spill and seepage into the ground will result in the contamination of surface and groundwater sources. These all will further affect human health and wellbeing in the project command area and beyond.

Mitigation measure

- Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills
- The wastewater from sanitary and construction works should be collected through the channel in a plastered pond or reservoir and can be recycled for construction, green area, and other purposes after proper filtering and treatment

6.3.2.3. Soil erosion

During construction work, a considerable volume of soil will be excavated for leveling site and solar mounting foundation. In the construction area, soils will be impacted due to the clearing of vegetation, mounting of the PV modules, construction of internal roads, etc. Exposure of the ground and removal of vegetation cover will make the soil vulnerable to erosion by wind and running water. However, due to the site's flat topography and the relatively limited earthworks associated with solar PV installations, these impacts are manageable by ensuring good international industry practice in construction works.

Mitigation measure

- Topsoil shall be set aside and reserved where possible

- Avoid excavation during the rainy season
- Heap the excavated soil in the selected area and reuse it to fill undulating areas
- Drainage measures shall be provided, prior to construction works, to reduce storm water run-off and flash floods

6.3.2.4. Noise pollution

During the construction phase, some noises could be generated from construction machinery (like excavators, loaders, bulldozers, mixers, dump trucks, compactors, generators, etc.) movements. This may disturb workers of the project and the nearby villagers to some extent. Noise by nature is a nuisance and may bring about annoyance, sleep disturbance, and interference with communication and cause ear disease if the level is beyond the acceptable limit (WHO prescribes 55dB for residential areas). However, the construction noise will last for a short period and is not expected to cause a significant nuisance to the public, at least not with standard mitigation measures in place.

Mitigation measure

- Noisy activities shall be scheduled to daytime hours
- Noise disturbance and impact can be reduced by also administration and management decision to work on a shift basis, work rotation and work time reduction for workers to reduce their exposure to noise, moving away the workers from the source of noise by restricting area and shutting or turning off noisy equipment or machineries when not needed
- Noise levels at sensitive receptors shall be measured regularly and whenever complaints arise. In instances where workers will be exposed to elevated sound levels, personal protective equipment (PPE) such as ear mufflers/plugs should be used

6.3.2.5. Air pollution

The main impact on air quality during construction will be from increased dust levels arising from the movement of vehicles and construction machinery, land clearing and levelling, cement mixing (fugitive dust, Pm2.5 microgram per litter), and internal road construction, etc. In addition to emissions of particles, there will be minor emissions of CO from construction machinery, vehicles, and diesel power generators. However, due to the relatively long distance between the main PV installation areas and the settlements, the impacts are very minor. Principally it is essential to keep control of dust particles during construction since dust particles contribute to air pollution that might limit visibility and affect human and animal health (It adversely and seriously affects human respiratory systems, particularly bronchitis and lung).

Mitigation measure

- Workers assigned in the construction machinery operation should wear a dust mask
- The supervisor should strictly follow and make sure this procedure is in place before starting their job
- Water shall be sprayed on all internal roads to minimize dust dispersion when necessary
- Develop a regular inspection and scheduled maintenance program for vehicles, machinery, and equipment to be used throughout the construction phase for early detection of issue to avoid unnecessary pollutant emissions

6.3.2.6. Impact on public health

The construction of a solar mini-grid power plant involves a high number of workers from other parts of the region. The influx of workers may contribute to a breakdown in social fabrics, norms, and practices, including sexual behavior. Many workers both male & female are expected to involve in the different stages of the construction activities as envisaged in the project feasibility study. Along the process, workers may have a chance to interact with themselves or with anyone nearby which might lead to behavioral change which could result in the transmission of contagious diseases such as HIV/AIDS and other STIs. Such incidences may further strain rural health infrastructure and become community health concerns. In addition, ponds and stored water may result in malaria risks and other diseases such as bilharzia (Schistosomiasis).

Mitigation Measures:

Prevention will be the key intervention measure and therefore sensitization and awareness measures on HIV/AIDS should be carried out regularly among workers and the host community during the construction phase

- Conduct public health campaigns addressing issues of behavioral change, HIV/AIDS, etc.
- Putting in place appropriate signage to educate workforce and community about the project's HIV policy
- Provision of materials useful for the prevention of HIV/AIDS
- A code of conduct shall be in place to manage worker behavior
- Conducting malaria awareness raising campaigns, using mosquito bite prevention methods such as mosquito nets.
- Avoid drinking contaminated water (raising communities' awareness to boil and drink water) to reduce Schistosomiasis infection

6.3.2.7. Impact on occupational health and safety

The construction activities will result in potential impacts on workers' health and safety due to exposure to risks through construction activities that lead to accidents causing injuries and death. Construction works and activities bear frequent accidents and health risks for the workers.

Mitigation measure

- The contractor shall provide all appropriate resources (Personal Protective Equipment) onsite

6.3.2.8. Impacts on fauna and flora

It may cause temporary disturbance to resident birds with ground nests due to noise, dust, and particulate emissions, and possible illegal hunting by construction workers. Reptiles present within the project site may temporarily move to adjacent locations during construction activities. During the baseline study, it is observed that the project sites are selected on bare and sparsely vegetated areas, so there will be minor clearances of some bushes and shrubs.

Mitigation measure

- Restrict activities to allocated construction areas only, including the movement of workers and vehicles to allocated roads within the site and prohibit off-roading to minimize disturbances
- Prohibit hunting at any time and under any condition by construction workers on site

6.3.2.9. Spread of Covid-19

The influx of labour is associated not only with the spread of HIV/AIDS and other sexually transmitted diseases but also with other pandemics such as Covid 19. Coronavirus is a novel contagious disease that is spread through crowding and from the person-to-person transmission of the virus. During construction work, many workers will be involved and work in close contact and this will aggravate the spread of Covid-19 among workers and also within the surrounding communities.

Mitigation Measures:

- Workers shall follow strictly Covid-19 prevention mechanisms
- Temperature measurement checkup each day at the gate of the compound
- Workers should clean their hands with soap and water, or sanitizers or alcohol many times as much as possible each day
- Keep a safe distance (2 meters) from anyone who is coughing or sneezing

- Workers keep proper physical distance from others (2meter) and always wear a mask and avoid handshakes or other physical contact
- Workers do not touch their eyes, nose, or mouth
- Cover their nose and mouth with their bent elbow or a tissue when they cough or sneeze
- Stay home if workers feel unwell
- If workers have a fever, cough and difficulty breathing, seek a doctor on time

6.3.2.10. Traffic accident

During the construction phase, there could be traffic accidents associated with the construction of the solar minigrd facility. Specifically, some large trucks, rollers and perhaps excavators will be used . In addition, the roads leading to the project area are not accessible for all vehicles except tracks during the dry season to transport agricultural products. Furthermore, the community awareness regarding the traffic system is also limited. Therefore, unless traffic safety is promoted among workers and the community, a traffic accident is expected to increase during the construction phase.

Mitigation Measures:

- Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages)
- Collabourating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)
- Mandatory speed limits not exceeding 40km per hour

6.3.2.11. landscape change and visual impacts

During the construction phase, the existing relatively flat topography may change due to excavation and leveling, in addition, the excavated overburdened materials and construction materials leftover inside the site and surrounding area may create visual impacts.

Mitigation Measures:

- Use the excavated soil for backfill during site restoration phase
- Properly store and finally clear construction leftover materials

6.3.2.12. Gender based violence (GBV)

Gender-based violence involves power imbalances where, most often, men are the perpetrators and women the victims. While women are usually the immediate victims of gender violence, the consequences of gender violence extend beyond the victim to society. Experience from other projects indicates that among the most serious and invisible risks is the increase in gender-based violence (GBV) in the populations in which a project is carried out. For this specific project during the construction phase, there will be a temporary labour influx may result in gender-based violence (GBV) and sexual exploitation risks for women and girls.

Mitigation Measures:

The main measures to minimize these cases in the context of development projects include preventive measures such as codes of conduct, worker training, and specific complaint mechanisms to address sexual violence. The proponent should work closely with local women’s support groups, organizations, and institutions that can provide the timely and immediate support that girls and women require.

6.3.2.13. Child labour abuse

In most parts of the country in Ethiopia including this specific project area, the culture encourages children to work to develop skills. Children are considered assets to generate income in a time of poverty. Children should, therefore, be given work at home early in life and be obliged to assist parents in the farming area. During the construction phase, children may be involved in construction activities as labourers and running errands. These activities will likely keep the children away from school in addition to the risk of being exposed to accidental and other injuries.

Mitigation Measures:

- Continuous monitoring of contractor's compliance to national labour laws and AfDB's OS5

6.3.3. Adverse impact during Operational phase

6.3.3.1. Impacts on bio- physical environment

6.3.3.1.1. Soil contamination and fertility decline

Solar mini-grid power plant facilities do not involve significant risks of pollution spills or the release of other hazardous materials during the operation phase. However, as mentioned earlier, solar PV modules and batteries contain potentially hazardous materials and need to be disposed of safely at the end of their use and when they are damaged during the operation phase.

Mitigation Measures:

- PV panels and batteries at the end of their useful life, and other potentially hazardous waste generated during the operation phase, shall be disposed of in accordance with best industry practices

6.3.3.1.2. Soil erosion

The proposed solar mini-grid plants at the site have flat laying topography and the expected soil erosion during the operation phase is very minimal. However, there will be a need to provide drainage around the solar mini-grid plant to prevent localized flooding and erosion. This will be considered in the detailed engineering phase as a measure to safeguard the solar PV installations as well as for environmental protection.

Mitigation Measures:

- Plant trees in areas exposed to flooding
- Provide permanent drainage at the project site to prevent flooding and soil erosion

6.3.3.1.3. Water contamination

The impact of water pollution from solar PV plants during the operation phase is very minimal. The expected potential source of water pollution is from the permanent workers (e.g., guard, technician) facilities, therefore, sources from these facilities may generate sanitary effluents.

Mitigation Measures:

- Ensure proper facilities and disposal processes exist for waste and water at the minigrid site and toilet/guardhouse facilities.

6.3.3.2. Impacts on socio economic environment

6.3.3.2.1. Loss of plots of land

Though the implementation of the solar minigrid project has numerous benefits for most of the local communities, the construction of the solar minigrid facility will occupy some amount of land not more than 0.5 hectares per site. Hence, land take will result in permanent loss of agricultural and grazing lands, though small. However, the area needed for solar is small and results in minimal economic displacement for farmers. In the project area at Lelicho, a public consultation was conducted, and the community agreed to hand over land for solar panel installation if compensation payment is made as per the provisions of the law (proclamation no. 1161/2019).

Mitigation Measures:

- Landowners shall be compensated as per the new proclamation No. 1161/2019 before the construction activities started
- Provide job opportunity priority for those, project affected people (PAP) during construction and implementation phases

6.3.3.2.2. Noise pollution

The solar minigrid facility emits insignificant sound pollution. Therefore, noise impact will likely be insignificant and may not need mitigation measures.

6.3.3.2.3. Air pollution

Air pollution is one of the serious environmental and social problems which create several adverse effects on human health due to their nature and residence time in the atmosphere. In addition to their negative effect on human health, they exert a strong effect on local and global climate change. Air pollution is often intensified in connection with development activities such as agriculture (irrigation) and industry. Hence, the source of air pollution and its mitigation measures should be understood and analyzed in advance prior to the commencement of any project development and implementation.

As baseline data field measurement was conducted for particulate matter and carbon monoxide in the field. Though we measured CO at a different time the result didn't exceed 0ppm.

Upon commissioning, the solar PV plant will supply renewable energy using a technology that does not involve the release of greenhouse gases (GHG) during operation. Compared to diesel generators or other thermal power plants, solar PV facilities can thus contribute to reducing air pollution.

Mitigation Measures:

- Measure levels throughout lifetime of project and address as needed

6.3.3.2.4. Generation of liquid waste

During the operation phase, generation of liquid waste from solar mini grid plants is very limited. The major source of liquid waste emanates from sanitary wastewater from restrooms and kitchens.

Mitigation Measures:

- Construct a septic tank inside the premise and collect sanitary waste and finally dispose it off at permitted area as needed

6.3.3.2.5. Occupational health and safety

The health and safety risks during the operation phase will be limited to the solar PV site workers. Technicians who operate or maintain PV panels and transmission lines will likely be exposed to electric shock, burns and body damage as they undertake routine operations and maintenance tasks.

Mitigation measures

- Use of appropriate PPE during installation and maintenance
- The solar mini grid plant shall be equipped with a fire-fighting system

6.3.3.2.6. Contagious diseases (STDs, HIV, TB) and Covid-19

The operation phase of the solar PV project involves a limited number of workers; however, the influx of labour is often associated with the spread of communicable diseases such as HIV/AIDS and other sexually transmitted diseases. Coronavirus disease is also a new and potentially dangerous contagious disease that is spread through crowding and from person-to-person contacts. In addition, it is expected that a disproportionate percentage of the labour force will be constituted of the young population in their sexually active age hence exposure to STDs (e.g., HIV) would be expected.

Mitigation measures shall include:

- Health promotion: sensitization of both community and workforce
- Provision of materials necessary for prevention and detection of COVID 19
- Provision of materials useful for the prevention of HIV/AIDS
- Having in place an appropriate signpost to educate the workforce and community about the Project's HIV policy and project COVID management and prevention policies

6.3.3.2.7. Fire hazard

During the operation phase of the project, there could be different activities that may lead to a fire outbreak. Poor handling of Solar PV components like AC and DC converters, transformer & electricity systems, faulty electrical equipment, carelessness, etc., are some of the possible causes of a fire outbreak. The effects may result in total damage from fire hazards which could permanently affect the project and may result in loss of property and life.

Mitigation Measures:

- The solar mini-grid plant shall be equipped with a fire-fighting system
- The technician should regularly inspect Solar PV components

6.3.3.2.8. Impacts on tourism and cultural heritage

Shebedino Woreda is rich in culture and areas that can attract tourists. However, the Woreda culture and tourism office and field visit confirm the absence of known historical and cultural heritage resources at the project site. However, as always, there is a risk that cultural heritage objects are unexpectedly uncovered during construction activities.

Mitigation Measures: prepare chance finds procedure based on the World Bank

6.3.3.2.9. Child labour abuse

In most parts of Ethiopia, including this specific project area, the culture encourages children to work to develop skills. Children are considered assets to generate income in times of poverty. Children should, therefore, be given work at home early in life and be obliged to assist parents in farming areas. During the operation phase, , the minigrd

developer will not have any role to hire children in to, so this is a highly unlikely risk for the operation of a solar energy power plant.

Mitigation Measures:

Provide training for families not to participate children underage

6.3.4. Impact during decommission phase

Information from different literature reviews reveals that solar power PV plants are expected to have an economic life span of 25 to 30 years and are more likely above with proper maintenance and interim replacement of major equipment (National Renewable Energy Laboratory, 2012). Once the power generation ceased, it is mandatory to decommission the solar modules and all associated equipment and facilities to return the affected area to the natural environment

6.3.4.1. Air pollution

Like the construction phase, the dismantling of the solar PV equipment and unwanted constructed structures will create dust emissions. The dust results in respiratory problems and other health impacts on decommissioning workers.

Mitigation Measures:

- Workers should wear dust masks
- Spray water on demolishing areas

6.3.4.2. Generation of solid waste

During the decommissioning phase, solid waste will be generated after the use-life of solar modules, batteries, cables, substructures, demolished civil structures, etc. Solar modules can contain potentially hazardous materials, so considerations should be given at the start of the project to determine how units will be disposed of at the end of the project lifetime.

Mitigation Measures:

- Hazardous wastes should be dumped in specified protected sites
- Separate recyclable materials and sell for interested buyers

6.3.4.3. Loss of employment

The solar PV project will create jobs for a limited number of workers during the implementation phase. When the project phases out, permanent workers will be jobless and will likely be negatively affected.

Mitigation Measures:

- Transfer permanent workers to other active projects
- Pay compensation (severance) for permanent workers

6.3.4.4. Noise pollution

The decommissioning activities of dismantling the solar power plant and removing the ancillary facilities are associated with potentially increased noise levels. The receptors of the increased noise level will likely be only the workers of decommissioning activities.

Mitigation Measures:

- As the only receptors will be the workers at the site and within the proposed facilities in the vicinity of the solar power plant, these increased noise levels are considered occupational noises that require occupational health and safety measures, like wearing earplugs.

6.3.4.5. Labour influx and GBV

The activities associated with decommissioning will involve the dismantling of the solar power plant, irrigation pipes, and removal of its facilities. These activities involve a limited number of workers. Hence it may have a temporary effect. We don't anticipate any significant impact on gender-related violence and the spreading of communicable diseases like HIV, Covid 19, etc. By the same token, the participation of child labour will be unlikely since the number of workers required for decommissioning phase is very limited.

6.3.5. Significance of impacts

Identification of impact significance and analysis is a core element in an ESIA process. It involves impact identification, prediction, and evaluation. Potential impacts associated with this project were identified using professional exposure to similar projects, from collected baseline data, community consultation, and professional judgments. Based on these factors, impacts on the biophysical and socio-economic environment of the area were evaluated and predicted. The identified impacts were evaluated to determine their significance by using typical parameters; type, duration, nature, magnitude, and significance through the project development periods as indicated in Table 11.

The parameters used in evaluating the magnitude and likelihood of the impacts are briefly addressed in the table. Spatial and temporal extent, the natural resources carrying capacity, and possible potential environmental impacts were identified. Based on these factors, potential impacts on the bio-physical and socio-economic conditions of the project area were evaluated. (Table 11 and Table 12).

TABLE 11: IMPACT SIGNIFICANCE EVALUATION CRITERIA

| S. No | Criteria | Impact rating | Description |
|-------|----------------------|---------------|---|
| 1 | Extent of the impact | Local | Site specific or confined to project premise |
| | | Regional | Extending beyond the boundaries of the project site and its buffer zone, affecting neighbors, town, local authority, district and even province |
| | | National | Affecting areas beyond the province. |
| 2 | Magnitude | Very low | Where the impact affects the environment in such a way that natural, cultural, and social functions and processes are not affected. |
| | | Low | Where the impact affects the environment in such a way that natural, cultural, and social functions and processes continue, albeit in a slightly modified way |
| | | Medium | Where the affected environment is altered, but natural, cultural, and social functions and processes continue, albeit in a modified way |
| | | High | Where natural, cultural, and social functions or processes are altered to the extent that it will temporarily or permanently cease. |
| 3 | Nature | Permanent | When the effect is long-lasting |
| | | Temporary | When the effect is for short period of time |

TABLE 12: POTENTIAL ENVIRONMENTAL AND SOCIAL IMPACTS EVALUATION

| S.No | Main Identified Potential Impacts | Type | | Reversibility | | Impact Extent | | Nature | | Magnitude | Significance |
|--------------------------------------|-------------------------------------|------------|---------|---------------|--------------|---------------|--------------|-----------|-----------|-----------|--------------|
| | | Beneficial | Adverse | Reversible | Irreversible | Local | Trans-Region | Temporary | Permanent | | |
| I. Potential positive impacts | | | | | | | | | | | |
| 1. | Employment opportunities | x | | x | | x | | x | x | Medium | Medium |
| 2. | Agricultural productivity | x | | x | | x | x | | x | Very High | Very High |
| 3. | Knowledge transfer | x | | x | | x | x | | x | Medium | Medium |
| 4. | Gender Equity | x | | x | | x | | x | | Low | Low |
| II. Potential Adverse Impacts | | | | | | | | | | | |
| A. Construction Phase Impacts | | | | | | | | | | | |
| 1. | Generation of Waste | | x | x | | x | | x | | Medium | Medium |
| 2. | Generation of noise | | x | x | | x | | x | | low | low |
| 3. | Dust emission | | x | x | | x | | x | | low | low |
| 4 | Impact on fauna & flora | | x | x | | x | | x | | low | low |
| 5 | Impact on public health | | x | x | | x | | x | | Medium | Medium |
| 6 | Workplace Accidents | | x | x | | x | | x | | Medium | Medium |
| 7 | Covid 19 | | x | x | | x | X | x | | High | High |
| 8 | Soil erosion | | x | x | | x | | x | | Medium | Medium |
| 9 | Traffic Accident | | x | x | | x | | x | | Medium | Medium |
| 10 | Landscape change and visual impacts | | x | x | | x | | x | | Medium | Medium |

| | | | | | | | | | | | |
|--|--------------------------------|--|---|---|---|---|---|--|---|----------|----------|
| 11 | GBV | | x | | x | x | | | x | High | High |
| 12 | Child labour abuse | | x | | x | x | | | x | High | High |
| B. Operation Phase Impacts | | | | | | | | | | | |
| 1. | Air emission/pollution | | x | x | | x | | | x | low | low |
| 2 | Noise pollution | | x | x | | x | | | x | Very low | Very low |
| 3 | Water wastage | | x | x | | x | | | x | Medium | medium |
| 4. | Siltation | | x | x | | x | | | x | Medium | medium |
| 5. | Water pollution | | x | x | | x | | | x | Medium | Medium |
| 6. | Soil contamination | | x | x | | x | | | x | Medium | medium |
| 7 | Impact on fauna | | x | x | | x | | | x | low | low |
| 8 | Impact on flora | | x | x | | x | | | x | Medium | medium |
| 9 | Covid 19 | | x | | x | x | X | | x | High | High |
| 10 | Sexually transmitted disease | | x | | x | x | X | | x | Medium | Medium |
| 11 | Impact on public health | | x | | x | x | | | x | Medium | medium |
| 12 | Fire Hazards | | x | | x | x | | | x | High | High |
| 13 | Traffic accident | | x | | x | x | | | x | low | low |
| 14 | Occupational health and safety | | x | | x | x | | | x | Medium | Medium |
| 15 | Impacts on culture, tourism | | x | | x | x | | | x | low | low |
| 16 | Loss of land | | x | | x | x | | | x | High | High |
| 17 | Child labour abuse | | x | | x | x | | | x | High | High |
| C. Decommissioning phase impact | | | | | | | | | | | |
| 1 | Pollution | | x | | x | x | | | x | low | low |
| 2 | Loss of employment | | x | | x | x | | | x | low | low |

7. Project Alternatives

During Environmental Impact Assessment, it is crucial that assess feasible alternatives for the project to bring sustainable development in the area. Therefore, before deciding on the proposed solar panel irrigation design and implementation of the project in general, several project options were examined to select feasible alternatives considering biophysical, social, economic, and technical factors. The alternatives considered were:

No project alternative: The “No action or do-nothing option” hinders the implementation of an irrigation project in the area using solar as an energy source. This option limits or excludes the benefits of the local community gained from the use of modern irrigation system. If the solar project cannot be implemented, the price of fuel for their pump will be more costly to the community. In addition, major benefits like increase in agricultural production and income of the community involved in the construction of the project will be lost. Moreover, it contradicts the interest of the people in the project as well as the socio-economic development needs of the nation by using the available water resources (see water management policy). As a result, this option was not found to be feasible. The sites are far from the main electric line, and it will be more costly to get power from the main grid. The sites are not favorable for generating power from wind. Currently, some farmers use fuel for their pumps, but the cost of fuel increases from time to time (40 to 50 birr per litter), and it's not economical to proceed with further irrigation activities. Environmentally, it is not advisable to use fuel for pumping. The ESIA team measured carbon monoxide (CO) at the field with a fuel-powered pump and read 56 ppm, whereas, in the absence of pump/ideal time, the measurement is 0 ppm.

Project implementation option: the planned project in the selected areas has numerous advantages for the local community. The community can get sustainable energy sources for their irrigation activities, and it enables them to increase agriculture products. Save the community from extra fuel costs and the environment from pollution. The community can also get electricity for their home, school, health post, and their flour mill, getting electricity for these infrastructures will improve the services which provide to the community.

Generally, all the above-mentioned alternatives were analyzed based on technical feasibility, economic viability, and environmental acceptability. The “No Action” alternative cannot be accepted when the project uses solar energy because of the numerous project advantages to the local community, and the low negative impacts of the project on the social and biophysical environment.

8. Environmental and Social Management Plan

8.1. General Overview

One of the objectives of undertaking an Environmental and Social Impact Assessment (ESIA) is to develop an Environmental and Social Management Plan (ESMP), which outlines the costs, timeframes, and responsibilities for the implementation of the proposed mitigation and enhancement measures. It identified all measures considered for the Mini-grid project and irrigation activities for handling impacts generated by the environment. These include:

- A mitigation plan with mechanisms and actions to minimize negative environmental impacts during construction, operation, and decommissioning
- A compensation plan with measures for designing activities to restore the environment
- A risk- and accident prevention plan linked to the construction, operation, and decommissioning of the mini-grid solar projects
- A public-participation plan that involves stakeholders
- A training plan to adequately meet human-resource needs

The sole responsibility for the implementation and outcome of the ESMP rests with the project proponent. In this case, the developer will be responsible for the implementation of ESMP. The proponent must incorporate environmental management system in its daily operations and, its ESMP is implemented, maintained, and updated in a manner that is consistent with nationally and internationally recognized standards. The environmental management issues outlined in this ESMP will be used to manage all environmental and social aspects of the operations activities. The proponent should ensure that it puts the essential institutional setup (Environment, Health, and Safety unit) and hire competent, experienced, and qualified person(s) to implement the ESMP.

8.2. Institutional frameworks

This section assesses institutional issues for implementing the ESMP and its monitoring plan and recommends a reporting and monitoring framework before discussing the mitigation measures for each identified impact in detail. The implementation of the mini-grid will directly involve the project proponent (developer). The duty and responsibility of managing the environmental and social impacts should therefore be the sole responsibility of the project proponent.

For this project, the Sidama regional bureau of agriculture and natural resources, water, and energy will be responsible for enforcing compliance with national standards in the different areas of specialization. At the national level, Environmental Protection Authority (former EFCC) is responsible for evaluating and approving ESIA study reports and for providing environmental approval licenses, which must be obtained before the commencement of project implementation.

In addition, environmental protection units from the respective bureaus of agriculture and natural resources are expected to be involved in the monitoring of the environmental performance of the solar mini-grid power plant project in Sidama region.

The contractor should maintain adequate control over the project to minimize the extent of impacts during construction, ensure appropriate restoration of areas affected by construction activities and prevent long-term environmental degradation.

8.3. Air quality and noise management plan

The intended project will have some pollution impacts on air and noise to workers during construction, operation, and decommissioning phases, Therefore, the project proponent must do its bests to comply with the performance standard that deals with pollution prevention and abatement.

During the design, construction, and operation of the mini grid, the project proponent must consider ambient conditions and apply pollution prevention and control technologies and practices (techniques) that are best suited to minimize or reduce adverse impacts on human health and the environment. Noise levels at the nearest sensitive receptors shall not exceed Ethiopian or international standards for daytime and nighttime noise. Regular measurements of noise level (Leq, dBA), using a standard sound level meter, shall be carried out to demonstrate compliance.

8.4. Occupational Health and safety plans

The project proponent provides safety wear, safety equipment, and occupational safety training before replacing and maintaining solar modules. To attain workplace safety, for example, some construction machines and solar PV components shall have protections, warning stickers, automatic stopping, or safety switches. Fire extinguishers should be placed at proper places which are easy to access during an emergency. Depending on the site context of workplaces and the types of machinery; workers shall be provided with safety wear such as goggles, hand gloves, work clothes, dust masks, safety shoes, working manuals, etc.

For example:

- Providing information materials, instructions, and regular pieces of training for employees regarding workplace injuries and hazards.
- Regular reporting and consultation with employee-elected health and safety representatives and/ or other employees about occupational health, safety, and welfare situations.
- Providing adequate personal protective clothing and equipment to ensure safety
- Ensuring all work procedures are undertaken without exposing workers to hazards

8.5. Waste management plan

The project site is selected in a rural space with no proper waste disposal site. Therefore, it is the proponent's responsibility to manage hazardous (e.g., accidental leakage of energy storage batteries) and non-hazardous wastes following the guidance included in the General Ethiopian Guidelines.

Management and disposal of hazardous and non-hazardous wastes should be undertaken following guidance included in the "General Ethiopian Guidelines".

8.6. Community Engagement Plan (CEP)

The proposed solar mini-grid plant has planned to supply electricity to the nearby community, but the main objective of this project is to provide a reliable supply of energy for irrigation so that smallholder farmers increase their farm productivity and mitigate climate change impacts. Farmers often use diesel pumps to irrigate their farms. Nonetheless, they face multifaceted problems such as rising diesel prices due to inflation, shortage of fuels in the market, and frequent maintenance-related costs of the pumps. During the public consultations, the ESIA team witnessed that the community members of the site were eager to see the implementation of this project. Hence such a positive outlook and attendant good relations with the community should be promoted by implementing an action plan that aims to provide a timely response to any inquiries, concerns, or complaints about construction or operation activities. The project proponent should consult and disclose any problems during operations, particularly regarding disclosure of information related to effluents, public health, and safety issues, and reporting results of environmental monitoring. The project should continue to remain in contact with irrigation user communities, local and regional agriculture offices, energy experts at various levels, and other stakeholders during the period of operation. Ongoing stakeholder consultation will allow the project to receive and respond to community concerns on an ongoing basis.

- The Community Engagement Plan (CEP) should be designed on the following principles:
- A Community Liaison Officer for each site needs to be appointed.
- The Community Liaison Officer will initiate the CEP through consultation with key stakeholders identified during community consultation.
- A formal CEP should be produced and documented in consultation with all key stakeholders.

- Through the Community Liaison Officer, the solar PV project proponent will implement a community grievance mechanism allowing community members to raise their concerns about any environmental or social concerns that they may have concerning the project.
- The project proponent will likely take responsibility for the implementation of the ongoing CEP.

8.7. Community Health and Safety Plan

The proponent will be responsible for safeguarding the health and safety of the public. During the construction phase, an influx of workers is expected from other parts of the country. The spread of Covid 19, HIV/AIDS, and other Sexually Transmitted Diseases (STDs) will be expected. In addition, due to the increased movement of construction machinery and dump trucks, traffic accidents will be one of the problems for the residents.

- Create awareness between workers and the community to prevent communicable diseases (HIV, Covid19, and other STDs)
- Enforce the drivers to limit speed (not more than 40km/hr.) in the project area and surroundings
- Aware the communities about traffic accidents through campaigns
- Put the traffic and other safety signage in the project site during construction and operation

8.8. Construction phase Environmental Management Plan

TABLE 13: SUMMARY OF CONSTRUCTION PHASE MANAGEMENT PLAN

| | Identified Impacts | Mitigation measures | Responsible | Estimated cost |
|--------------------------------|-----------------------------------|---|---|--|
| Biophysical Environment | Generation of solid Waste | Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practices Any heaps of sand and concrete aggregates in the compound should be cleared in order to keep the area neat and clean Solid waste from packaging materials like fertilizer & seed bag should be disposed at appropriate place. Bottles and containers of pesticides and herbicides should be stored and removed following best industrial practices | Minigrud Contractor Woreda office of Agriculture | P Estimated cost for disposal of solid waste 40,000 birr |
| | Generation of liquid Waste | Storage areas for fuel and hazardous materials shall be roofed and have a concrete floor with a bund for secondary containment and collection of spills The wastewater from sanitary and construction works should be collected through channel in a plastered pond or reservoir and can be recycled for construction, green area and other purposes after proper filtering Very minimal amount of wastewater for Minigrud, very limited amount of fuel or hazardous material | Minigrud Contractor | For construction of plastered pond and other storage structure is 60,000 |
| | Soil erosion | Avoid excavation during the rainy season Heap the excavated soil in the selected area and reuse to fill undulating areas | Minigrud Contractor | Labour cost to pile up soil is 30,000 |

| | | | | |
|--|--|--|---|--|
| | Noise pollution | Noisy activities shall be scheduled to daytime hours Personal protective equipment such as ear mufflers/plugs should be used Noise disturbance and impact can be reduced by also administration and management deciding to work on a shift basis, work rotation and work time reduction for workers to reduce workers exposure to noise, etc. Personal protective equipment such as ear mufflers/plugs should be used | Minigrid Contractor | For purchasing PPE is 30,000 birr |
| | Air pollution | Workers assigned in the construction should wear dust mask. The supervisor should strictly follow and make sure this procedure is in place before starting their job; and Water shall be sprayed on all internal roads to minimize dust dispersion when necessary | Minigrid Contractor | PPE included above, and water spray is 20,000 birr |
| | Impact on flora and fauna | Restrict activities to allocated construction areas only Prohibit hunting Replantation in the selected areas | Contractor | Replantation cost estimated to be 30,000 birr |
| Human Environment | Public health | Conduct public health awareness campaigns addressing issues of behavioral change, HIV/AIDS, etc. Prepare training manual and conduct regular training about STDs Provision of materials useful for the prevention of HIV/AIDS | Community /woreda labour and women affairs office Minigrid Contractor | Awareness-raising and training 25,000 birr For internal half day training 15,000 birr |
| | Covid 19 | Workers shall follow strictly Covid19 prevention mechanisms such as temperature measurement at the gate of the compound, washing of hands, wearing of masks, avoid hand shack, and keep social distance as much as possible. | Contractor/EHS unit of the project proponent | PPE cost included above |
| | Gender-based violence/child labour | Provision of training for workers and families, Community sensitization, regular monitoring for EHS compliance | Woreda labour and women's affairs office | 100,000 for training, and regular monitoring |
| | Traffic accidents | Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages) Mandatory speed limits not exceeding 40km per hour Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns) | Minigrid Contractor in collaboration with Woreda traffic police | Training cost for awareness creation for community and workers 20,000 |
| | Impacts on cultural, historical, and archaeological sites | If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual | Minigrid Contractor, supervised by Sidama regional state culture and tourism office | Supervision cost 20,000 birr |
| Total Minigrid Developer / Contractor Only | | | | 235000 |
| Total other parties | | | | 125000 |
| Total Construction Phase | | | | 360000 |

8.9. Operational phase Environmental Management Plan

TABLE 14: SUMMARY OF OPERATIONAL PHASE MANAGEMENT PLAN

| | Identified Impacts | Mitigation measures | Responsible | Estimated cost |
|---|--|---|--|---|
| Biophysical Environment | Liquid waste | Construct a toilet inside the premise and collect sanitary waste and finally dispose it off at permitted area | Minigrid Developer | Septic tank is expected to be constructed during construction phase |
| | Loss of farm and grazing land | Landowners shall be compensated as per the new proclamation No. 1161/2019 before the construction activities started Provide job opportunity priority for those projects affected people (PAP) during construction and implementation phases | Minigrid Developer, Woreda Agriculture offices, Woreda administration | The cost will be estimated later by Woreda experts |
| Human Environment | Occupational health and safety | Use of appropriate PPE during installation and maintenance The solar PV plant shall be equipped with fire-fighting tools Ensuring all electrical equipment and machinery are properly grounded Maintenance should be conducted by trained professionals only | Minigrid Developer | Estimated cost to purchase lifetime PPE is 60,000 birr |
| | Fire hazards | The solar PV plant should be equipped with proper fire extinguishers The technician should regularly inspect Solar PV components | Minigrid Developer | fire protection systems 40,000 |
| | Impacts on cultural, historical and archaeological site | If, in case, something new finds is suspected to be religious or historical site during excavations work, Chance Find Procedure for physical and cultural resources will be prepared as per World Bank Guidelines - OP 4.11 and will be part of construction procedure manual | Contractor, supervised by Sidama regional state culture and tourism office | No cost is implied |
| Total Minigrid Developer / Contractor Only | | | | 100000 |
| Total Operation Phase | | | | 100000 |

8.10. Decommissioning Phase Environmental Management Plan

TABLE 15: SUMMARY OF DECOMMISSION PHASE MANAGEMENT PLAN

| | Identified Impacts | Mitigation measures | Responsible | Estimated cost |
|--|---|--|---|--|
| Biophysical Environment | Generation of solid Waste | Hazardous waste, including broken PV panels, used batteries, shall be disposed of in accordance with best industrial practices | Minigrid Contractor | Waste disposal cost 150,000 |
| | Air pollution | Workers assigned to the demolition should wear dust masks. | Minigrid Contractor | PPE purchase and water spray cost 40,000 |
| Human Environment | Loss of employment | Transfer permanent workers to other active projects | Minigrid Contractor /regional government | Compensation payment for workers should be paid by the project proponent TBD |
| | Gender-based violence/child labour | Pay compensation (severance) for permanent workers | Contractor/EHS unit of the project proponent/Community/ Woreda labour and women's affairs office | 20,000 for training, and regular monitoring |
| Total Minigrid Developer / Contractor Only | | | | 190000 |
| Total other parties | | | | 20000 |
| Total Decomission Phase | | | | 210000 |

9. Environmental and social monitoring plans

Monitoring usually takes two forms, i) compliance monitoring and ii) effect monitoring. The former is about whether impact mitigation and enhancement measures are implemented in time and to the agreed national and international standards. Whereas the latter refers to the monitoring of project-induced impacts on the social and biophysical receptors. Thus, the compliance aspect is monitored by government authorities at the federal level (EPA), and Sidama regional bureau of agriculture and natural resources (environmental protection authority unit) (Figure 14).

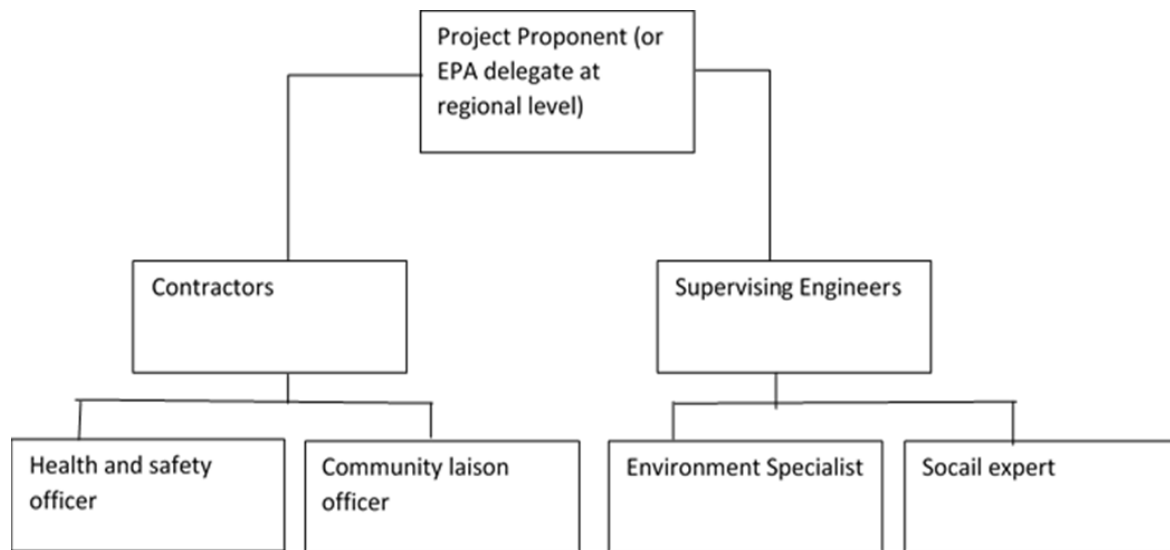


FIGURE 14: DIAGRAM SHOWING ORGANIZATIONAL STRUCTURE OF COMPLIANCE MONITORING

The main objective of the environmental monitoring plan is to ensure that the predicted outcome of the company is achieved. Primarily, its focus will be on the sustainable power production of the intended solar mini-grid plant and associated irrigation projects and protection of the humans and the environment from adverse detrimental effects. The overall objective of this EMP is to integrate environmental and social considerations into account to ensure the successful economic and social development of the project. The regular monitoring program will determine whenever changes or operations are required to reduce the negative impacts and enhance the beneficial ones. Therefore, conducting monitoring will be of paramount importance.

Effect (target) Monitoring: Periodical ambient air quality measurement should be conducted at solar panel installed areas and around irrigated farmlands and the quality of the water effluent should be monitored regularly for all critical parameters such as Biochemical Oxygen Demand (BOD), pH, Total Dissolved Solids (TDS), Total Suspended Solids), alkalinity, hardness, and turbidity. In addition, soil samples should be collected from irrigated farms and monitor changes in soil fertility. Shebedino Woreda Environmental protection office should periodically conduct its independent monitoring for compliance with national standards and the project proponent should also submit an annual compliance report indicating all the monitoring results to them.

TABLE 16: ENVIRONMENTAL MONITORING PLAN

| Parameters to be monitored | Mitigation Measures | Responsible for monitoring | Monitoring schedule | Monitoring indicators | ESM cost in ETH Birr |
|--|---|---|---|--|--|
| Contract management | Make sure the contractor has prepared ESMP for approval by the client | Proponent | Pre-construction and construction phases | Copy of the approved ESMP and implementation of it | Cost internal to developer to get approvals |
| Social support to vulnerable people | Job opportunities for project-affected people (loss land), Landowners should be compensated as per proclamation No. 1161/2019 | Proponent | Throughout operation phase | Check the amount of money paid out from finance | Supervision cost 5,000 birr |
| Employment opportunity | Hire workers from local people depending on their education preparedness and skill level | Proponent & Woreda | At the beginning and annually | Number of local workers from company human resource office | Supervision cost 2,000 |
| Solid waste | Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practice Any heaps of sand and concrete aggregates in the compound should be cleared to keep the area neat and clean | Proponent | Quarterly during construction and annually in operation Disposal of hazardous waste in compliance with waste management procedures | Annual site visit to determine if any hazardous waste is on site | Supervision cost 5,000 |
| Liquid waste | Storage areas for fuel and hazardous materials should be stored in a concrete floor with a bund for secondary containment and collection of spills The waste from sanitary and construction should be collected through channels in a reservoir and can be recycled for reuse during construction, and other purposes after proper filtering | Proponent | Beginning of construction and annually each year of Operation | Annual check that the necessary are in place Constructed plastered pond reservoir if required | Supervision cost 5,000k to be done in conjunction with above annual visit |
| Noise pollution | Noisy activities shall be scheduled to daytime hours personal protective equipment such as ear muffers/plugs will be used | Proponent in collaboration with Woreda Health experts | Weekly during the construction phase | Noise level should not exceed the World Bank standard (55dBA and 45 dBA during day and nighttime, respectively) | Cost for regular checking of noise level 5,000 |
| Air pollution | Workers assigned in the construction should wear dust masks. The supervisor should strictly follow and make sure this procedure is in place before starting their job. Water should be sprayed on all internal roads to minimize dust dispersion when necessary | Proponent collaboration with Woreda Health experts | Periodically during the construction and operation phase | Check air quality measurement, air emission shouldn't exceed WHO standards Supervise workers proper use of PPE's Complaints from the local governor, and community | Expert cost for regular check emission level 5,000 to be done together with noise checks |
| Loss of farm and grazing lands | Landowners should be compensated as per the new proclamation No. 1161/2019 before the construction activities start Provide priority for a job opportunity for those projects affected people (PAP) during construction and implementation phases | Proponent | Before commencement of construction work | Check the amount of money paid for PAP Contractor's personnel office documentation | No cost |

| Parameters to be monitored | Mitigation Measures | Responsible for monitoring | Monitoring schedule | Monitoring indicators | ESM cost in ETH Birr |
|---|--|---|--|---|---|
| Traffic accident | Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages) Mandatory speed limits not exceeding 40km per hour Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns) | Proponent collaboration with Woreda traffic police | Every three months at all phases of the project | Number of accidents on the site Speed limits put at appropriate places Erected traffic sign | Supervision cost 2000, to be done together with above checks |
| Sexually transmitted diseases like HIV | Health promotion: sensitization of both community and workforce Provision of materials useful for the prevention of HIV/AIDS Having in place appropriate signposts to educate the workforce and community about the Project's HIV policy | Proponent / Woreda health office | Every month during the construction and operation phase | Number of distributed condoms Check the number of trainings conducted | Training cost 100,000 |
| Covid 19 | Train workers to follow strictly Covid-19 prevention mechanisms Temperature measurement checkup each day at the gate of the compound Provision of materials necessary for prevention and detection of COVID 19 | Proponent in collaboration with Woreda health experts | Regularly during construction and operation | Number of infected people with covid 19 | Expense already included in construction and operations No cost to report # of cases |
| Occupational Health and safety | Use of appropriate PPE during installation and maintenance The solar mini-grid plant shall be equipped with a fire-fighting system Ensuring all electrical equipment and machinery are properly grounded | Proponent | Regularly during construction and operation | Total recordable incidence rates | For the provision of first aid a lump sum of 5,000 |
| Fire hazards | The solar mini-grid plant should be equipped with a fire-fighting system The technician should regularly inspect Solar PV components | Proponent | Every three months during the construction and operation phase | Number of incidents and reported cases | Part of project and operation cost |
| Impacts on historical, cultural heritage | Excavation work should be done carefully as per World Bank Guidelines - OP 4.11 and prepare chance find procedures | Contractor | During construction work | Number of discovered heritage sites or artifacts | Part of supervision cost |
| Total Minigrid Developer / Contractor Only | | | | | 34000 |
| Total other parties | | | | | 100000 |
| Total Monitoring | | | | | 134000 |

10. Conclusion and Recommendations

Conclusions

The main aim of the environmental and social impact study was to identify, predict and evaluate all the potential environmental and social impacts due to the proposed solar power plant project in Lelicho (Sidama region). The ESIA study is done with the overall intention of integrating environmental and social concerns into the projects' planning, design, construction, and operation stages.

Environmental and Social impacts have been identified for both components of the project (solar mini-grid) for the proposed project site. For all identified negative impacts, mitigation measures were provided and, in some cases, enhancements for positive impacts were also indicated in chapters (see chapters 7, 8, and 9).

A review of international safeguard standards reveals that the major policies triggered relate to Environmental and Social Assessment, labour and working conditions, community health and safety, information disclosure, and stakeholder engagement. Management measures have been proposed and most of these can be easily implemented with available local resources and national policy and legal provisions (e.g., proclamation 1161/2019).

Recommendations

As soon as the project proponent is identified, the project implementation schedule covering all project activities (e.g., solar panel installations, identification of command areas for irrigation, time, and modalities for compensation for land take) should be communicated ahead of time to the Woreda and Kebele administrations as well as to the potentially affected people. This should be done at least three months before the commencement of solar mini-grid and irrigation scheme installations.

To avoid any potential conflicts which might delay the project implementation, the potential developer/project proponent should work in tandem with Kebele administrators and local traditional leaders to establish committees in the project area to serve as grievance handling committees, which will serve as avenues for community members to channel grievances to the project proponent. The potential contractor should also prepare the grievance handling mechanism for the workforce during the construction phase, and this must be monitored by the client or any other responsible body.

Monitoring of impacts on the biophysical and social environment should be a continuous process throughout the construction and operation phases to get lessons for future planning of solar power plant and irrigation projects.

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Annexes

Annex 1: Consultation minutes

Aferomdo men o lilla asmaanni
Hafsa Wale (Hawooni) - (Edo) wati, Gortum
Wolfaate ministere ledo

Hafsa Wale beeffano:

- Dr. Dejelefn
- SWET Enbakhom
- Wubalen Mihret
-

Hafsa Wale fananni Dr. Dejelefn projectete
hedo beeffano xaxa'anni tiri projecte
Genetere xaxa'anni (orti) koroonidha'anno namni
Solarete (ortihote) Wolfa'anni koroonidha'anno
qete ofateeti

- manru ma' ba'ite fahio ollakko!
Kala' Betene Coriranni: Buna, weede, chaate,
Mobe, avo Gado, badala, Bahiraza'afe, Zeritooze,
Gati Shaanirriro: di Fili Poanene, Kaxoste,
famburuma, falka, ba'abul Maana, Sa'adate Ce'aa
wid'anni Wakuwa, Sa'ada, karte, mee lastidha'ano
ha'ikonna ollacha xaxa'oma 1A (tona'adole)
Genetere Peexthaa ofama'nshe ikkana
lawidha'ano ani 600M xaxa'ipni Peexthaa la'adu
Ani hoo'nsite fofa hoo'nsite'anno, xaxa'abb'aa
dina'ake, xaxa' hoo'nsite'anno wati anjanni shaxa'
mmo.
- Gorsu latittha ba'nsi'neo baatto idha'nniti
no'ne du'ushititoti?

4. marichi xibbanni amedome ofannino
manru

- foyifode, totifese, Sa'arbu xibbi, sukka
arete xibbi, wabu, sefelete onje xibbi
ba'awo Pele kulino shoni ofateetu Corir
ni, fofa'nshe kumate hoo'nsite'anno xaxa', amaru
5. hoo'nsite'anni dattitote manru mafek
ni ba'ate ofannone.

dafilfa, 1 ba'ate hoo'nsite'anno fofa'
anni ba'awo qiddanni dattitanni
fo dafuro no, fofa' yannaxo'nsi fofa'
sho'alamu Arfatihu Coriranni.
fo'nsite'anni (Sanitoshien'anna h'ipirete)

Edo amedome fofa'nsite'anni hoo'nsite'anno
fayimmate ba'awo Peexthaa in'itotanna xaxa'
ni t'waxo'nsi nookite. State Yennaxo'nsi amaru
ofa' ba'ate'anna fofa'awo fofa', UMU d'annone
ano w'annu d'annu fayimmate merer'eta
d'annu, fayimmate ofe'et'anno m'annu ba'awo
fo'nsite'anno, w'annu di ikkitino, 5 d'iti fofa'
annu noo ofa'nsi re'otanni fofa' on'annu.

7. fofa' amantooti h'itooti: Solare, m'abate
xi'p'eral fofa' m'abate h'adi'annu: Kala'aa
Te'fate m'abate Coriranni. fofa'nsi ofa'nsi nookite
k'at'anni di fofa' m'annu di fofa'nsi m'abate
ante ba'awo hoo'p'ino ofa'nsi ba'awo. 8. x'afite
Peexthaa k'onne m'annu fofa'nsi fofa'nsi hoo'
hoo'nsite'anno ba'ate'anni xaxa'ofa'. lawidha'ano
ani Elekitirika'ate m'abate fofa'nsi fofa'nsi
mmo.

Kala'aa m'abate UMU hoo'nsite'anno hoo'nsite'anno
ba'awo m'abate

Af'annu fofa'nsi
Kala'aa Waa'awo Coriranni fofa'nsi ba'awo m'abate
ba'awo m'abate ofannone di k'annu d'annu
hoo'nsite'anno m'abate hoo'nsite'anno. Ba'awo hoo'nsite'anno
Am'annu/af'itotanni fofa'nsi

Ba'abbe Af'annu Coriranni w'annu
fo'nsi, Wubalen uko ofa'nsi m'annu hoo'nsite'anno
fo'nsi m'annu (h'ip'anni) hoo'nsite'anno. fofa'nsi
m'annu ofa'nsi

9. xibbanni uko w'annu m'annu projectete ledo
amed'annu fofa'nsi hoo'nsite'anno (w'annu) fofa'
nsi?
- Ba'abbe Af'annu Coriranni 111/xibbu
Covid-19 ba'ate fayimmate hoo'nsite'anno ollacha
hoo'nsite'anno d'annu w'annu ofa'nsi m'annu
fofa'nsi fofa'nsi m'annu hoo'nsite'anno m'annu.

10. Af'annu ba'awo hoo'nsite'anno w'annu ba'awo
ch'awa ofa'nsi hoo'nsite'anno af'annu.

fofa'nsi fofa'nsi m'annu ba'awo,
fofa'nsi fofa'nsi fofa'nsi, fofa'nsi fofa'nsi
fofa'nsi fofa'nsi ba'awo hoo'nsite'anno
fofa'nsi fofa'nsi m'annu hoo'nsite'anno fofa'nsi
w'annu hoo'nsite'anno ba'awo.


11. Projectete'anne hoo'nsite'anno w'annu hoo'nsite'anno
ba'awo hoo'nsite'anno hoo'nsite'anno.
Kala'aa ba'awo Coriranni ba'ate'anni
ofa'nsi ba'awo ikkitino fofa'nsi fofa'nsi noo
ba'awo fofa'nsi ba'awo m'annu hoo'nsite'anno, ba'awo
di'annu fofa'nsi ofa'nsi hoo'nsite'anno
fo'nsi fofa'nsi.

12. fofa'nsi am'annu fofa'nsi hoo'nsite'anno

fanbooshhu beeffano

| T.K | Suma | kebele/olaa | ma'abate | Ma'abate |
|-----|-------------------|-------------|----------|------------|
| 1. | Lafese Lankano | Aferdomero | - | |
| 2. | Tefera Enfiso | Aferdomero | - | |
| 3. | Inbaqoomi shibir | Aferdomero | - | |
| 4. | Namo mude | - | - | |
| 5. | Choma Arfo | - | - | 098904529 |
| 6. | Waltu Ze'ude | - | - | 091348468 |
| 7. | Betene Mariso | - | - | 098238585 |
| 8. | Aitama Kee'hamo | - | - | 0926998304 |
| 9. | Urato Ucha | - | - | 092628695 |
| 10. | Nuka Naramo | - | - | 092178950 |
| 11. | Gaba'ala Gabb'ito | - | - | 0926604966 |
| 12. | Gosooma Shite | - | - | 091697117 |
| 13. | Tefaye m'abate | - | - | 0916234418 |
| 14. | Shenfa Bahola | - | - | 092592402 |
| 15. | Jawit Boshola | - | - | 0926617880 |
| 16. | Af'annu Chirko | - | - | |
| 17. | Shenfa Refasa | - | - | 0916407011 |
| 18. | Maw Mame'o | - | - | 092110621 |
| 19. | Tafeef Lolamo | - | - | 0916787249 |
| 20. | Betene Beta | - | - | |
| 21. | Alemu Arfeto | - | - | 0916156675 |
| 22. | Ernal sabatam | - | - | 0916039308 |
| 23. | Sirew Betene | - | - | |

Annex 2: Letters to Regional and local government offices



 የኢትዮጵያ ፌዴራላዊ ዲሞክራሲያዊ ሪፐብሊክ
 የውሃ፣ ንግድና ኃይል ሚኒስቴር
 The Federal Democratic Republic of Ethiopia
 Ministry of Water, Irrigation and Energy

ቁጥር: ወ/ቆ/የ/ደ/ቦ/ጋ/ጋ/ፊ/ፊ/15/74
 Ref. No:
 ቀን: 18 ጳጉሜ 2014
 Date:

ለግብር ማስተካከያ ወረቀት

ይህ ወረቀት የተዘጋጀው የውሃ ማስተካከያ ስርዓት ለማስፈጸም የሚያስፈልግ ሲሆን፣ ለሁሉም አካላት በደንበኞች ስም ለማስተካከል ይጠቀሳል።

| | |
|-------------------|------------|
| 1. አጠቃላይ ዋጋ | ወጪ ስጦታ |
| 2. አጠቃላይ የሥራ ወረቀት | የአጠቃላይ ስጦታ |
| 3. አጠቃላይ የሰው ኃይል | የአጠቃላይ ስጦታ |
| 4. አጠቃላይ የቤት | የአጠቃላይ ስጦታ |
| 5. አጠቃላይ የሥራ | የአጠቃላይ ስጦታ |
| 6. አጠቃላይ የሥራ | የአጠቃላይ ስጦታ |
| 7. አጠቃላይ የሥራ | የአጠቃላይ ስጦታ |
| 8. አጠቃላይ የሥራ | የአጠቃላይ ስጦታ |
| 9. አጠቃላይ የሥራ | የአጠቃላይ ስጦታ |

ለሁሉም አካላት የሚያስፈልግ ሆኖ የሚያገለግል ይሆናል።

- በደንበኞች ዘርፍ ላይ የሚገኙት ስም ይህ ወረቀት ላይ ተጽቦ ስም ላይ ማስተካከል ይገባል።
- በደንበኞች ዘርፍ ላይ የሚገኙት ስም ይህ ወረቀት ላይ ተጽቦ ስም ላይ ማስተካከል ይገባል።
- በደንበኞች ዘርፍ ላይ የሚገኙት ስም ይህ ወረቀት ላይ ተጽቦ ስም ላይ ማስተካከል ይገባል።
- በደንበኞች ዘርፍ ላይ የሚገኙት ስም ይህ ወረቀት ላይ ተጽቦ ስም ላይ ማስተካከል ይገባል።

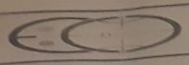
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 ግብር ማስተካከያ


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 ለ 011-661-72-22

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 አድራሻ: አድራሻ

Annex 3: Soil laboratory results

| | | | |
|--|--|---|--------------------------------|
|  | | Company Name: Ethiopian Construction Design & Supervision Works Corporation በኢትዮጵያ የኮንስትራክሽንና ስፔሻላይዥን ማራጃ ስርዓት | |
| Title: Soil Fertility Testing Report | | Document No: OF.ECDSWC.0921 | Issue No: 1 Page No: 1 of 1 |
| Client: Geoscience Consultancy PLC | | Client Ref: SF/049/2021 | |
| Project: Source of Sample: Lechicho (Sidama) | | Reported Date: 10/01/2022 | |
| Location: | | Date of Collection: | |
| Date Received: 09/12/2021 | | Test Requested: pH, H ₂ O, Exch. Bases, Av. P, Av. S, Micronutrients (Fe, Mn, Cu, Zn) | |
| Laboratory Number: 578/14 | | Test Method | |
| Profile Code: LS-1 | | Potentiometric | |
| Depth (m): 0.30 | | Ammonium Acetate Ext. and Instrumental | |
| pH-H ₂ O (1:2.5): 4.61 | | Olsen | |
| Exch. Na (meq/100 gm of soil): 1.20 | | KH ₂ PO ₄ Ext. Turbidimetric | |
| Exch. K (meq/100 gm of soil): 0.31 | | DTPA Ext. & Instrumental | |
| Exch. Ca (meq/100 gm of soil): 12.14 | | Olsen | |
| Exch. Mg (meq/100 gm of soil): 5.67 | | KH ₂ PO ₄ Ext. Turbidimetric | |
| Available Phosphorus (Av. P) (mg P ₂ O ₅ /kg soil): 85.03 | | Olsen | |
| Available Sulfur (Av. S) (mg/kg of soil): 108.55 | | KH ₂ PO ₄ Ext. Turbidimetric | |
| Micronutrients | | DTPA Ext. & Instrumental | |
| Fe (mg/kg soil): 56.99 | | Olsen | |
| Mn (mg/kg soil): 40.98 | | KH ₂ PO ₄ Ext. Turbidimetric | |
| Cu (mg/kg soil): 0.71 | | Olsen | |
| Zn (mg/kg soil): 2.01 | | KH ₂ PO ₄ Ext. Turbidimetric | |
| REMARK: The Soil sample is collected and submitted to the laboratory by the client. | | | |
| Reported by: Tseganesh K. [Signature] | | Checked by: Tseganesh K. [Signature] Senior Soil Expert | |
| Lab Expert | | Approved by: Getu D. [Signature] Soil Fertility Lab S/P Manager | |
| Among the major services rendered by the Soil Fertility Laboratory Testing S/Process of Ethiopian Construction Design & Supervision Works Corporation are: Testing Soil Fertility, Agricultural Soil Testing and Plant Analysis, Sampling of soil, etc | | | |
| Please make sure that this document is the correct version before use | | | |

Annex 4: Water Baseline Laboratory Test


ADDIS ENVIRONMENTAL SERVICES
WATER & WASTE WATER QUALITY TESTING LABORATORY
LABORATORY TEST REPORT

| | | | |
|------------------------------|-----------------------------|-------------------------------|-----------------------------|
| Client: | Geoscience Consultancy plc. | Lab Ref: | AES/LAB/21/193 |
| Location: | Region: Sidama. | Sample No: | 21/192-5 |
| | Zone/Town: Leku. | | |
| Project /Institution: | ESIA Study for irrigation. | Water use: | Domestic Use |
| Source of Water | River. | Sample Delivered on: | Oct 21/2021 |
| Sample point (Site): | L.W-2. | Test report issued on: | Oct 27/2021 |
| Sample Collected by: | Geoscience Consultancy plc. | Sample Delivered by: | Geoscience Consultancy plc. |


Test Description: Selected Physicochemical Tests

| No | Parameters | Unit | Value | WHO Maximum Allowable Concentration for Drinking |
|----|--|------------------------------------|------------|--|
| 1 | Odourless | - | Odourless | Unobjectionable |
| 2 | Colour | - | Colourless | Colourless |
| 3 | Turbidity | NTU | 34.08 | 5 |
| 4 | E. Conductivity | $\mu S/cm$ | 66.8 | 2000 |
| 5 | PH | Log 10 | 6.92 | 6.5-8.5 |
| 6 | TDS | Ppm | 33.5 | 1000 |
| 7 | Total Alkalinity | mg/l CaCO ₃ | 20 | 200 |
| 8 | Ammonium, NH ₄ | mg/l | 0.01 | 1.5 |
| 9 | Bicarbonate, HCO ₃ ⁻ | mg/l HCO ₃ ⁻ | 24.4 | - |
| 10 | Calcium, Ca | mg/l | 26 | 200 |
| 11 | Chloride, Cl ⁻ | mg/l | Nil | 250 |
| 12 | Carbonate | mg/l | Nil | - |
| 13 | Fluoride, F | mg/l | 0.22 | 1.5 |
| 14 | Magnesium, Mg | mg/l | Nil | 150 |
| 15 | Manganese, Mn | mg/l | 0.1 | 0.1 |
| 16 | Nitrate, NO ₃ | mg/l | 0.75 | 10 |
| 17 | Nitrite, NO ₂ | mg/l | 0.01 | 1 |
| 18 | Phosphate, PO ₄ | mg/l | 0.18 | - |
| 19 | Potassium, K | mg/l | 1.4 | - |
| 20 | Sodium, Na ⁺ | mg/l | 11 | 200 |
| 21 | Sulphate, SO ₄ | mg/l | 4 | 250 |
| 22 | Total hardness | mg/l CaCO ₃ | 10 | 300 |
| 23 | Total Iron, Fe | mg/l | 0.10 | 0.3 |

>> Turbidity Concentration exceeds WHO Maximum Allowable concentration for drinking water & not recommended for drinking purpose. Installed Appropriate water treatment is recommended to make water potable.

Test Performed by: Fasika Berhanu
 Checked by: Degnet Goshu
 Approved by: Dr Addis A. Zeleke

Signature: _____
 Signature: _____
 Signature: _____

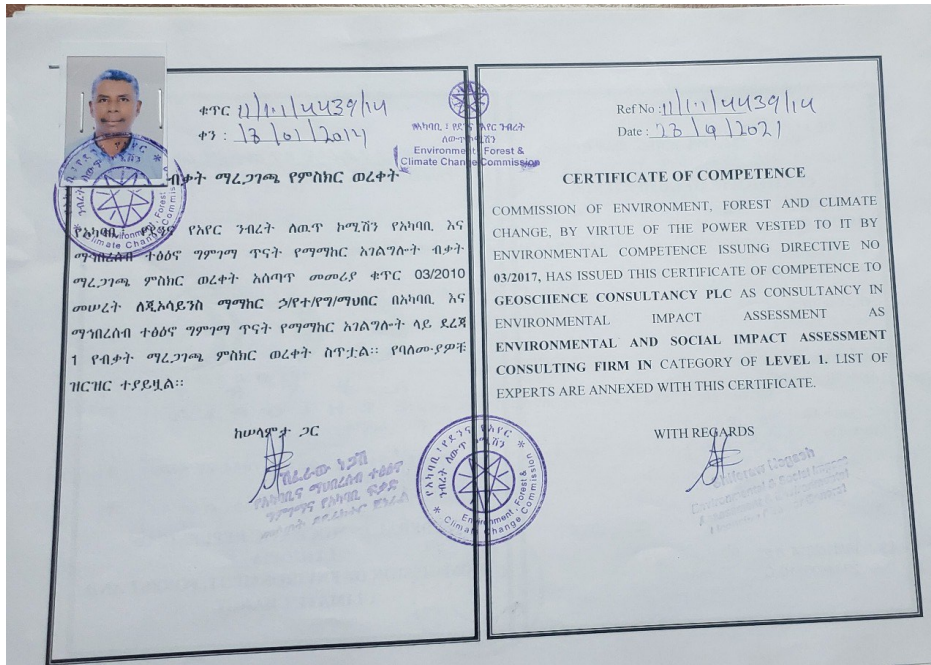


Page 1 of 1

Tel. 0115631773, 0935401532, 0911244918 Email: info@addisenvironmental.com, addisenvironmental@gmail.com
 www.addisenvironmental.com

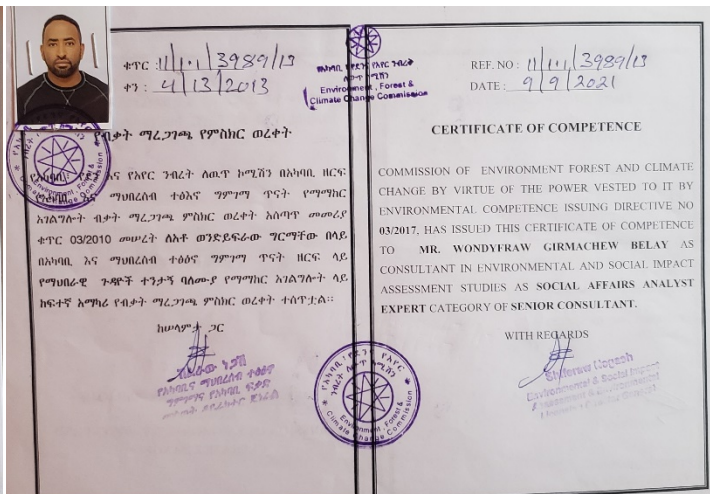
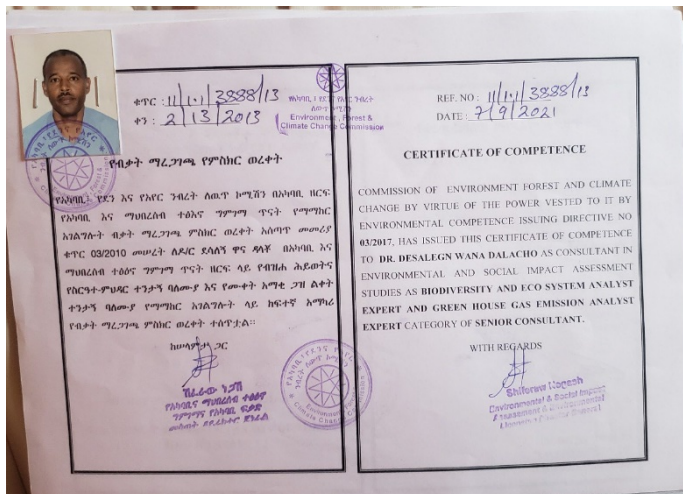
Annex 5: List of ESIA Competence certificates

Goescience PLC competence certificate

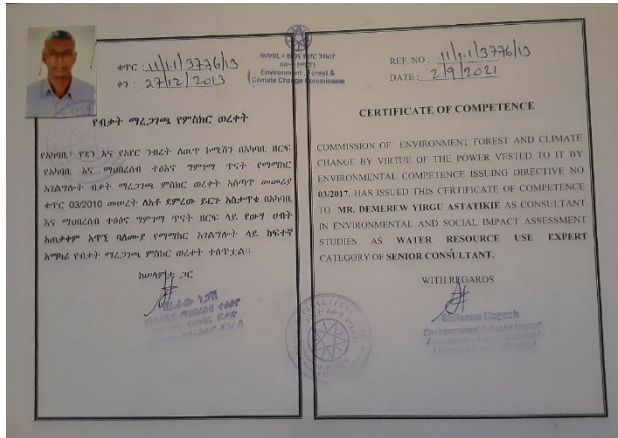


Dr Desalegn Wana, Senior Environmental Expert

Mr. Wondfraw Girmachew, Senior social expert



Demirew Yirgu, Senior Water use expert



MS Hanna Atsbeha, Pollution Expert

