

## **FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA**

Environmental and Social Impact Assessments for the Proposed Mini-Grid Solar Power Plant Project in Moko locality, Akaki Woreda, Oromia National Regional State

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# Executive summary

## 1. Introduction

Renewvia Solar Ethiopia Limited (RSEL) is a solar company newly incorporating in Ethiopia. RSEL intends to deploy Solar mini-grid solutions in Moko, Oromia in line with the DREAM projects described herein.

Renewvia Solar Ethiopia Limited is a subsidiary of Renewvia Energy Corporation, a global solar developer with its headquarter in Atlanta, Georgia, USA. African subsidiaries of REC currently operate 22 solar mini-grids in Kenya and Nigeria, with over 7 years' experience developing solar projects in East and West Africa. Expansion of the company to Ethiopia through RSEL will begin with 4 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 Moko site, in Dodota Chiri Kebele, Oromia special zone surrounding Finfine for mini-grid and irrigation systems development. The size of the mini-grid is currently estimated to be around 280 kW in Moko, but the final size will be confirmed by the mini-grid developer for the site. 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 September 2023 and supply electricity to households in the community and 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 Moko site in Oromia national regional state.

### 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 Moko site, Oromia 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, respectively; 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 & main activities

The project has two main components: mini-grid and irrigation systems.

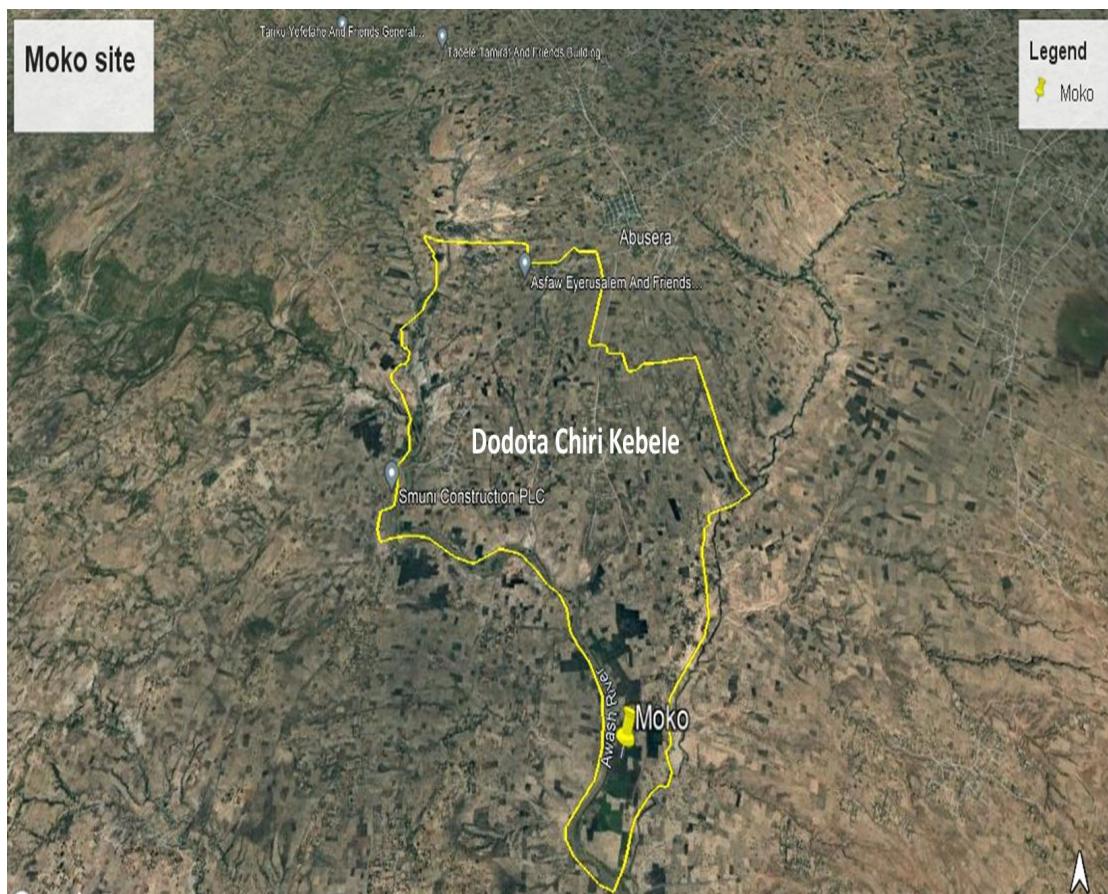
The mini-grid solar system includes the following components: a mounting system that will be used to mount PV modules on structures made of aluminum or hot-dip galvanized steel. While the mounted PV panel modules absorb the sun's rays as a source of energy to generate electricity, inverters will be used 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 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 Moko site is located at 8°35' N and 38°46' E. Administratively, it is found in Akaki Woreda, Oromia Special Zone Surrounding Finfine. The project site can be accessed from Dukem town a drive towards southwest through a 26 km gravel road.



Moko site map

### 4. Baseline conditions of the proposed Moko site

The Moko site experiences semi-arid climatic conditions due to its location in the Ethiopian Main Rift valley basin. The main rainy season begins in June and ends in October whereas the light rainy season (Belg) starts in March and ends in May, and these are interrupted by a dry season (November to February). The rainiest month is August whereas the driest month is in December. The average annual rainfall ranges in the area from 500mm to 800mm depending on the altitude while the annual average temperature ranges from 10-30°C in Akaki Woreda.

The region's geology is dominated by quaternary volcanic deposits, with tertiary volcanic rocks covering the escarpments and ridges surrounding the main Ethiopian rift valley, and alluvial lacustrine sediments found within it. Consequently, the geological formations are almost entirely volcanic in origin and include both basic (basalt) and acidic (rhyolite, ignimbrite, pumic, and ash) rock types. Specifically, the project area is underlain by pyroclastic rocks. At the Moko site, the rock exposure is limited since the surface is covered by thick soil overburden; however, it was possible to observe the lithological exposures along Awash River and other small streams. The soils at the Moko site thus originated from quaternary volcanic deposits with alluvial lacustrine sediments. The color of the soil ranges from light grey to dark-brown soil gradients due to soil topo-sequence. According to FOA (2007), the major soils in the project area are eutric fluvisols, pellic vertisols, and vertic cambisols. Eutric fluvisols develop on flat or nearly flat ground, on recent alluvial deposits. The ESIA team collected representative soil samples from the cultivated field to characterize important macronutrients and micronutrients in the soil. The soil had been analyzed in the laboratory of Ethiopian Construction and Design Supervision Works Corporation, in Addis Ababa. Accordingly, the soils of Moko site has a pH of 7.15 which is very ideal neutral medium for the concentration of essential plant nutrients under natural circumstances. The results also indicate that exchangeable cations such as Na, K, Ca and Mg are 0.009348meq/100g, 0.00954meq/100g, 0.26525meq/100g and 0.108689meq/100g, respectively. The concentration of exchangeable Na, K, Ca and Mg in the target area are very low for the healthy and productive growth of crops. As presented in Annex 5 the concentration of available phosphorus and sulfur in the soils were 252.41 mg/kg and 119.39mg/kg, respectively. Whereas the recommended av. P and S in the soils should be 1000mg/kg-5000mg/kg and 500 mg/kg -5000mg/kg, respectively. Moreover, the laboratory results indicate that the concentration of iron, Manganese, Copper, and Zink in the Moko area are 9.64mg/kg, 4.27mg/kg, 1.01mg/kg and 0.13mg/kg, respectively. Based on FAO classification, healthy and productive soils should contain 50-1000mg/kg iron (Fe), 20-200mg/kg Manganese (Mn) and 2-20mg/kg copper (Cu) and 10-100mg/kg zink (Zn). Therefore, the concentration of Fe, Mn, Cu and Zn in the target area is lower than the FAO recommended essential nutrients concentration in the soils

#### Results of Awash River water sample analysis

No	Parameters	Unit	Result (Moko)	WHO maximum limit
1	Electrical Conductivity	µS	175	2000
2	pH	Log 10	7.12	6.5-8.5
3	Total alkalinity	Mg/l CaCO <sub>3</sub>	55	200
4	Ammonium	Mg/l	0.01	1.5
5	Calcium	Mg/l	141	200
6	Chloride	Mg/l	7	250
7	Fluoride	Mg/l	0	1.5
8	Manganese	Mg/l	0.02	0.5
9	Nitrate	Mg/l	1.7	50
10	Sodium	Mg/l	29	200
11	Sulphate	Mg/l	Nil	250

Concerning the natural vegetation, the most common and dominant indigenous trees in Moko project area are *Vachellia* (acacia) species, *Ficus sur* (sholla), and *Ficus vasta* (warka) which are relicts of the former climax vegetation. But some other trees and shrubs were often seen in the project area which includes *Juniperus procera* and *Eucalyptus globulous*. Species of *Ficus vasta* are currently being used as ritual sites for Oromo Irrecha festivity. During their time at the site, the ESIA team did not observe any species which may have conservation concerns. Similarly, there was no evidence 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 finds 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.

Regarding 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 Labor 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 labor. Construction and decommissioning of mini-grid power plants facilities may temporarily attract a medium sized labor 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 include:

- Employment opportunities for skilled and non-skilled labor,
- 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 the clearing of dotted acacia trees in the matrix of farmlands and along the shore of Awash River for the solar mini-grid power plant installation, these remnants of climax species are currently serving as shade and agroforestry purposes for the local community. The risks of contamination of water and soil from the disposal of hazardous wastes (including PV panels) in Akaki and Awash Rivers could potentially be an adverse impact.

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, a temporary labor influx, especially during the 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 involved 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 Consultations

### Public Consultations

Name of participant	Issues raised	Response
Ato Awaso Babura (M)	Ato Awaso mentioned that previously they had discussed with some other groups (possibly the feasibility study team) about the mini-grid irrigation project. They agreed to find a suitable place for the project. However, they did not decide on the exact place because the place they selected may not be suitable for the installation of pumps. He underlined that this project is essential to improving the lives of their community and sustainable development for their children. He added again that they are poor people and thus could not pay for diesel pumps. Without irrigation, they could produce only once a year. But with irrigation, they can produce twice a year. Therefore, the commencement of this project will improve their livelihoods and their children's lives. We are very much eager to see the commencement of this project as soon as possible.	The ESIA team extended regards to the community's willingness and motivations for the realization of this project. The team also stated that they will discuss and select a place with the Kebele administration before the installation of solar panels for irrigation.
Ato Chala Hailu (M)	Ato Chala stated that when you (the ESIA team) disclosed the project, we are very happy and accept this with enthusiasm. We are eagerly awaiting the beginning of the project implementation since we heard about it. However, the project looks too late. The long delay in the project's implementation is quite frustrating. Although the project's implementation is too late, they expressed that they are still hopeful because of the coming of the ESIA team. He indicated that the farmers that are gathered here are not benefiting from the current irrigation scheme because of the lack of finance. So, they feel that they will benefit much from this new project. Therefore, they promised that they welcome the project joyfully and will cooperate on anything that the project needs from them.	The commencement of the project is delayed because of the procedures that are followed before the implementation of such projects. Since the project is funded by the African Development Bank and other financiers, all the legal frameworks and guidelines need to be followed. In addition, the final decision to implement it will be made by higher officials after the final evaluation of the ESIA and other technical and financial requirements.
Ato Alemayehu Degefa (M)	Ato Alemayehu stated that he was overjoyed at the arrival of the ESIA team. He said that foreigners and "other ESIA teams" had previously visited the site and communicated with us. But he said that they were frustrated because of the long delay. However, they are happy to see this team again after a long overdue. He reiterated that the community needs the project badly. He further noted that the community is ready to provide the space for the installation of solar power plants.	The ESIA team responded that the commencement of the project was delayed due to reasons stated earlier. The ESIA team is also hopeful that the project will be commenced as soon as it gets approval from the relevant Ethiopian authorities and potential financiers.



Name of participant	Issues raised	Response
Ato Abu Gurara (M)	Ato Abu expressed that the issues raised by Alemaye Degefa and Chala Hailu are sufficient. He also underscored the need to implement the project as soon as possible.	The ESIA team responded that they expect the project will be implemented soon in the Moko village.
Ato Tefera Yirbo (M)	Ato Tefera further noted that they have discussed this issue with 3 different teams. They also requested us whether we could be able to provide the space for solar power plant installations. We agreed back then and reaffirm it again. Hence, we are hopeful and see the implementation of the project	The ESIA appreciated Ato Tefera's view and expressed that the project will hopefully be commenced as soon as possible.
Ato Tire Awaso (M)	Ato Tire expressed his delight to see the coming of this team but advised to contact Kebele administration since the exact time for the installation of solar power plants is not known yet. If you inform them, the kebele administration will make the space free for the installation of solar panels and may provide a replacement plot to the farmers who concede the land. He also urged the quick implementation of the project and finally thanked the ESIA team for their effort to improve the livelihood of his community.	The team responded that the project would be commenced immediately after all requirements are fulfilled. They reminded the community that this public consultation may be the final stage of community consultation. The team accepted the suggestions to communicate with the Kebele administration concerning the selection of a site for the installation of the solar panel. Finally, the team thanked the community and the kebele chairperson for their warm reception and hospitality.

## 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 below reflect expected costs over the 20-year estimated lifetime of the minigrid project.

Phases	Category of Impacts	Identified Impacts	Mitigation measures	Responsible Body	Estimated cost
Construction	Biophysical Environment	Generation of solid Waste	<p>Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practices</p> <p>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 &amp; seed bag should be disposed of 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>Minigrad Contractor</p> <p>Very minimal amount of wastewater for Minigrad, very limited amount of fuel or hazardous material</p>	For construction of plastered pond and other storage structure is 60,000
		Soil erosion	<p>Avoid excavation during the rainy season</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	Noisy activities shall be scheduled to daytime hours	Minigrad Contractor	For purchasing PPE is 30,000 birr

		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 muffers/plugs should be used		
	<b>Air pollution</b>	Workers assigned in the construction should wear a 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	Minigrig Contractor	PPE included above, and water spray is 20,000 birr
<b>Human Environment</b>	<b>Public health</b>	Conduct public health awareness campaigns addressing issues of behavioral change, HIV/AIDS, etc.	community /woreda labour and women affairs office	Awareness-raising and training 25,000 birr
		Prepare training manual and conduct regular training about STDs Provision of materials useful for the prevention of HIV/AIDS	Minigrig Contractor	For internal half day training 15,000 birr
	<b>Covid 19</b>	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.	Minigrig Contractor /EHS unit of the project proponent	PPE cost included above
	<b>Gender-based violence/child labour</b>	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
	<b>Traffic accidents</b>	Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages) Mandatory speed limits not exceeding 30km per hour	Minigrig Contractor in collaboration with Woreda traffic police	Training cost for awareness creation for community and workers  20,000

			Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)		
		<b>Impacts on cultural, historical and archaeological site</b>	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	Minigrig Contractor supervised by Oromia regional state culture and tourism office	Supervision cost 20,000 birr
<b>Operation</b>	<b>Biophysical Environment</b>	<b>Liquid waste</b>	Construct a toilet inside the premise and collect sanitary waste and finally dispose it off at permitted area	Minigrig Developer	Septic tank is expected to be constructed during construction phase
		<b>Loss of farm and grazing land</b>	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	Minigrig Developer, Woreda Agriculture offices, Woreda administration	The cost will be estimated later by Woreda experts
	<b>Human Environment</b>	<b>Occupational health and safety</b>	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	Minigrig Developer	Estimated cost to purchase lifetime PPE is 60,000 birr
		<b>Fire hazards</b>	The solar PV plant should be equipped with proper fire extinguishers The technician should regularly inspect Solar PV components	Minigrig Developer	fire protection systems 40,000

		<b>Impacts on cultural, historical and archaeological site</b>	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 Oromia regional state culture and tourism office	No cost is implied
Decommissioning	Biophysical Environment	Generation of solid Waste	Hazardous waste, including broken PV panels, used batteries, shall be disposed of in accordance with best industrial practices	Minigridd Contractor and Irrigation Contractor	Waste disposal cost 150,000
		Air pollution	Workers assigned to the demolition should wear dust masks.  Spray water on demolishing areas	Minigridd Contractor and Irrigation Contractor	PPE purchase and water spray cost 40,000
	Human Environment	Loss of employment	Transfer permanent workers to other active projects  Pay compensation (severance) for permanent workers	Minigridd 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
<b>Total</b>					<b>670,000</b>

## 9. Environmental and Social Monitoring Plan

ESMP has been prepared for addressing all adverse impacts of the implementation of the mini grid projects. The ESMP presents in detail parameters to be monitored, their mitigation measures, institutional responsibility, and indicative budget. The proposed 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 and irrigation project. The Minigrid Developer, Minigrid Contractor, Irrigation Developer, Irrigation Contractor and all project employees 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 Protection Authority is the regulatory body responsible to review ESIA, monitoring, auditing, enforce and guide its implementation.

Parameters to be monitored	Mitigation measures	Responsible	Monitoring schedule	Monitoring indicators	Monitoring cost (Birr)
<b>Contract management</b>	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
<b>Social support to vulnerable people</b>	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	Check the amount of money paid out from finance	Supervision cost 5,000 birr
<b>Employment opportunity</b>	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
<b>Solid waste</b>	Hazardous waste, including broken PV panels or panels at the end of their use-life, 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	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
<b>Liquid waste</b>	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	proponent	Beginning of construction and annually each year of Operation	Annual check that the necessary are in place	Supervision cost 5,000k to be done in conjunction with above annual visit



	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			Constructed plastered pond/ reservoir if required  Amount of water recycled	
<b>Noise pollution</b>	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 the day and night times, respectively)	Cost for regular checking of noise level 5,000
<b>Air pollution</b>	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; and  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, community	Expert cost for regular check emission level 5,000 to be done together with noise checks
<b>Loss of farm and grazing lands</b>	Landowners should be compensated as per the new proclamation No. 1161/2019 before the construction activities started  Provide priority to 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 is implied
<b>Traffic accident</b>	Emphasizing safety aspects among drivers (putting up signposts and other precautionary messages)	Proponent in collaboration with Woreda traffic police	Every three months during construction, annually during operations	Number of accidents on the site	Supervision cost 2000, to be done together with above checks

	<p>Mandatory speed limits not exceeding 40km per hour</p> <p>Collaborating with local communities on education about traffic and pedestrian safety (e.g., school education campaigns)</p>			<p>Speed limits put at appropriate places</p> <p>Erected traffic sign</p>	
<b>Sexually transmitted diseases like HIV</b>	<p>Health promotion: sensitization of both community and workforce</p> <p>Provision of materials useful for the prevention of HIV/AIDS</p> <p>Having in place an appropriate signpost to educate the workforce and community about the Project's HIV policy</p>	Woreda health office	Every month during the construction and operation phase or as determined by the local health office	<p>Number of distributed condoms</p> <p>Check the number of trainings conducted</p>	Training cost 100,000
<b>Covid 19</b>	<p>Train workers to follow strictly Covid-19 prevention mechanisms</p> <p>Temperature measurement check-up each day at the gate of the compound</p> <p>Provision of materials necessary for prevention and detection of COVID 19</p>	Proponent in collaboration with Woreda health experts	Regularly during construction and operation	<p>Number of Covid-19 infected</p>	<p>Expense already included in construction and operations</p> <p>No cost to report # of cases</p>
<b>Occupational Health and safety</b>	<p>Use of appropriate PPE during installation and maintenance</p> <p>The solar PV plant shall be equipped with a fire-fighting system</p> <p>Ensuring all electrical equipment and machinery are properly grounded;</p>	Proponent	Regularly during construction and operation	Total recorded incidence rates	for provision of first aid a lump sum of 5,000
<b>Fire hazards</b>	<p>The solar PV plant should be equipped with a fire-fighting system</p> <p>The technician should regularly inspect Solar PV components</p>	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 prepared chance find procedures	Contractor	During construction work	Number of discovered heritage site or artifacts	Part of supervision cost
<b>Total Minigrad Developer / Contractor Only</b>					<b>34000</b>
<b>Total other parties</b>					<b>100000</b>
<b>Total Monitoring</b>					<b>134000</b>

### 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:

1. The community will be informed about the procedures in Afaan Oromo language. All information about grievance mechanisms will be available in public areas and with the community leaders.
2. 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, a brief description of the issue, proposed corrective actions, and date of response sent to the complainant.
3. All grievances will be registered and acknowledged within 6 working days and 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.

### Roles and responsibilities

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

### Cost

The estimated overall budget for the implementation of all environmental and social measures which includes the cost for ESMP and ESMMP, is 804,000 birr or ~15,000 USD (assuming 1 USD = 53.65 Birr).

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# 1. Introduction

## 1.1. Background of ESIA study

Ethiopia has shown remarkable 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 "Mini-grids powered by renewable energy directly address 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).

In view of this, a solar-powered mini-grid is favorably considered for a small-scale project in Oromia Region, Akaki Woreda at Moko locality. 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 projects. 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 impact enhancement and management options are also suggested.

## 1.2. Objectives of ESIA Study

The main objective of carrying out the Environmental and Social Impact Assessment for the proposed DREAM 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, the positive and negative 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
- Reviewing and accessing national and international policies, laws, standards, and guidelines.
- Assess and report on the likely magnitude and significance of the positive and negative impacts,
- Conduct stakeholders and community consultations
- Propose mitigation actions to reduce negative impacts and enhancement mechanisms for positive impacts
- Propose environmental and social management and monitoring plans for significant impacts

## **1.3. Approaches and Methods**

### **1.3.1. General**

The Environmental and Social Impact Assessment (ESIA) was conducted between August and September 2022. 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, feasibility study of the project, 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 project 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). Other related information which is available on internet free online is also reviewed.

### **1.3.3. Field Survey**

Field surveys and observations are critical to understand the likely impact of a given project on the environment. The ESIA study team conducted a field survey of the project site in August 2022. The team made observations in and around the project sites 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 done. 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**

Stakeholders and public consultations were conducted. To provide and gather information, discussion was conducted with stakeholders regarding the potential impacts and effects of the project. 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.

Concerned and related governmental offices were separately consulted. Official letter communications were submitted to all the concerned government offices and then key informant interviews or focus group discussions were conducted as appropriate. Public meetings and consultation with negatively vulnerable and positively influenced community members and social influences were made. The discussion was made with potentially directly or indirectly affected people as well as community leaders and representatives, church leaders, elders.

The local government administration at Akaki Woreda and other appropriate government offices (Agriculture, Health, Education, Water, Mines and Energy, Culture and Tourism, Small Scale and Microfinance were consulted to obtain their concerns and inputs for the success of the proposed project. Community consultations were conducted with local communities in the project site with Afaan Oromo language (following AfDB's requirement to conduct consultation in a language the communities are comfortable with).

The public consultation at the project site was made in two step approaches. The first was to have general community meetings targeting residents of the Moko community and the second is conducting interviews with community representatives such as community leaders and social influencers. During the disquisition consultation, the ESIA experts disclosed the aim of the project and presented project objectives the likely benefits, and adverse

impacts. Then, participant from the community were given the chance to elaborate their concern, fear, doubt and expectations regarding the project and likely social and environmental impacts that would likely happen during the construction and operation phases of the mini-grid solar power plant project.

#### **1.4. ESIA Report Structure**

The ESIA report is set into 11 chapters. Chapter 1 is an executive summary, while chapter 2 introduces the project's background, scope, and objectives. Chapter 3 discuss 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 are presented in chapter 4. In chapter 5, details of baseline environmental and social conditions of the proposed project areas are presented. Chapter 6 presents stakeholders and community consultation findings whereas potential environmental and social impacts of the proposed mini-grid solar power plant activities are presented in chapter 7. This is followed by discussions of project alternatives in chapter 8. Chapters 9 and 10 present the proposed ESMP and monitoring plans, respectively. In chapter 11, conclusions and recommendations, based on the findings of the ESIA study, are presented. Finally, references and annexes are provided at the end of the report.

#### **1.5. Limitations**

Some secondary data at Woreda and Kebele levels are not well organized, irregular, and incomplete. For instance, water quality and borehole yield and updated number of populations has some limitation. To rectify the constraints and limitations the study team conducted key informant interviews with concerned stakeholders and further key interview with selected community members.



## 2. Policy, Legal and Administrative Framework

This chapter provides an overview of the relevant legislation, policies, standards, and guidelines applicable to the proposed DREAM mini-grid solar power plant in Moko site, Oromia national regional state. 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 in 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.

Secondly, 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 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 Labor 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 an 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 servants shall not be a civil servant:

- a. Person under the age of 18 years
- b. Any person who has been convicted by a court of competent jurisdiction for offenses 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 the oath of fidelity per 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 the following.

#### **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 in order 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.

#### **2.2.9.6. FDRE, Pesticide Registration and Control Proclamation No.674 /2010**

The main purpose of this proclamation is to enact comprehensive legislation to regulate the manufacture, formulation, import, export, transport, storage, distribution, sale, use, and disposal of pesticides and other matters by laying down a scheme of control that would minimize the adverse effects that pesticide use might cause to human beings, animals, plants, and the environment. The detailed legislation of pesticides is presented in this proclamation under 37 articles. To mention some, article 14 of this proclamation states about pesticides registration and the Ministry 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 ads, etc.

Article 17 (pesticide import and export permit), in this article under No 1 and 5, it is stated that no person shall make any import and export of any pesticide without obtaining an import or export permit issued by the Ministry and under No. 3 (a) of this article, no pesticide consignment shall be imported if it has been manufactured six months from its date of entry into the country. The disposal rule of pesticides is articulated in Article 21 and No 1 of this article 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 labor 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 15<sup>th</sup> 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 these sites. 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 labor.

## 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.

## **2.6. Environmental Protection Authority of Ethiopia (EPA)**

The former Environment, Forest, and Climate Change Commission (EFCCC) is now renamed as Environmental Protection Authority (EPA). 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.

## **2.7. Regional Government Offices**

The regional governments 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:

### **2.7.1. Oromia Bureau of Agriculture and Natural Resources**

The Oromia Bureau of Agriculture and natural resources has a wide range of duties in improving agriculture activities in the Region. The most relevant to the proposed project include the following:

- Provides 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, Field sanitation, Land preparation, planting method, and Planting materials
- Provides agriculture information and extension services to the community and shall be giving similar support to the targeted farmers in the project
- Supports by training the full package and scaling up best practices to all farmers. For such cases, farmers training center (FTC) is mandated to train farmers on different agricultural technologies
- Administers the land resource of the region and prepare land use plan
- Encourages farmers to undertake crop protection to control crop damage or yield reduction caused by insects, diseases, weeds, and other destructive animals
- Follows the implementation of recommended fertilizer rates and time of fertilizer application for the proposed crops of this project

### **2.7.2. Oromia Bureau of Water, Irrigation, and Energy**

The bureau entitled to the power wide range of duties related to irrigation activities in the region, the most relevant

to the proposed activities include:

- Assign irrigation experts in the project area to advise and assist irrigation users
- Provide training for irrigation users for the wise use of the water resource
- Form and follow irrigation water user associations, the association will work on fair distribution of waters

### **2.7.3. The Oromia Environmental Protection Authority**

Oromia regional Authority of Environment acts as a regional environmental regulator (with its respective offices at lower levels) and is responsible for the following basic activities:

- Reviewing or evaluating the ESIA document prepared by the consultant of the proponent
- Based on the assessment results, setting the overall direction for the project's environmental performance
- Enforce and guide land compensation payment issues as per land proclamation and rules
- Regulate and follow up that any development shall conduct ESIA before the project implementation
- Undertake environmental auditing of establishments for the safe disposal and management of liquid and toxic wastes

### 3. Description of the Project Area

#### 3.1. Project Location

The proposed mini-grid solar and irrigation project is located south of Addis Ababa in Oromia National Regional State, Oromia Special Zone Surrounding Finfinne, Akaki Woreda, Dodota Chir Kebele at Moko locality. Akaki Woreda is bounded by Ada Woreda to the east, Liben Chukala Woreda to south, Addis Ababa to west and Gimbichu Woreda to the north and the project site is in the western and Southern parts of Akaki Woreda and Dodota Chir Kebele correspondingly. The Administration of Akaki Woreda is in Dukem town which is found at 30km to south of Addis Ababa. The project area can be accessed hardly using four-wheel drive vehicle during summer season. The project site can be accessed from Dukem town to southwest through 26 km poorly maintained gravelly road (Figure 1).



Figure 1 Location map for the project site

#### 3.2. Project Justification and Key Information

Mini-grid solar power plants have been proven 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). In the project area, farmers use diesel pumps to irrigate their farms from Awash River, however, the irrigation activities slowdown due to the rise of fuel price. 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. 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. Key project information

Particulars	Description
Project developer/owner	Will be identified later
Type of business	Renewable energy activities
Planned irrigable land	122 ha
Expected power generation	280kW
Location	Dodota Chir kebele, Akaki Wereda, Oromia Regional State
Manpower requirement during construction and operation phases	300
Project land area	
Solar PV modules installations	0.28ha
Total area required for project	0.336ha

### 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 aluminium or hot-dip galvanized steel. Footing design and type will be decided during design works
- **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.
- **HDPE (High Density Polyethylene) main line** will distribute water from river to lay flat hose



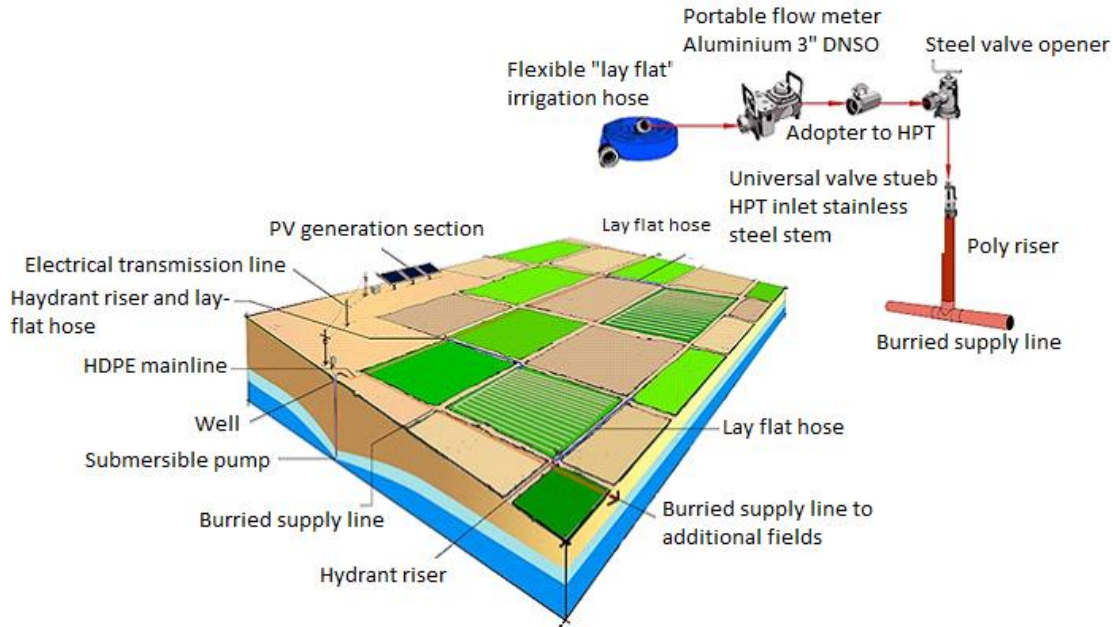


Figure 2 Irrigation scheme design

### 3.4. Civil works

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

### 3.5. Manpower Requirement

Installation of solar PVs, and installation of distribution grids are labor intensive during the short construction phase and are expected to hire 70 skilled and unskilled workers. However, during the implementation phase, manpower requirement is minimal; it is expected to create jobs 5-7 skilled manpower and about 6 unskilled labors. Similarly, during the decommissioning phase, about 5 to 6 skilled manpower and about 50 laborers are required to dismantle solar panels and other equipment's.

The non-skilled workers will be hired from the nearby community and some skilled manpower may come from other parts of the country and will rent a house in the nearby towns. Therefore, there is no need to construct a camp during construction or house for temporary workers. During the construction phase, construction machinery such as an excavator, dump trucks, a mixer, and rollers will be used.

### 3.6. Land Requirements

The land required for Solar PV modules installations is 0.28ha. The total area required, including internal roads, and light buildings are estimated to be 0.336 ha. The required land should be compensated or leased from government.

### 3.7. Implementation Schedule

The major activities are tentatively scheduled as follows:

- Construction and installation are expected to start in April 2023
- Construction and installation are expected to complete in October 2023.
- Distribution and operation expected to start in November 2023.

## 4. Baseline Information for the Proposed Project Areas

### 4.1. Physical and Biological Baseline Information

#### 4.1.1. Climate, temperature, and rainfall

The Moko site experiences semi-arid climatic conditions due to its location in Ethiopian Main Rift valley system. The main rainy season begins in June and ends in October whereas the light rainy season (Belg) starts in March and ends in May, and these two rainy seasons are interrupted by a dry season (November to February). The rainiest month is August whereas the lowest rainfall is observed in December. The average annual rainfall ranges in the area from 500mm to 800mm while the annual average temperature ranges from 10-30°C depending on the elevation in Akaki woreda. Field temperature measurement was conducted at Moko on 25/08/2022 at noon time and recorded as 25°C.

#### 4.1.2. Geology

The geology of the region is dominated by quaternary volcanic deposits, with tertiary volcanic rocks covering the escarpments and ridges that surround the main Ethiopian rift valley and alluvial lacustrine sediments found within it. Since the end of the Tertiary period, the Ethiopian Main Rift Valley has been the scene of intense volcanic activity and further minor faulting. Consequently, the geological formations are almost entirely volcanic in origin and include both basic (basalt) and acidic (rhyolite, ignimbrite, pumic and ash) rock types. Specifically, the project area is underlain by pyroclastic rocks. At Moko site, the rock exposure is limited since the surface is covered by thick soil overburden; however, it was possible to observe the lithological exposures along Awash River and other streams. The rock is light in colour, very porous, soft, loose, and friable (Figure 3).







Figure 3. Geological formation of the project area: pyroclastic (above) and vesicular basalt (below)

#### **4.1.3. Topography and Drainage**

Topographically Akaki Woreda is categorized into plateau, rugged and mountainous. The plateau, rugged and mountainous areas cover 56%, 36% and 8%, respectively. Mountains such as Yerer, Insilale, Guji, Boreta, Gerado, Bilbilo (covered by forest), Duffan, Loya, Dimtu, Gale and koftu are prominent in Akaki Woreda.

The project area (Moko) lies within the periphery of the main Ethiopian rift valley. Topographically, it is found in low-lying and flat parts of the rift valley (Figure 5) and is surrounded from its west by the volcanically formed chain of ridges. Elevation decreases from north to south and northeast to southwest direction. In the locality elevation varies from 1920m above mean sea level at north of Moko and 1800 meter above mean sea level at the project area (Figure 4). Thus, the water flows from northeast to the southwest and north to south direction. Akaki River joins Awash River at southeast side near to the project area. Awash, Dukem and Akai rivers are the main perennial rivers flowing through Akaka Woreda and these rivers are the main water and recharge areas for the project site (Figure 4).



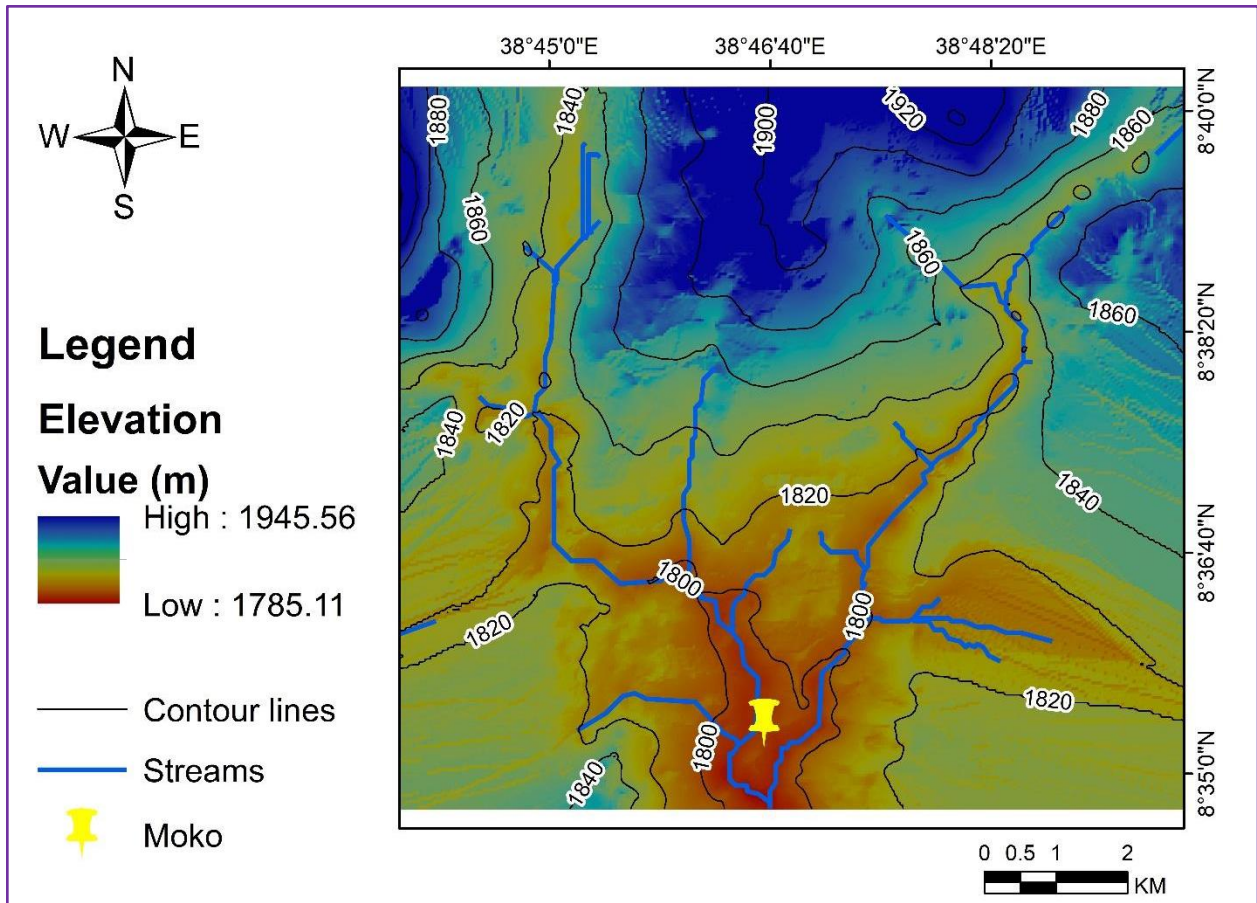


Figure 4. Elevation and stream network of the project site



Figure 5. Photo showing flat topography of the project area

#### 4.1.4. Soil

The soils at the Moko site originated from quaternary volcanic deposits with alluvial lacustrine sediments. As a result, the soils are the result of weathered rift-related pyroclastic flow and alluvial deposits. The color of the soil ranges from light grey to dark-brown soil gradients due to soil topo-sequence.

According to FOA (2007), the major soils in the project area are eutric fluvisols, pellic vertisols, and vertic cambisols (Figure 6). Eutric fluvisols develop on flat or nearly flat ground, on recent alluvial deposits. These soils are associated with fluvial (river) deposits. These are soils formed due to the deposition of eroded materials from the highlands. The deposition takes place in depressions, lower valleys, and lowlands. Fluvisols are found in the lower regions of rivers like Awash. Fluvisols are highly variable but highly prized for intensive agriculture because:

- They develop on flat ground (deposition sites),
- They are associated with rivers and groundwater which make them important for large-scale irrigation
- They are fertile and their fertility is always renewed because of the deposition of new soil materials

Pellic vertisols are heavy clay soils with a high proportion of swelling clay when wet and cracking when dry. These soils are extremely difficult to manage (hence easily degraded) but have very high natural chemical fertility. Pellic vertisols mostly develop on volcanic plateaus with basalt, trachyte, pyroclastic materials, sedimentary rocks, colluvial slopes, and alluvial plains. Vertic cambisols which cover the project area (Figure 5 & Figure 6) are characterized by the absence of a layer of accumulated clay, soluble salts, or iron and aluminum oxides. Vertic cambisols make good agricultural land and are intensively used in Ethiopia (Eyasu Elias, 2016).

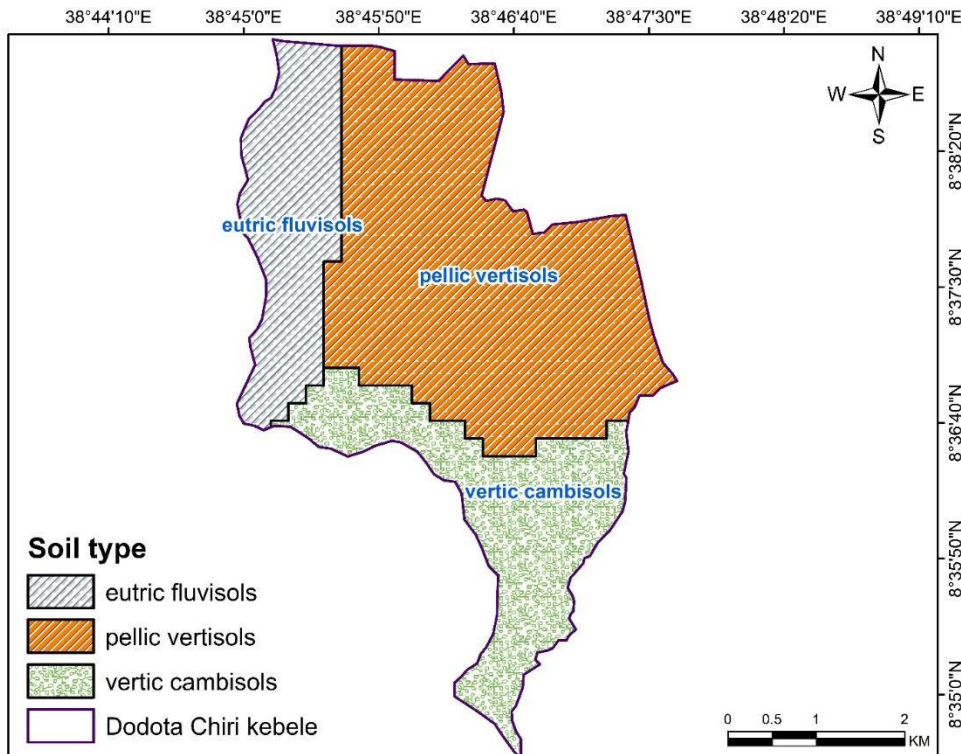


Figure 6 Soil distribution at and around the project site

The ESIA team had collected representative soil sample from cultivated field after digging 20-30cm depth to characterize important macronutrients and micronutrients in the soil. The soil has been analysed in the laboratory of Ethiopian Construction and Design Supervision Works Corporation, in Addis Ababa. The ESIA team has collected representative soil samples (20-40 Cm depth) from cultivated fields to characterize essential plant nutrients (macro-nutrients and micro-nutrients) in the soil. The soil samples were analysed in Ethiopian Construction and Design



Supervision Works Corporation Laboratory, in Addis Ababa (Annex 5). The soils of Moko site have a pH of 7.15 which is very ideal neutral medium for the concentration of essential plant nutrients under natural circumstances. The results also indicate that exchangeable cations such as Na, K, Ca and Mg are 0.009348meq/100g, 0.00954meq/100g, 0.26525meq/100g and 0.108689meq/100g, respectively. The content of these nutrients in the soil are classified by Food and Agricultural Organization (FAO, 2006) for the purpose of interpretation of exchangeable cation in the soil.

However, FAO cautioned the interpretation of these categorization of these nutrients should not be considered in isolation but in relation to other ions present, the rate of its movement to the plant roots which is determined by soil texture, soil moisture conditions, and nature of cations (FAO, 2006) and this classification is presented in Table 2 below. Compared with FOA classification, the concentration of exchangeable Na, K, Ca and Mg in the target area are very low for the healthy and productive growth of crops. As presented in annex 5 the concentration of available phosphorus and sulfur in the soil sample are 252.41 mg/kg and 119.39mg/kg respectively. Whereas the recommended av. P and S in the should be 1000mg/kg-5000mg/kg and 500mg/kg -5000mg/kg, respectively.

Moreover, the laboratory results indicate that the concentration of iron, Manganese, Copper, and Zink in the Moko area are 9.64mg/kg, 4.27mg/kg, 1.01mg/kg and 0.13mg/kg, respectively. Based on FAO classification, healthy and productive soils should contain 50-1000mg/kg iron (Fe), 20-200mg/kg Manganese (Mn) and 2-20mg/kg copper (Cu) and 10-100mg/kg zink (Zn). Therefore, the concentration of Fe, Mn, Cu and Zn in the target area is lower than the FAO recommended essential nutrients concentration in the soils.

Table 2 : FAO cation reference data for soils (2006)

Rating	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
Medium	5-10	1-3	0.3-0.6	0.-0.7
Low	2-5	0.3-1	0.2-0.3	0.-0.3
very low	<2	<0.3	<0.1	<0.1



Figure 7: Soil exposure in Moko area

#### 4.1.5. Flora

##### 4.1.5.1. Forests

Based on the information from agriculture office of Akaki Woreda and local people as well as expert field observation, there were no known reserved forest areas around this project. But bushes and trees are grown along

the cultivated and grazing lands. The most common and dominant indigenous trees in Moko project area are Vachellia (acacia) species, Ficus sur (sholla) and Ficus vasta (warka) which are relicts of the former climax vegetation (Figure 8). But some other trees and shrubs were rarely seen in the project area and include Juniperus procera and Eucalyptus globulous,

Based on the information from the forest and forest wildlife office of Akaki Woreda, the forest in the Woreda is owned by government, community and open access forest (Table 3). **Error! Reference source not found.**

Table 3: Forest distribution in Akaki Woreda

SNo	Title-holder	Area in hectare	Registered in hectare	Non-registered in hectare
1	Community forest	1588	1588	-
2	Government forest	3446	346	-
3	Open access forest	692.3	568.6	123.702
<b>Sum</b>		<b>4,138.3</b>	<b>3875</b>	<b>123.702</b>

Source: Forest and forest wild animals' office of Akaki Woreda



Figure 8: The common *Vachellia tortilis* (acacia tortilis ) left and *Ficus vasta* (warka) at the right

#### 4.1.5.2. Crops and vegetables

Based on the information obtained from agriculture office of Akaki Woreda, different crops are grown in the locality. Both rainfed and irrigation agriculture is practiced in the area. They have reported that over 8,844 hectares of farmland are covered each year by irrigation. The detail type of crops grown and their productivities in Akakai Woreda are presented in Table 4.

Table 4: Major crops by irrigation and their corresponding productivity and yields (2014 EC)

SNo	Major Crop	Area in hectare	Productivity in quintal /hectare	Total Production in quintal
1	Onion	4089	158.186	646825
2	Cabbage	3149	163.43	514641
3	Tomatoes	226	143	32318
4	Beet root	1899	140.3	266434
5	Carrot	460	143.5	66023
6	Potatoes	260	332.26	86388
7	Wheat	4634	73.54	340792

Source: Akaki Woreda Agricultural office

Table 5: Major crops by rainfed agriculture and corresponding productivity and yield (2014 EC)

SNo	Major Crop	Area in hectare	Productivity in quintal /hectare	Total Production in quintal
1	Wheat	11510	44.09	507486
2	Teff	12927	30.2	390414
3	Barely	179.5	36.69	6585
4	Maize	337.8	54.87	18533.4
5	Fabae Bean	976.1	25.8	25180.7
6	Field Bean	108	22	2376
7	Haricot Bean	93	27.57	2564
8	Chickpea	2964	34.4	101957.5
9	Lentil	963.5	23.48	22624.8



10	Mung pea	179	29	5191
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Source: Akaki Woreda Agricultural office

#### 4.1.6. Fauna

##### 4.1.6.1. Domestic animal

Livestock raising is an integral part of mixed farming systems Akaki Woreda Woreda. Livestock serve as draught power for farming (Oxen), sources of income, and transportation. The number and quantity of domestic animals in Akaki Woreda are presented in Table 6.

Table 6 : Variety and number of animals in Akaki Woreda

Woreda	Cattle	Sheep	Goat	Donkey	Horse	Mule	Hen
Akaki	81,479	35,479	30,606	25,528	2876	611	169966

Source: Akaki Woreda agricultural office

At the same time, farmers at Moko project site rear domestic animals such as cattle, goats, horses, donkeys, and chickens (Figure 9). As stated above livestock are an essential part of the farming system at Moko Site. Mules, horses, and donkeys are used for transportation. Small livestock such as sheep, goats, and chickens are raised as a source of food for either their families or for sell to generate household incomes. Crop residues and small private lands are the primary sources of feed for domestic animals at the site. The animal in the area is affected by diseases like bacterial, internal, and external parasite, Protozoa and other diseases. As reports from the Akaki woreda indicate, there are 8 veterinary D-type animal health care centers in the Woreda to treat these and other diseases.



Figure 9: Cattle at the project area

##### 4.1.6.2. Wild animals

The commonly known wild animals in Akaki Woreda are registered by forest and wildlife office of the Akaki Woreda. These include grey duiker, Antelope, hyena, Monkey, Fox, Rabbit, Colobus Monkey, Bushbuck, and birds such as pigeon, duck, and owls. There are no known endangered species of wild animals that will be affected by the implementation of solar powered irrigation project.

#### 4.1.7. Water Resource

The hydrogeological characteristic of a region affects the distribution and availability of water resources. The region has a good potential for ground water sources. In line with this, the main sources of water in Akaki Woreda for drinking and other purposes are mainly groundwater (Table 7 **Error! Reference source not found.**) but considerable number of people living in some kebeles including Dodota chir kebele (project site) are still using untreated river and pond water for drinking and other domestic purposes. According to the information obtained from Akaki Woreda water and energy development office, the existing potable drinking water coverage in the Akaki Woreda is 47% and serving over 40,000 people. Sources for drinking water in Akaki Woreda are deep well and shallow well, hand dug well and springs (please see Table 7 for details).

Despite the enormous potential of ground and surface water sources in the project site (Moko), there is shortage of potable water for drinking remains.

Table 7: Number of deep, shallow wells, hand dug wells and springs at Akaki Woreda

SNO	Water source	Functional	Non-Functional	Under construction	Ongoing project
1	Deep well	17	4	6	6
2	Shallow wells	5	-	-	-
3	Hand dug wells	40	-	-	-
4	Spring	8	-	-	-
	<b>Sub-total Total</b>	<b>70</b>	<b>4</b>	<b>6</b>	<b>6</b>

The existing water infrastructure is dilapidated due to lack of maintenance. Currently, the community depends on Awash River water for drinking. Some households transport clean drinking water from Abusera town (4 kms away). The occurrence of drought in 2015/2016 compelled some farmers to apply diesel pump irrigation. The Awash River and its tributaries (e.g. Akaki stream) serve as Moko's main irrigation water source. Most of the diesel pumped irrigation is applied during the dry season. However, households that use diesel pump irrigation are very small in number (only 20 households), and they reported that shortage of diesel was one of the challenges they face.

The ESIA team has also collected a representative water sample from project site (Awash River) on 28/08/2022. The sample was analyzed in Addis Environmental Services for Water and Wastewater Quality Testing Laboratory and the result is presented (Table 8 and Annex 4). As indicated in Table 8 and Annex 4, there is no concern of water pollution. Most of the parameters measured are within World Health Organization Maximum (WHO) allowable concentration for drinking purpose.

Table 8 : Selected parameters of water quality test result

No	Parameters	Unit	Result (Moko)	WHO maximum limit
1	Electrical Conductivity	µS	175	2000
2	pH	Log 10	7.12	6.5-8.5
3	Total alkalinity	Mg/l CaCO <sub>3</sub>	55	200
4	Ammonium	Mg/l	0.01	1.5
5	Calcium	Mg/l	141	200
6	Chloride	Mg/l	7	250
7	Fluoride	Mg/l	0.89	1.5
8	Manganese	Mg/l	0.02	0.5

9	Nitrate	Mg/l	1.7	50
10	Sodium	Mg/l	29	200
11	Sulphate	Mg/l	Nil	250

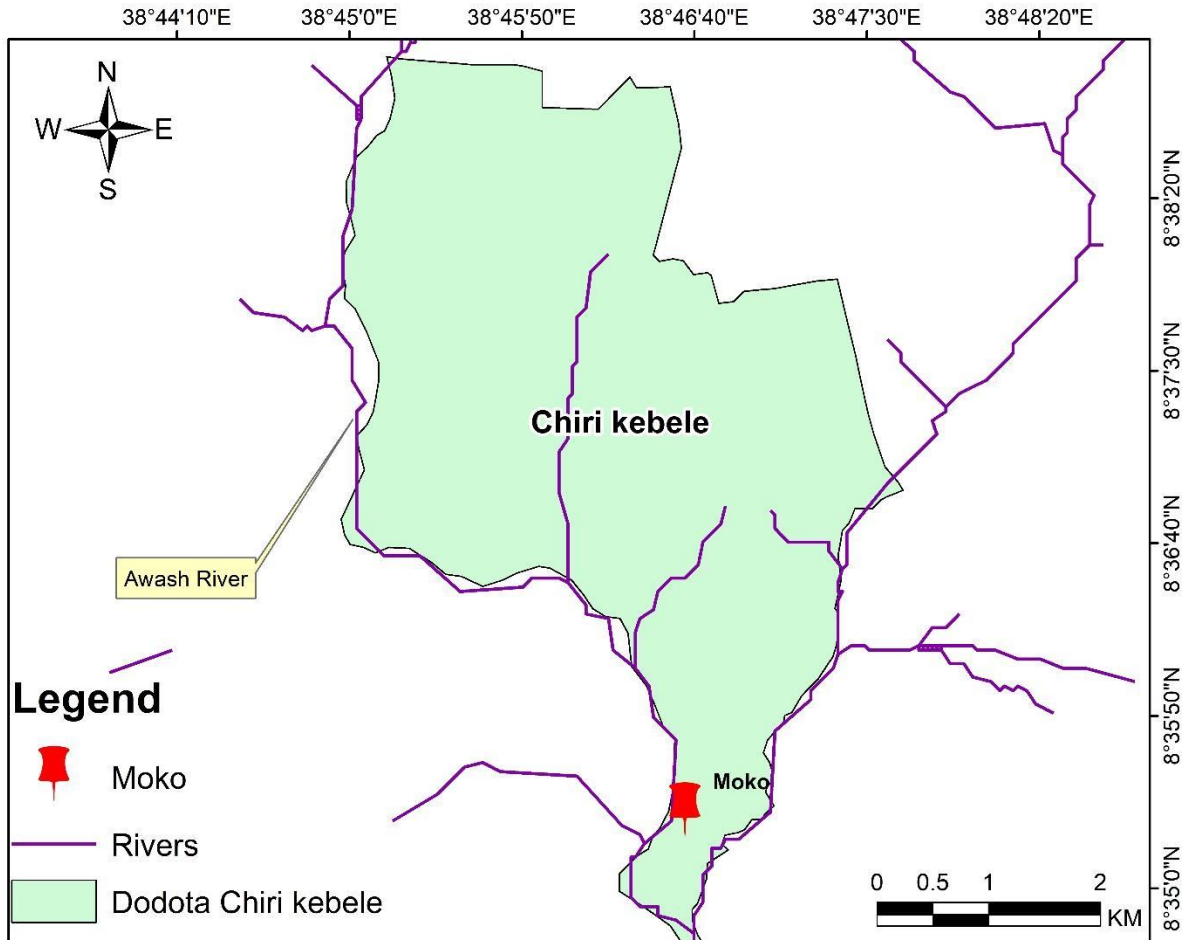


Figure 10 : Water resources in the project site





Figure 11 : Awash River flowing southeast direction, adjacent to irrigable land and main source of water for irrigation

**4.1.8. Air Quality Conditions**

Ambient air quality measurements are essential to describe the existing conditions, providing a baseline against which changes can be measured and help to determine the potential impacts of the proposed project on air quality conditions. There is an international standard for environmental air quality since air quality is the most vital concern for a healthy life. Accordingly, at Moko site, two locations were selected for air quality measurements: the settlement area (considered as sensitive receptors) and the actual project area (irrigation/farm area). **Error! Reference source not found.** presents air quality measurements in Moko. In this regard, air quality measurements indicate that particulate matters (Pm2.5 <0.03 ppm) is quite low and hence pollution is not of concern. Similarly the measurements were also conducted in the site and the value 55dB appears to be slightly high, probably due to sourcing of noise from Awash River.

Table 9: Air and noise quality measurements at Moko site

Table: Particulate matter measurements PM2.5 and PM10 Moko										
Site	UTM	Measurement points	Unit	PM2.5			Pm10			Date & time
				Min	Max	Avg	Min	Max	Avg	
Awash River	475323E 949871 N	Mk001	ppm	0.001	0.004	0.002	0.001	0.007	0.004	28/8/22 5:43AM
Dodota Kebele	475323E 949871 N	MK002	ppm	0.003	0.004	0.003	0.004	0.006	0.005	28/8/22 6:18AM

Table: Noises, temperature, and Co measurement results of Moko								
Site	Location UTM	Station	CO in ppm	Temp C <sup>o</sup>	Noise in dB			Date & time
					Max	Min	Avg.	
Awash river	475323E 949871 N	MK001	0	23			55.4	28/8/22 5:43AM
Dodota Kebele	475323E 949871 N	MK002	0	27			54	28/8/22 6:18AM

## 4.2. Socio-Economic Baseline Information

### 4.2.1. Population and economic activities

Based on information from Akaki Woreda administration the population of Akaki Woreda is 83,332 of which 41,999 are men and 41,333 are women. A small proportion of this population (8.57%) are urban residents. Akaki Woreda has a crude density of 217.07 per km<sup>2</sup> which is greater than the national average (115 per Km<sup>2</sup>).

The main source of livelihoods for the proposed Moko site is mixed farming. The major crops grown on the Moko site include onions, tomatoes, teff, wheat, potatoes, chilies, beetroot, maize, and beans. Without irrigation, farmers produce once a year since rainfall and subsequent soil moisture recharge is not sufficient to produce all year round. However, using diesel pump irrigation, farmers produce more than once a year. Farmers underscored that the lack of fertilizer, pesticides, and diesel are seriously affecting their crop productivity. In addition to crop production, farmers at the Moko project site rear domestic animals such as cattle, goats, horses, donkeys, and chickens. Cattles and lands (renting lands) are the main source of incomes for all households. However, the land is considered a huge and better asset that serves as a major source of livelihood. For example, some households are renting their land to youth and well-off farmers. However, landholding is not sufficient enough for some households. Another household asset on the site is an irrigation diesel pump. However, few farmers own diesel pump (20 households) and renting from them found to be very expensive.

### 4.2.2. Health Facilities

There are limited health infrastructure services in the Akaki Woreda compared to the catchment area population and widespread disease prevalence. Table 10 presents health infrastructure and service information for the Woreda where the proposed project site is located.

Table 10: Number of health organizations in Akaki Woreda

SN	Type of Health Facility	Akaki	Moko
1	Hospital	0	
2	Health centre	4	1
3	Health post	28	1
4	Clinics	2	1

5	Total	34	3
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In the project area there is one health post (Figure 12) which provides limited services. In terms of health, absence of well-trained health experts and shortage of medicines are the main problems in the project site. It was also noted that malaria occurs the project area often as outbreaks in some seasons.

The two most prevalent diseases in Akaka Woreda are Diarrhea and Pneumonia. These two diseases are the major causes of morbidity and mortality for many people in rural communities. Typhoid fever and Dyspepsia (inability to swallow) are also the second most prevalent diseases affecting the communities. The top 10 diseases in the Woreda in 2021/2022 is presented in **Error! Reference source not found..**

Table 11: Ten top diseases and number affected people in July 2021 to June 2022 in Akaki Woreda

SNo	Disease	No. Of Affected People
1	<i>Diarrhea</i>	5396
2	<i>Pneumonia</i>	2063
3	<i>Typhoid fever</i>	934
4	<i>Dyspepsia</i>	728
5	<i>Tonsillitis</i>	711
6	<i>Respiratory infections</i>	663
7	<i>Common cold</i>	587
8	<i>Persistent Diarrhea</i>	402
9	<i>Conjunctivitis</i>	372
10	<i>Amoebiasis</i>	368

Source: Akaki Woreda health office



Figure 12: Health post at Dodota chire Kebele use solar as source of energy

#### 4.2.3. Education

Education services are distributed unevenly in most parts of rural Ethiopia. This has also been observed in the site, we visited the Oromia region where towns and urban centers have better access to education services than rural areas. However, relatively the people in Akaki Woreda have fairly good access to education. There are a total of 52 schools of which 3 are high schools and 49 are primary schools and they serve about 15,843 students (Table 12). In Dodota Chir kebele where the project site is located, there is one first cycle (grade 1 to 4) and one primary school (grade 1 to 6) schools. Those schools have not enough teaching materials and teachers.

Table 12 : Number of schools, students and teachers in Akaki Woreda in July 2021 to June 2022

Students					
SN	Level of school	No. of school	No. student		
			Male	Female	Total
1	Prim (1-8)	49	8249	6043	14,292
2	Sec (9-12)	3	958	593	1551
Sub-Total		52	9,207	6636	15,843
Teachers					

1	Master's degree	5	0	5
2	Degree	163	48	211
3	Diploma	239	149	388
4	Certificate	2	3	5
Sub-total		409	200	609

The number of girls attending school is slowly declining due to various socio-economic and security challenges. In this regard, the school dropout and attrition rates are also higher among girls than boys.

Education quality and retention capacity have been compromised due to various factors such as:

- High students to teacher's ratio
- Shortages of funds for the school facilities
- Very old curriculum: that is not adapted to current situations and standards
- Teachers' competence and training (e.g., BSc graduates are not competent enough to handle courses for secondary grades).

#### 4.2.4. Electric Supply

In Akaki Woreda 11 kebeles have access electric city from the main grid. The local administration reported that energy source from Biogas is very limited (only 51 households use biogas energy). In addition, about 232 households has get energy from solar sources among these 60 households are from Dodota chire.

The Moko area has no access to electricity from the main grid lines. Almost all of households use traditional sources of energy for lighting and cooking purposes, mainly firewood, animal dung, and crop residues.

#### 4.2.5. Road Infrastructure

The Moko project site is connected to its capital town (Dukem) by a dry weather road (Figure 13). Farmers in Moko site complained that they had no quality road that connect them to the market center where they could purchase different materials and sell their agricultural products. The key informants underscored that due to poor road quality and a poor road network, most perishable agricultural products expire before being transported to the market centers.

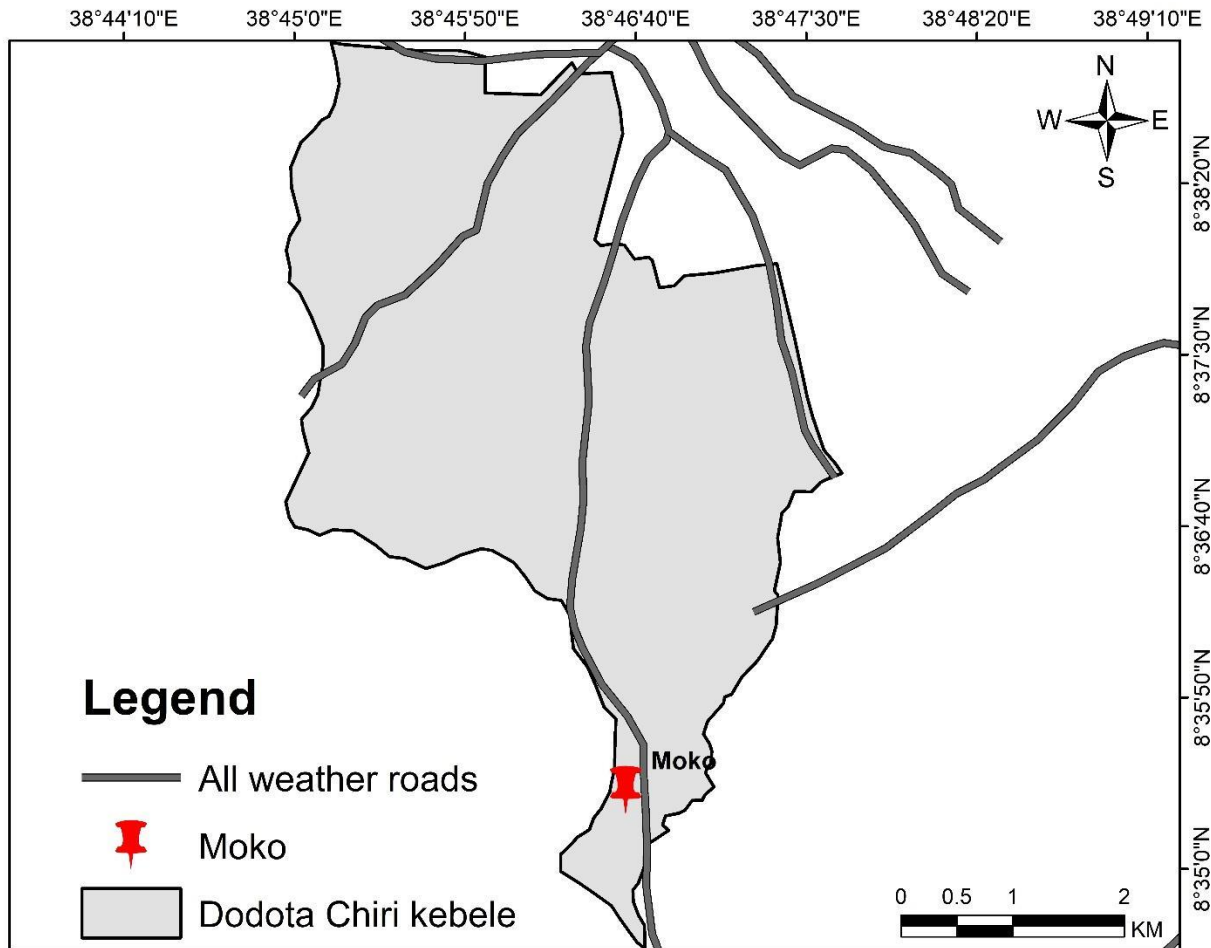


Figure 13: Road networks in the project site

#### 4.2.6. Utility Service

Mobile telephones and mobile data are available on the project site. However, banks, fuel stations, post offices, hotels, supermarkets, and other shopping services are not available at the project site. However, bank and shops are available at Abusera Kebele which is 4km far away from the project area.

#### 4.2.7. Cultural, religious, archaeological, tourism resources

There is a strong relationship between cultural, customary, and religious beliefs with implications for environmental management. There are no well-known heritage sites in the area. However, there are some waterfalls on the Awash River and species such as *Ficus vasta* on the Awash riverbank which are often considered as *Odda* in Oromo culture. The traditional religion followers' worship and celebrate the *Erecha* festival under the shadow of *Ficus Vasta*. Thus, project planning should consider such indigenous cultural practices. But, according to the information from the Woreda culture and tourism offices there are different tourism sites in different places (Table 13).

Table 13 : Tourist attraction areas in Akaki Woreda (2014 EC)

S/No		Distance from Woreda centre (km)	Locality (kebele)
1	GaraYerer	20	YererAbay
2	OdaNabe	8	OdaNebe
3	HalayaGete	25	GelanArabsa
4	Deke Kor	-	Hechu
5	ChefeTuma	-	Hechu
6	Holqa Aba Samuel	25	Aba Samuel
7	QiltuAtete	-	Aba Sera
8	OdaHyicha	-	Aba Sera
9	HolqgaraYerer	-	YereAbay
10	BishanHo-itu	34	Amuye Sera
11	A/lugna	-	A/lugna

Source: AkakiWoreda Culture and tourism office



## 5. Public Consultation and Grievance Redress Mechanism

### 5.1. Objectives of stakeholders and community consultations

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 and help contribute to improving the design and implementation of the project activities. In addition, public consultations will enable the project, proponent in close cooperation, 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
- **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 host communities. The team also undertook to consult with administrative stakeholders to identify their views on the proposed project and perceived impacts.

### 5.2. Stakeholders Mapping and Analysis

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

List of stakeholders consulted to date is included in the appendices section attached to this report. The input from stakeholders obtained during the ESIA has informed the identification of important issues and potential sensitivities that merit further stakeholder engagement (Table 14).

Table 14: Stakeholders identified, their roles and status of consultations

Stakeholder	Role and Interest/ influence	Status of consultation	Outcome
Oromia Region Agriculture and Natural Resource Bureau	Regional government	Letter sent, a meeting was conducted to introduce the project and project team.	Project disclosure was made, data and information were collected, letter prepared for Zone Agriculture and Natural Resource office



Stakeholder	Role and Interest/ influence	Status of consultation	Outcome
Finfine and Surrounding Finfine Zone Agriculture and Natural Resource Department	Local government	Letter sent from the Region and meeting was conducted to introduce the project and project team.	Project disclosure was made, data and information were collected, letter prepared for Woreda
Akaki Woreda Agriculture and Natural Resource Office	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, letter prepared for Kebele
Community from Moko villages	Host communities, all have an interest in power for irrigation, electricity for domestic consumption and some have an interest in new job opportunities	meetings were conducted to disclose the project to the community and to gather information from them	PAPs may be identified later when the exact location of the project is known, and the developer identified
Akaki Woreda Health, Education, planning, Water, and Mine and Energy Offices etc.	Local government	Project disclosure and data collection	Consultations were made and socio-economic baseline data were obtained
Akaki Woreda culture and Tourism office	Local governments	Meetings were conducted to disclose the project and to obtain data about any cultural, archaeological and tourist sites in the Woreda and proposed project area	Discussions were made, data were obtained regarding culture and tourism sites

### 5.3. Outcomes from Community and Major Institutional Stakeholders' Consultations

#### 5.3.1. Moko Communities

For community consultations, we conducted a public meeting including all the community members and social influencers (e.g., clergymen, elders) who could potentially affect or be affected by the proposed off-grid solar power plant in Moko site. During the public consultations, many people were happy to participate, and the enthusiasm could be seen from their turnover and composition both young and old farmers participated. During community consultations, women, elders, youth, and village representatives were present (Figure 14). The ESIA team has introduced itself and proceeded to disclose the proposed project, objectives and asked the community members to express their expectations and concerns. Then opened the floor for discussion, questions, and opinions. Accordingly, the following points were raised by the participants (Table 15).

**Date:** 26/08/22

**Place of meeting:** Moko village

**Number of participants:** Male (43) & female (20)

Table 15: Summary of community consultation

Name of participant	Issues raised	Response
Ato Awaso Babura (M)	Ato Awaso mentioned that previously they had discussed with the some other groups (possibly feasibility stydt team) about the mini-grid irrigation project. They agreed to find a suitable place for the project. However, they did not decide on the exact place because the place they selected may not be suitable for the installation of pumps. He underlined that this project is essential to improving the lives of their community and sustainable development for their children. He added again that they are poor people and thus could not pay for diesel pumps. Without irrigation, they could produce only once a year. But with irrigation, they can produce twice a year. Therefore, the commencement of this project will improve their livelihoods and their children's lives. We are very much eager to see the commencement of this project as soon as possible.	The ESIA team extended regards to the community's willingness and motivations for the realization of this project. The team also stated that they will discuss and select a place with the Kebele administration before the installation of solar panels for irrigation.
Ato Chala Hailu (M)	Ato Chala stated that when you (the ESIA team) disclosed the project, we are very happy and accept this with enthusiasm. We are eagerly awaiting the beginning of the project implementation since we heard about it. However, the project looks too late. The long delay in the project's implementation is quite frustrating. Although the project's implementation is too late, they expressed that they are still hopeful because of the coming of the ESIA team. He indicated that the farmers that are gathered here are not benefiting from the current irrigation scheme because of the lack of finance. So they feel that they will benefit much from this new project. Therefore, they promised that they welcome the project joyfully and will cooperate on anything that the project needs from them.	The commencement of the project is delayed because of the procedures that are followed before the implementation of such projects. Since the project is funded by the African Development Bank and other financiers, all the legal frameworks and guidelines need to be followed. In addition, the final decision to implement it will be made by higher officials after the final evaluation of the ESIA and other technical and financial requirements.
Ato Alemayehu Degefa (M)	Ato Alemayehu stated that he was overjoyed at the arrival of the ESIA team. He said that foreigners and "other ESIA teams" had previously visited the site and communicated with us. But he said that they were frustrated because of the long delay. However, they are happy to see this team again after a long overdue. He reiterated that the community needs the project badly. He further noted that the community is ready to provide the space for the installation of solar power plants.	The ESIA team responded that the commencement of the project was delayed due to reasons stated earlier. The ESIA team is also hopeful that the project will be commenced as soon as it gets the approval from the relevant Ethiopian authorities and potential financiers.
Ato Abu Gurara (M)	Ato Abu expressed that the issues raised by Alemaye Degefa and Chala Hailu are sufficient. He also underscored the need to implement the project as soon as possible.	The ESIA team responded that they expect the project will be implemented soon in the Moko village.

<p>Ato Tefera Yirbo (M)</p>	<p>Ato Tefera further noted that they have discussed this issue with 3 different teams. They also requested us whether we could be able to provide the space for solar power plant installations. We agreed back then and reaffirm it again. Hence we are hopeful and see the implementation of the project</p>	<p>The ESIA thanked Ato Tefera’s view and expressed that the project will hopefully be commenced as soon as possible.</p>
<p>Ato Tire Awaso (M)  Chiri kebele chairperson</p>	<p>Ato Tire expressed his delight to see the coming of this team but advised to contact Kebele administration since the exact time for the installation of solar power plants is not known yet. If you inform them, the kebele administration will make the space free for the installation of solar panels and may provide a replacement plot to the farmers who concede the land. He also urged the quick implementation of the project and finally thanked the ESIA team for their effort to improve the livelihood of his community.</p>	<p>The team responded that the project would be commenced immediately after all requirements are fulfilled. They reminded the community that this public consultation is the final stage of community consultation. The team accepted the suggestions to communicate with the Kebele administration concerning the selection of a site for the installation of the solar panel. Finally, the team thanked the community and the kebele chairperson for their warm reception and hospitality.</p>





Figure 14 :Local people participating in public consultation at the Moko site

## 6. Potential Environmental and Social Impact Identification and Significance

### 6.1. General

Environmental and social impact assessment (ESIA) aims to inform the process of decision making by identifying and addressing the potentially significant environmental, social, and economic risks of projects. ESIA predicts the environmental and social consequences that a future project/intervention might entail. ESIA is a comprehensive document of a project's potential environmental and social risks and impacts. It is conducted before a project is implemented and proposes measures to mitigate potential adverse impacts. It is a part of the planning process for the project that helps to mitigate the negative impacts and enhance the positive effects. Furthermore, ESIA provides information for decision-makers to improve planning and resource management and to minimize or avoid negative consequences. Therefore, the identified potential impacts of the proposed projects were categorized as biological, physical, and socio-economic. Based on the key activities of the projects, significant impacts, their likelihood, and severity levels were identified.

The impacts were identified based on:

- The main environmental and social resources and receptors from the baseline data collection from the project site
- Results of the stakeholders' and community consultations
- A literature review of the impacts of solar generation projects

In an environmental impact assessment (EIA), several factors are considered, including the land environment, water environment, air environment, noise environment, and socioeconomic environment.

### 6.2. Beneficial Impacts

#### 6.2.1. Environmental, Economic and Social Benefits

The following are some of the positive impacts of the project.

##### 6.2.1.1. Reduces Greenhouse Gases Emissions

The primary aim of this project is to provide electricity to the community for their irrigation pumps through mini-grid solar power plants. The project will have various positive impacts. Solar panels can be a vast source of power that can provide clean and sustainable electricity. The more energy that we can create with solar power the less fossil fuels we will be burning and the smaller amount of greenhouse gasses we will release into the atmosphere. The project will substantially replace the diesel pumps with electric pumps, which will reduce dependence on diesel and result in a reduction of greenhouse gas emissions into the atmosphere. Solar energy is an amazing way to reduce our greenhouse gas emissions and live greener lives. No greenhouse gases are released into the atmosphere when we produce electricity with solar panels. The only thing that's created is clean energy! Solar energy is also a renewable resource. If the sun is shining in the sky, the community will always have access to solar energy. So solar power is an unlimited energy source that will be there to meet the energy needs of the community. Community's current dependency on diesel pumps is putting a community in a compromising situation. Carbon emissions, floods, droughts, heatwaves are just a few of the environmental and climate issues the people are currently facing. However, as a renewable source of power, solar panel has an important role in reducing greenhouse gas emissions and mitigating climate change, which is critical to protecting humans, wildlife, and ecosystems.

##### 6.2.1.2. Protects the community from rising diesel prices

The price of diesel has increased steadily over the past 10 years. However, the cost of solar panel has continued to fall. The baseline information indicated that the farmers cannot afford diesel as it is costly, and its cost is also skyrocketing from time to time. One of the biggest benefits of solar panels is that they can provide a community with a substantial savings on their diesel bill. This will also encourage business owners to start up new businesses



including shops, groceries, and flour mills. Moreover, it improves the individual quality of life, facilities community services such as health (clinics can operate at night) and education (students can study at night-time).

After installation, solar technology requires low maintenance. Therefore, they are great for rural areas that are off the grid and can't be accessed easily and don't require as much manpower to maintain. The source of solar energy is free and is in great abundance. Which means that as long as there are discount schemes to help with the solar panel costs, they can also be a great help to people in areas that might not have access to electricity due to the lack of infrastructure to bring in electricity or fuel or a power plant. Finally, relying on fossil fuels can exacerbate many technical, political, and financial issues. Thus, the community can better safeguard themselves by collecting their own energy and not being dependent on others. Wars and natural disasters can also put a heavy strain on the existing fuel supplies, leading to very high prices. This makes solar power that much more of a cost-efficient solution.

#### **6.2.1.3. Increase in agricultural productivity**

The baseline information indicates that without irrigation, farmers produce only once a year because of the monomodal rainfall. In addition, the trends of crop productivity are decreasing due to the lack of fertilizer, pesticides, and diesel. Farmers who have diesel pumps underscored that the lack of diesel is seriously affecting their crop productivity. In addition, they travel a long distance to get fuel and its availability is often a challenge. Therefore, the planned project is expected to solve the problem of fuel shortages in the project area. It will provide and/or increase access to water for several farmers and can have substantial impact on agricultural yield and income. Thus, the establishment of solar panels will ensure sustainable agricultural productivity throughout the year, which will strengthen the food security of the community. Nowadays, farmers are dependent on imported fuel, and its cost has been rising over time. There will be a sustainable and diverse food supply throughout the year. Furthermore, the project will encourage crop diversification and provide opportunities to produce market-oriented or high-value horticultural crops for urban centres.

#### **6.2.1.4. 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. While the number of jobs is related to the size of the solar plant, these jobs in rural areas provide income for additional families and increase the use of local facilities – which would in turn help decrease the unemployment rate of the given area. Moreover, unemployed youths in the community will form associations and participate in irrigation activities.

#### **6.2.1.5. Electric supply for the nearby community**

Solar power plants can be used for a number of different purposes such as to generate electricity. As we have already mentioned, they can also be used to produce electricity in areas without access to an energy grid, solar farms, solar PV arrays and solar thermal heating systems. The community will benefit from the planned solar mini-grid plant since it will reduce their reliance on wood, charcoal, and diesel generators and give them access to a reliable and reasonably priced power supply. Thus, the project will reduce pressure on wood and crop residues. Consequently, the farmers will use crop residue for animal feed. The establishment of the solar mini-grid plant will facilitate agrobusiness and enable investors to start up new businesses such as shops, hotels, bars, restaurants, and flour mills. Furthermore, it will improve the residents' quality of life through the setup of community services such as health institutions (clinics, health centres, and hospitals) and education. As the residents can charge their mobile phones with the solar panel, it will improve the connectivity and communications of the community. In addition, the problems that diesel irrigation pump owners and flour mills face will be mitigated.

#### **6.2.1.6. Knowledge transfer**

The project will significantly contribute to the transfer of knowledge and abilities about the use of solar technology and the best irrigation farming techniques. The young people living in the project area will acquire knowledge and skills about solar mini-grid project development and operation. The irrigation users will be grouped into an irrigation users' cooperatives, which can support in the effective and efficient dissemination of information. People from other parts of the country will visit the project site and share the knowledge they acquire with their communities.

#### **6.2.1.7. Alternative source of energy**

Solar, water, geothermal, and wind energy are some of the renewable energy sources that Ethiopia has the capacity to produce in large quantities. While fossil fuels cannot be replenished, solar energy can. Solar energy is available to us as long as the sun is shining. Therefore, solar energy is a limitless source of energy that will be available to satisfy the energy needs of the community. Solar energy which is clean, environmentally friendly, and requires low-maintenance, is the alternative renewable energy source, especially for nations like Ethiopia that have a high annual solar irradiation rate. In addition, for Ethiopia's rural areas where people reside in dispersed settlements, mini-grid solar energy is the most preferable source of energy. Globally, solar photovoltaic (PV) technology is perhaps the most commonly used to generate electricity, especially in rural areas. In some rural areas of Ethiopia, people currently use solar energy for domestic purposes. During field observation in the project area, it was found that rural people use solar power for charging mobile phones and lighting their homes.

#### **6.2.1.8. Gender equality**

Depending on the gender roles in agriculture, irrigation interventions can also have an impact on the empowerment of women. Women may be relieved of water collection duties because of improved access to the water supply, allowing them to engage in other agricultural activities that generate income. If women have access to irrigation, the productivity of the plots they cultivate might increase.

### **6.3. Potential Adverse Impacts and Mitigation measures**

#### **6.3.1. Adverse impacts during pre-construction phase**

Forest areas and vegetation areas are avoided. Alignment in this project has avoided geologically unstable areas, which can also pose foundation-related problems. Before the commencement of construction, a feasibility study and an environmental and social impact assessment study were conducted. Baseline data collection and public consultation have been conducted at the project site. All the preconstruction activities do not have any substantial impact on the environment.

#### **6.3.2. Adverse impacts during construction**

The environmental impact during the construction phase is localized and of short-term magnitude and will be controlled through mitigation measures. The identified impacts are the following:

##### **6.3.2.1. Generation of solid waste**

The solid waste generated during the construction phase is mostly made up of damaged solar PV modules, extra concrete and cement, scrapped building materials, and packing and shipping supplies (pallets, boxes, Styrofoam, plastics, etc.). These modules can contain potentially hazardous materials and result in soil and water contamination. Other construction wastes include sand and aggregate heaps, bits and pieces of various pipe types, electrical materials, cans and bags of paint and plastering, packing materials, pieces of timber, scraps and pieces of metal sheet and iron bar (metals), and other items scattered throughout the project site. If the appropriate avoidance and mitigation measures are not put in place and implemented on time, these waste products have negative effects on the biophysical environment of the project area. In general, the generated solid waste will be minimized based on the designated practices for solid waste disposal. Solid waste disposal will be done as follows:

##### **Mitigation measure**

- To the greatest extent practicable, the excavated material will be recycled for site levelling and filling tasks.
- Broken PV panels and other hazardous trash will be disposed of in accordance with industry best practices.
- The scrap metal waste generated from the erection of structures and related construction activities will be collected and stored separately in a stack yard and sold to local recyclers. Until the recycled materials are sold and the unwanted materials are taken to a designated disposal place, the waste will be kept in a storage container.
- Wastes will be kept in a dedicated storage container until the recycled materials are sold and the unwanted materials are transported to a designated disposal site. Food waste and recyclables, viz. paper, plastic, glass,



etc., will be properly segregated and stored in designated waste bins/containers. The recyclables will be periodically sold to local recyclers, while food waste will be disposed of through waste handling practices.

- To keep the compound tidy and clean, any piles of sand or concrete materials should be removed properly.

#### **6.3.2.2. Generation of liquid waste**

Liquid waste from machinery, grease, and gasoline left in the garage by the vehicles are anticipated to harm the environment during the construction phase. The construction personnel would be housed in temporary settlements. These settlements would discharge a considerable amount of domestic waste. Stagnant pools of water would increase the breeding of mosquitoes and generally create insanitary conditions. In addition, it is anticipated that water waste from sprinklers and concrete rationing will rise. Additionally, the unintentional discharge of additional hazardous substances from tools employed in the solar panel installation procedure would probably result in the creation of liquid waste. If these wastes are not effectively handled and reduced, they can seep into the soil, damage plants, contaminate surface and subsurface water, destroy natural habitats, and result in a loss of biodiversity (particularly for microbes and small invertebrates). In addition, pollution of surface and groundwater sources will occur due to the ongoing spill and seepage into the earth. Consequently, the health and wellness of people in the project command area and elsewhere will be adversely affected. Hence, the following mitigation measures are suggested.

#### **Mitigation measure**

- After proper filtering and treatment, wastewater from sanitary and construction works should be collected through a channel in a plastered pond or reservoir and recycled for construction, green area, and other purposes.
- Storage areas for fuel and hazardous materials should be roofed and have a concrete floor with a bund for secondary containment and collection of spills.
- The contractor will provide a soak pit with a depth of 2 meters to dispose of liquid waste so that such water does not form stagnant pools.

To address potential impacts on water quality, disinfected latrines (e.g., through regular liming) will be used as the main component of the sanitation system.

The wastewater will be blocked before discharge to prevent solids from building up in the existing drains.

#### **6.3.2.3. Soil erosion**

Cutting and filling the ground is required during construction. A substantial amount of soil volume will be excavated for the foundation of the solar mounting and levelling site. The construction activities result in the loss of vegetation cover and topsoil in the plant area. The construction activities that affect the soil are the mounting of the PV modules, construction of internal roads, and so on. The soil will become more susceptible to wind and water erosion due to the removal of the vegetation cover. However, since the site's plain topography and the relatively limited earthworks required for solar PV installations, these effects can be controlled by using excellent international industry practice during construction.

#### **Mitigation measure**

- Topsoil will be put aside and reserved. In addition, heaving the excavated soil in the selected area and reusing it to fill undulating areas is essential.
- Avoid excavation during the rainy season. Completion of excavation and foundation work in limited time schedule would also reduce / minimize the chances of soil erosion.
- Before construction can begin, drainage measures will be put in place to lessen flash floods and storm water runoff.
- To minimize such impacts, appropriate soil erosion control measures would be undertaken

#### **6.3.2.4. Noise pollution**

The major noise generating sources during the construction phase are vehicular traffic and construction equipment like dozers, excavators, scrapers, concrete mixers, cranes, generators, pumps, compressors, rock drills, pneumatic tools, vibrators, dump trucks, and so on. This noise may disturb workers on the project and the nearby community. However, the construction noise will last for a short period and is not expected to cause a significant nuisance to the public.

#### **Mitigation measure**

- Noisy activities shall be scheduled to daytime hours
- To minimize the impact on nearby communities, construction schedules have been optimized and vehicular traffic will be routed away from the nearest settlement.
- The noise level is substantially lower near the plant boundary due to attenuation caused over the distance. Overall, the impact of generated noise on the environment during the construction period is insignificant, reversible, and localized in nature.
- The work will be done in rotation and work time will be reduced for workers to reduce their exposure to noise by moving away from the source of noise by restricting area and shutting or turning off noisy equipment or machinery when not needed.
- In instances where workers will be exposed to elevated sound levels, personal protective equipment (PPE) such as ear muffs or plugs will be used.
- Noise levels at sensitive receptors will be measured regularly and whenever complaints arise

#### **6.3.2.5. Air pollution**

The proposed project is a solar PV project, so the impact during construction is expected to be minimal. Particulate matter in the form of dust would be the predominant pollutant affecting the air quality during the construction phase. Dust generation will be generated mainly during excavation, back-filling, and hauling operations along with transportation activities. The main source of gaseous emissions during the construction phase is the movement of equipment and vehicles at the site. Equipment deployed during the construction phase is also likely to result in a marginal increase in the levels of SO<sub>2</sub>, NO<sub>x</sub>, and particulate matter. The impact is reversible, marginal and temporary in nature. 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. Mainly, 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.

#### **Mitigation measures**

- Workers assigned in the construction machinery operation should wear a dust mask and the supervisor should strictly follow and make sure this procedure is in place before starting their job.
- Covering stockpiles and sprinkling water during excavation will greatly reduce dust emissions. Water will be sprayed on all internal roads to minimize dust dispersion when necessary.

#### **6.3.2.6. Impact on public health**

The influx of workers may contribute to a breakdown in social fabrics, norms, and practices, including sexual behavior. Many workers, both male and female, are expected to be involved in the different stages of the construction activities as envisaged in the project feasibility study. Workers may have opportunities for interaction within themselves or with others along the way, which could result in behavioral changes that could result in the transmission of contagious diseases such as HIV/AIDS and other STIs. Such incidences may further strain rural health infrastructure and cause community health concerns. In addition, ponds and stored water may result in malaria risks and other diseases such as bilharzia.

## **Mitigation measures**

Prevention will be the key intervention measure and therefore sensitization and awareness measures on HIV/AIDS should be carried out on a regular basis among workers and the host community during the construction phase in the following ways:

- Conduct public health campaigns addressing issues of behavioral change, HIV/AIDS, etc.
- Putting in place appropriate signage to educate the workforce and community about the project's HIV policy. In addition, the provision of materials useful for the prevention of HIV/AIDS is essential.
- Conducting a malaria awareness-raising campaign, using mosquito bite prevention methods such as mosquito nets.
- Avoiding drinking contaminated water (raising communities' awareness to boil and drink water) to reduce bilharzia infection.

### **6.3.2.7. Impact on occupational health and safety**

Project activities could impact the health and safety of the work force and of the public, in particular, in terms of the risk of accidents and exposure to electromagnetic fields along the alignment. The accidents may be caused by electro-cutting, lightning, fires, and explosions. Solar PV installation involves a high number of workers from other parts of the region.

## **Mitigation measure**

- Necessary training regarding safety aspects for the personnel working on the line will be provided by the contractor.
- Personal protective equipment like safety gloves, helmets, harnesses, goggles, and mufflers will be provided during the construction period and during the maintenance work

### **6.3.2.8. Impacts on fauna and flora**

The site development work would not lead to any substantial loss of important species or ecosystems. However, 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. During construction, reptiles on the project site may temporarily relocate to adjacent areas. During the baseline study, it was observed that the project site was selected for being agricultural land and sparsely vegetated areas.

## **Mitigation measures:**

- Reserving *Ficus vasta* and *Ficus sur* species, which are found on the cultivated land.
- 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 on the project site at any times and in all circumstances

### **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 within the surrounding communities.

## **Mitigation measures:**

- A body temperature check-up will be conducted daily at the gate of the compound.
- They should clean their hands with soap and water, or sanitizers, at any necessary moment.
- They should keep a safe distance (2 meters) from anyone who is coughing or sneezing

- They keep a proper physical distance from others (2 meters) and always wear a mask and avoid handshakes or other physical contact
- They do not touch their eyes, nose, or mouth
- They must wear face masks and cough or sneeze into their elbows
- They must stay at home if you feel unwell
- If they have a fever, a cough, and difficulty breathing, they will seek the doctor on time.
- Workers shall strictly keep the COVID-19 prevention protocols

#### **6.3.2.10. Traffic accident**

There is a lack of community awareness about the traffic system. The installation of PV panels systems may cause traffic accidents while they are being built. Large pumps, drilling equipment, and the logistics surrounding them could increase the number of accidents. Therefore, it is anticipated that accidents will rise during the building phase unless traffic safety is promoted among workers and the community.

##### **Mitigation measures:**

- Putting up safety aspects among drivers (putting up signposts and other precautionary messages).
- Collaborating with local communities on education about traffic and pedestrian safety.
- Speed limits of no more than 30 km/h are mandatory
- Landscape change and visual impacts

The generally flat topography may change during the construction phase due to excavation and levelling. Moreover, the excavated materials and residuals of the building debris inside the site and vicinity could have an aesthetic impact.

##### **Mitigation measures:**

- Using the excavated soil for backfill during the site restoration phase
- Finally, construction leftover materials must be properly stored and cleared

#### **6.3.2.11. 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 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 which will likely result in gender-based violence and sexual exploitation risks for females.

##### **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 females require.

#### **6.3.2.12. Child labour abuse**

In most parts of Ethiopia including project site, the culture encourages children to work to develop work skills. Children are considered as assets to generate income. Therefore, children should be given work at home in early life and are obliged to assist parents in the farming activities. During the construction phase, children may be involved in construction activities as labourers and running errands. These activities will likely results in students' dropout and high attrition rate. In addition, children may be exposed to the accidents and other injuries.

**Mitigation measures:**

- Continuous monitoring of contractor's compliance in accordance with the national labour laws and AfDB's OS5

**6.3.3. Adverse Impact during Operational or Implementation Phase****6.3.3.1. Impacts on biophysical 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 releases 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 that have reached the end of their useful life, as well as other potentially hazardous waste generated during the operation phase, must be disposed of using best industry practices.

**6.3.3.1.2. Soil erosion**

The proposed solar mini-grid plants at the site have flat-lying topography and the expected soil erosion during the operation phase is very minimal. However, there is 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 and for environmental protection.

**Mitigation measures**

- Terracing, slope reduction, runoff velocity limitation, and the installation of appropriate drainage should be incorporated into the site management plan to limit soil erosion.
- Plant trees in areas exposed to flooding.

**6.3.3.1.3. Water contamination**

The cleaning of solar PV modules will result in a negligible wastewater discharge. Moreover, the expected potential source of water pollution is from the permanent workers (e.g., guards, technicians) facilities. Therefore, sources from these facilities may generate sanitary effluents. The farmers in the project area have a tendency to utilize agricultural inputs like herbicides, pesticides, and fertilizers to enhance crop productivity.

**Mitigation measures**

- The wastewater emanating from cleaning operations shall be recycled for plantation and greenbelt development around the plant.
- Providing regular training to the farmers about the removal of weeds in environmentally friendly systems, such as timely manual weeding,
- Using crop varieties, crop rotation, and intercropping to reduce the use of chemicals.
- Spraying of chemicals will be performed during favorable weather conditions only (it should not be done in windy or rainy conditions). Besides, it should be conducted by trained personnel.
- Encouraging the farmers to utilize more organic fertilizers (compost, manure, and crop residues) than inorganic fertilizers.
- Terracing, reforestation, and construction of check dams at the mouths of gullies.

#### **6.3.3.1.4. Over-abstraction**

Currently, the farmers use diesel pumps, and the cost of fuel makes it challenging to extract more water from the source. However, once the solar PV systems are installed, there will be no more cost per unit of power, and this will enable farmers to extract more water. This can lead to wasteful water usage, over-abstraction, and low field application efficiency. The problem will be more aggravated due to current extreme climatic events such as the drought.

#### **Mitigation measures**

- Creating awareness and providing basic training for farmers about efficient water utilization
- Advising farmers to efficiently utilize the water and avoid flooding during sprinkling or dripping

#### **6.3.3.1.5. Impacts on biodiversity (flora and fauna)**

The planned solar PV installation areas are sparsely covered with *Ficus vasta* and *Ficus sur*.

#### **Mitigation measures**

- Reserving the trees on the cropland and replanting them.
- Working in collaboration with the stakeholders concerning the reduction of population pressure on natural vegetation

### **6.3.3.2. Impacts on the socio-economic environment**

#### **6.3.3.2.1. Loss of plots of land**

Use of private land for constructing towers will cause the private landowner to lose a small portion of land. Although the implementation of the irrigation project has several benefits for most of the local communities, the construction of the solar PV will occupy a significant amount of land, not more than 0.5 hectares per site. Therefore, land-take will result in the permanent loss of cropland. During the public consultation, the community agreed to hand over land for solar panel installation if compensation is to be paid based on proclamation No. 1161/2019. The site, after completion of its development, would consist of built structures, landscaped to give a pleasing outlook.

#### **Mitigation measures**

- Following the construction phase, the temporarily modified land use pattern, such as the construction of temporary tents to accommodate some construction personnel, will be totally removed during the operation stage.
- Land released from the construction activities would be put to economic and aesthetic use to hasten recovery from adverse impacts.
- Landowners will be compensated as per the new proclamation No. 1161/2019 before the construction activities start.
- Providing job opportunity priority for those projects' affected people (PAP) during construction and implementation phases.

#### **6.3.3.2.2. Noise pollution**

Both the solar PV facilities and the irrigation activities emit minor sound pollution. Thus, the noise impact will be insignificant and may not need mitigation measures.

#### **6.3.3.2.3. Air pollution**

Baseline data field measurements were conducted for particulate matter and carbon monoxide in the field. Though we measured CO at a different time, the result didn't exceed 0 ppm. The proposed plant operation would not significantly affect the air quality, as the solar project is a greenfield project and there are no gaseous emissions during the operation phase of the proposed project. Thus, 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.

#### **6.3.3.2.4. Generation of liquid waste**

The cleaning of solar PV modules will produce a little waste as possible. However, the major source of liquid waste emanates from sanitary waste from restrooms.

##### **Mitigation measures**

- The wastewater generated by cleaning operations will be recycled and used to develop plantations and greenbelts around the plant.
- constructing a septic tank on-site, collecting sanitary waste, and finally disposing of it in a permitted area

#### **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 will be exposed to electric shock, burns, and body damage as they undertake routine operations and maintenance tasks.

##### **Mitigation measures**

- Electric shocks must be minimized through the installation of security fences around substations, the installation of warning signs, and careful design using appropriate technologies
- Using appropriate PPE during installation and maintenance
- The solar mini-grid plant will 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. The influx of labor 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. In addition, it is expected that a disproportionate percentage of the labor force will be comprised of the young population at their sexually active age, hence exposure to STDs (e.g., HIV) would be expected.

##### **Mitigation measures:**

- Health promotion: sensitization of both the community and the workforce
- Providing materials which are essential to prevent and detect COVID 19
- Providing materials which are necessary to prevent HIV/AIDS
- Creating awareness for the workforce and community about the project's HIV policy and project COVID management and prevention policies

#### **6.3.3.2.7. Fire hazards**

There could be different activities that may lead to a fire outbreak during the operation phase. In particular, poor handling of solar PV components like AC and DC converters, transformers and electricity systems, faulty electrical equipment, and carelessness are some of the probable causes of a fire outbreak. The impacts may be substantial, which will result in total damage that could permanently affect the project or may result in loss of property and life.

##### **Mitigation measures**

- Equipping solar mini-grid plants with a fire-fighting system.
- Inspecting the status of the solar PV components regularly by technicians

#### **6.3.3.2.8. Impacts on tourism and cultural heritage**

As indicated in the baseline information, there are no known historical or cultural heritage resources at the proposed project site except *Ficus vasta* species.

##### **Mitigation measures**

- Preserving these historical tree species

#### **6.3.3.2.9. Child labour abuse**

The Ethiopian culture encourages children to work to develop farming skills. In most rural parts of Ethiopia, children are considered an asset to generate income in the farming system. Therefore, children are encouraged and obliged to assist their parents in farming activities. Consequently, during the operation phase, the minigrid 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**

- Providing training for families not to participate with children underage

### **6.3.4. Impact During Decommission Phase**

A solar PV plant is expected to have an economic life span of 25 to 30 years (National Renewable Energy Laboratory, 2012). Once the power generation life ends, it is compulsory to avoid the solar modules and all associated equipment and facilities to return the affected area to the natural environment.

#### **6.3.4.1. Air pollution**

The disassembling 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**

- Decommissioning workers should wear dust masks
- Spraying 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, and demolished civil structures. 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's lifetime.

##### **Mitigation measures**

- Separating recyclable materials and selling them to interested purchasers.
- Hazardous waste will be dumped in specified, protected disposal sites.

#### **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**

- Transferring permanent workers to other active projects' sites.
- Paying compensation to 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 only people who will be affected by the increased noise level will most likely be those involved in decommissioning activities.

#### Mitigation measures

- The increased noise levels are considered occupational noises and 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-based violence (GBV) and the spread of communicable diseases like HIV, COVID-19, and so on. Similarly, the participation of child labour will be unlikely since the number of workers required for the decommissioning phase is very limited.

### 6.3.5. Significance of Impacts

A key component of an ESIA process is the significance analysis and identification of impacts. Impact identification, prediction, and evaluation are involved. It involves impact identification, prediction, and evaluation. The most possible potential impacts associated with this project were identified using professional exposure to similar projects, collected baseline data, and professional judgments. Based on these factors, the identified impacts of the project 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 16 and Table 17.

The factors that were considered in determining the likelihood and nature of the consequences are briefly discussed in Table 17. The spatial and temporal extent of the natural resource carrying capacity and possible environmental sustainability because of the impacts of the identified parameters were determined. Based on these factors, the most possible impacts of the project on the biophysical and socio-economic conditions of the project area were assessed.

Table 16: Impact significance evaluation criteria

S.No	Criteria	Impact rating	Description
1	The 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 they will temporarily or permanently cease.

S.No	Criteria	Impact rating	Description
3	Nature	Permanent	When the effect is long-lasting
		Temporary	When the effect is for a short period of time

Table 17 Potential Environmental and Social Impacts Evaluations

Table ...S.No	Main Identified Potential Impacts	Type		Reversibility		Impact Extent		Nature		Magnitude	Significance
		Beneficial	Adverse	Reversible	Irreversible	Local	Trans-Region	Temporary	Permanent		
<b>I.</b>	<b>Potential positive impacts</b>										
1	Reduces Greenhouse Gases Emissions	x		x		x	x	x	X	Very low	Very low
2	Protects the community from rising diesel prices	x		x		x	x		X	Very High	Very High
3	Increase in agricultural productivity	x		x		x	x		X	Medium	Medium
4	Employment opportunity	x		x		x		x	X	Medium	Medium
5	Electric supply for the nearby community	x		x		x			X	High	High
6	Knowledge transfer	x		x		x	x		X	Medium	Medium
7	Alternative source of energy	x		x		x		x	X	Medium	Medium
<b>8</b>	Gender equality	x		x		x			X	Low	Low
<b>a. Construction Phase Impacts</b>											

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 public health		X	x		x		x		Medium	Medium
5	Workplace Accidents		X	x		x		x		Medium	Medium
6	Covid 19		X	x		x	x	x		High	High
7	Soil erosion		X	x		x		x		Medium	Medium
8	Traffic Accident		X	x		x		x		Medium	Medium
9	Landscape change and visual impacts		X	x		x		x		Medium	Medium
10	GBV		X		X	x			x	High	High
11	Child labor abuse		X		X	x			x	High	High
<b>b. Operation Phase Impacts</b>											
1	Air emission/pollution		X	x		x			x	Low	Low
2	Noise pollution		X	x		x			x	Very low	Very low
3	Over abstraction		X	x		x			x	Medium	Medium
4	Siltation		X	x		x			x	Low	Low
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
<b>C. Decommission phase impact</b>											
1	Pollution		X		x	x			x	Low	Low
2	Loss of employment		X		x	x			x	Low	Low

## 7. Project Alternatives

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

- **No project alternative:** This is the “No action or does nothing option” which 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 that will be gained from a modern irrigation system. The community will be dependent on wood and cow dung for their energy source, and this will intensify deforestation. If the solar project cannot be implemented, the price of fuel for their pump and flour mill will be more costly to the community and gases from diesel pump create localized pollution. In addition, the major benefits like increasing agricultural products and income of the people from the project will be lost. Moreover, it contradicts the interest of the people in the project, as well as the socio-economic development, and need of the nation by using the available water resources (see water management policy). As a result, this option was not found to be feasible.
- **Other sources of power (Hydro, Fuel, Wind):** The site is far from the main electric line, and it will be more costly to get power from the main grid. The site is not favorable for generating power from wind due to location topography. Currently, some farmers are using fuel for their pump & flour mill, but the cost of fuel increases from time to time (50 to 55 birr per liter) and is not economical to proceed with further irrigation activities. Environmentally, it is not advisable to use fuel for the pump. The ESIA team measured carbon monoxide (CO) at the field while the pump worked with fuel and read 56 ppm at the Moko site whereas in the absence of pump/ideal time the measurement is 0 ppm.
- **Project location alternative:** The study teams have analysed other site alternatives, based on topography, hydrology, available irrigable land, soil, and biological and socioeconomic parameters. Moko site is located adjacent to Awash River, which is the most source of water for irrigation in Ethiopia main rift valley. The community practicing irrigation activities in the project area suffers from the high price of fuel for their pump, to alleviate this problem and due to the presence of plenty of water and irrigable lands, made the selected site more favorable. In addition to supplying energy to irrigation pumps, it is planned to supply electricity for Moko village for domestic use and also for other service-giving organizations like schools, and health posts. All the selected areas are currently not getting electricity from the main grid; therefore, it is a good opportunity for communities to implement this solar mini-grid power plant.
- **Time alternatives:** Currently Ethiopia has an aspiration to grow its agricultural productivity through modern irrigation. The cost vegetables which are planned to grow in this project area increasing from time to time. Therefore, the implementation of this project will increase agricultural production and play its own role in reducing the sky rocketing vegetable prices.
- **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 analysed based on technical feasibility, economic viability, and environmental acceptability. Then, the “No Action” alternative has not been accepted while the project implementation option using solar energy is selected because of the numerous project advantages of the project 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 in the handling of impacts that were significantly generated by environmental impacts. 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 and irrigation activities
- 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/ proponent will be responsible for the implementation of ESMP. The proponent has to incorporate an 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 in place the essential institutional setup (Environment, Health, and Safety unit) and hire competent, experienced, and qualified person(s) to implement the ESMP.

### **8.2. Institutional framework**

This section assesses institutional issues for implementing the ESMP and its monitoring plan and accordingly recommends a reporting and monitoring framework before discussing the mitigation measures for each identified impact in detail. The implementation of Mini grids in this project will directly involve the project proponent, the duty and responsibility of managing the environmental and social impacts should therefore be the sole responsibility of the project proponent. At the national level, the Environmental Protection Authority (former EFCC) is responsible for evaluating and approving ESIA study reports as well as for providing environmental approval licenses which must be obtained before the commencement of project implementation.

In addition, the environmental protection Agency of Oromia regional state is expected to be involved in monitoring the environmental performance of the solar power PV project in the 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. Community associations/ cooperatives are responsible for fair water sharing among farmers; it will solve problems that arise due to water shortages during the dry season.

### **8.3. Air Quality and noise management plans**

The intended project will have some pollution impacts on air and noise to workers during construction, operation and decommissioning phases, Therefore, the project proponent has to 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-grids, the project proponent has to 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 night-time 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. The irrigation activities will be performed by local peoples whom already practicing using diesel pump, this project will only substitute the diesel pump with solar energy source. Therefore, providing PPE and trainings will improve farmer's occupational health and safety. 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; and
- Ensuring all work procedures are undertaken without exposing workers to hazards.
- Provide training for farmers how to use especially agrochemicals

#### **8.5. Waste Management Plan**

The project site is selected in rural areas where there is no proper waste disposal. Therefore, it is the proponent's responsibility to manage hazardous (e.g., accidental leakage of energy storage batteries, damaged solar PV modules) and non-hazardous wastes following 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 concerned 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 tracks, 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 18: Summary of construction phase management plan

	Identified Impacts	Mitigation measures	Responsible Body	Estimated cost
Biophysical Environment	Generation of solid Waste	<p>Hazardous waste, including broken PV panels, shall be disposed of in accordance with best industry practices</p> <p>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 &amp; seed bag should be disposed of 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>Minigrad Contractor</p> <p>Very minimal amount of wastewater for Minigrad, very limited amount of fuel or hazardous material</p>	For construction of plastered pond and other storage structure is 60,000

Human Environment	<b>Soil erosion</b>	Avoid excavation during the rainy season  Heap the excavated soil in the selected area and reuse it to fill undulating areas	Minigrig Contractor	Labour cost to pile up soil is 30,000
	<b>Noise pollution</b>	Noisy activities shall be scheduled to daytime hours  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 muffers/plugs should be used	Minigrig Contractor	For purchasing PPE is 30,000 birr
	<b>Air pollution</b>	Workers assigned in the construction should wear a 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	Minigrig Contractor	PPE included above, and water spray is 20,000 birr
	<b>Public health</b>	Conduct public health awareness campaigns addressing issues of behavioral change, HIV/AIDS, etc.	community /woreda labour and women affairs office	Awareness-raising and training 25,000 birr
		Prepare training manual and conduct regular training about STDs  Provision of materials useful for the prevention of HIV/AIDS	Minigrig Contractor	For internal half day training 15,000 birr
	<b>Covid 19</b>	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.	Minigrig Contractor /EHS unit of the project proponent	PPE cost included above
	<b>Gender-based violence/child labour</b>	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
	<b>Traffic accidents</b>	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)	Minigrig Contractor in collaboration with Woreda traffic police	Training cost for awareness creation for community and workers  20,000



	<b>Impacts on cultural, historical and archaeological site</b>	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 Oromia regional state culture and tourism office	Supervision cost 20,000 birr
<b>Total Minigrid Developer / Contractor Only</b>				<b>235000</b>
<b>Total other parties</b>				<b>125000</b>
<b>Total Construction Phase</b>				<b>360000</b>

## 8.9. Operational phase Environmental and Social Management Plan

Table 19: Summary of operational phase management plan

	Identified Impacts	Mitigation measures	Responsible body	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 Oromia regional state culture and tourism office	No cost is implied
<b>Total Minigrid Developer / Contractor Only</b>				<b>100000</b>
<b>Total Operation Phase</b>				<b>100000</b>

## 8.10. Decommission phase Environmental Management Plan

Table 20: Summary of decommissioning phase management plan

	Identified Impacts	Mitigation measures	Responsible Body	Estimated cost
<b>Biophysical Environment</b>	Generation of solid Waste	Hazardous waste, including broken PV panels, used batteries, shall be disposed of in accordance with best industrial practices	Minigrad Contractor and Irrigation Contractor	Waste disposal cost 150,000
	Air pollution	Workers assigned to the demolition should wear dust masks.  Spray water on demolishing areas	Minigrad Contractor and Irrigation Contractor	PPE purchase and water spray cost 40,000
<b>Human Environment</b>	Loss of employment	Transfer permanent workers to other active projects  Pay compensation (severance) for permanent workers	Minigrad 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
Total Minigrad Developer / Contractor Only				190000
Total other parties				20000
<b>Total Decommission Phase</b>				<b>210000</b>

## 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 the Oromia regional bureau of environmental protection authority unit. The proposed organizational structure for monitoring is provided in Figure 15 below:

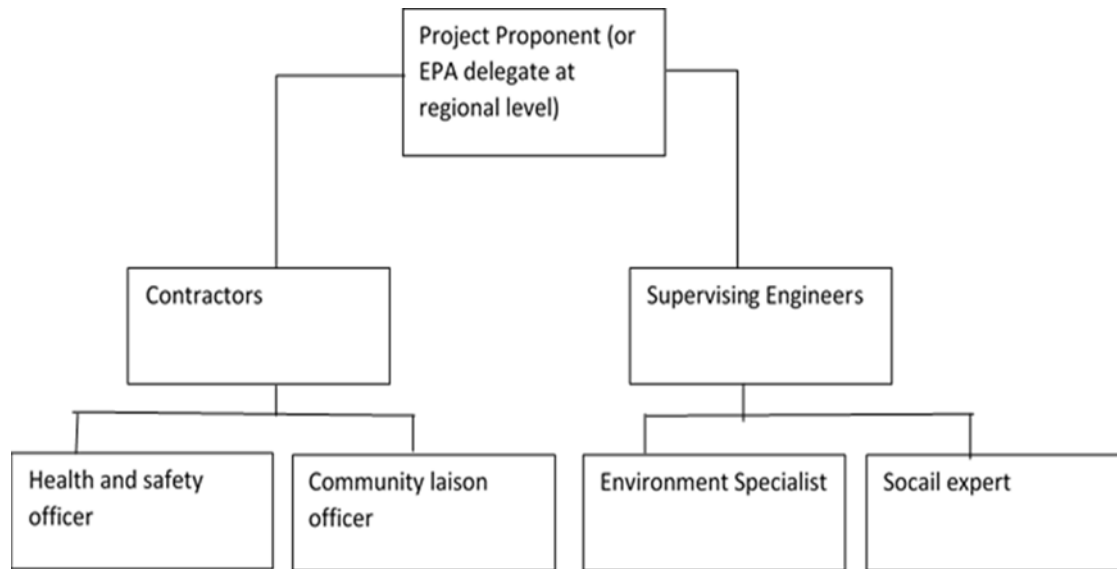


Figure 15: Organizational structure for compliance monitoring

The main objective of the environmental monitoring plan (EMP) is to ensure that the predicted outcome of the company is achieved. Primarily, its focus will be on the sustainable service of the intended solar mini-grid plant and the protection of 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 PV 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. Woreda Environmental protection office should periodically conduct its independent monitoring for compliance with national standards. The project proponent should submit an annual compliance report indicating all the monitoring results to the respective woreda Environmental protection office as well. Details for monitoring are provided in Table 21.

Table 21: Environmental monitoring plan

Parameters to be monitored	Mitigation measures	Responsible	Monitoring schedule	Monitoring indicators	Monitoring cost (Birr)
<b>Contract management</b>	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
<b>Social support to vulnerable people</b>	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	Check the amount of money paid out from finance	Supervision cost 5,000 birr
<b>Employment opportunity</b>	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
<b>Solid waste</b>	Hazardous waste, including broken PV panels or panels at the end of their use-life, 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	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
<b>Liquid waste</b>	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
<b>Noise pollution</b>	Noisy activities shall be scheduled to daytime hours	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 the day and night	Cost for regular checking of noise level 5,000

	personal protective equipment such as ear muffers/plugs will be used			times, respectively)	
<b>Air pollution</b>	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; and  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, community	Expert cost for regular check emission level 5,000 to be done together with noise checks
<b>Loss of farm and grazing lands</b>	Landowners should be compensated as per the new proclamation No. 1161/2019 before the construction activities started  Provide priority to 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
<b>Traffic accident</b>	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 during construction, annually during operations	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
<b>Sexually transmitted diseases like HIV</b>	Health promotion: sensitization of both community and workforce  Provision of materials useful for the prevention of HIV/AIDS	Woreda health office	Every month during the construction and operation phase or as determined by the local health office	Number of distributed condoms  Check the number of trainings conducted	Training cost 100,000



	Having in place an appropriate signpost to educate the workforce and community about the Project's HIV policy				
<b>Covid 19</b>	<p>Train workers to follow strictly Covid-19 prevention mechanisms</p> <p>Temperature measurement check-up each day at the gate of the compound</p> <p>Provision of materials necessary for prevention and detection of COVID 19</p>	Proponent in collaboration with Woreda health experts	Regularly during construction and operation	Number of Covid-19 infected	<p>Expense already included in construction and operations</p> <p>No cost to report # of cases</p>
<b>Occupational Health and safety</b>	<p>Use of appropriate PPE during installation and maintenance</p> <p>The solar PV plant shall be equipped with a fire-fighting system</p> <p>Ensuring all electrical equipment and machinery are properly grounded;</p>	Proponent	Regularly during construction and operation	Total recorded incidence rates	for provision of first aid a lump sum of 5,000
<b>Fire hazards</b>	<p>The solar PV plant should be equipped with a fire-fighting system</p> <p>The technician should regularly inspect Solar PV components</p>	Proponent	Every three months during the construction and operation phase	Number of incidents and reported cases	Part of project and operation cost
<b>Impacts on historical, cultural heritage</b>	Excavation work should be done carefully as per World Bank Guidelines - OP 4.11 and prepared chance find procedures	Contractor	During construction work	Number of discovered heritage site or artifacts	Part of supervision cost
<b>Total Minigrad Developer / Contractor Only</b>					<b>34000</b>
<b>Total other parties</b>					<b>100000</b>
<b>Total Monitoring</b>					<b>134000</b>

## 10. Conclusion and Recommendations

The main aims of the environmental and social impact study were to identify, predict and evaluate all the potential environmental and social impacts due to the proposed solar power plants and irrigation project in Moko site, Kality Woreda, Oromia national regional state. The ESIA study is done with the overall intention of integrating environmental and social concerns into the project's planning, design, construction, operational, and decommissioning stages.

Environmental and social impacts have been identified for all components of the project (solar power plant, irrigation, and electric supply to the community) in the proposed project site. For all the identified negative impacts mitigation measures were provided alongside the impacts and in some cases, enhancement measures for positive impacts were also indicated in chapters (see chapters 7, 9, and 10).

A review of international safeguard standards reveals that the major policies triggered relate to environmental and social assessment, biodiversity and ecosystem services, labor 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, proclamation 1156/2019).

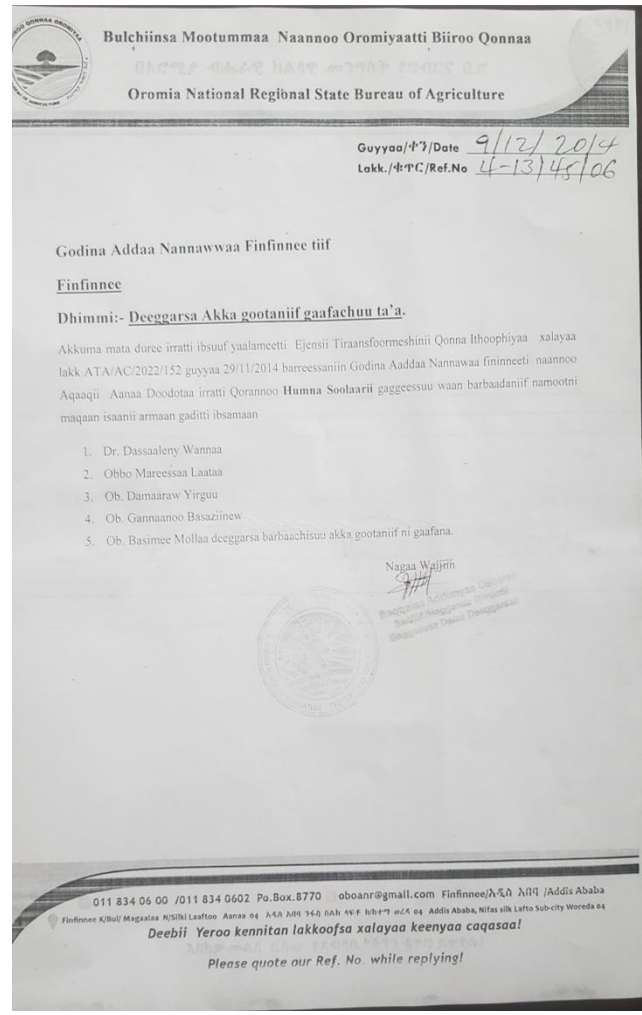
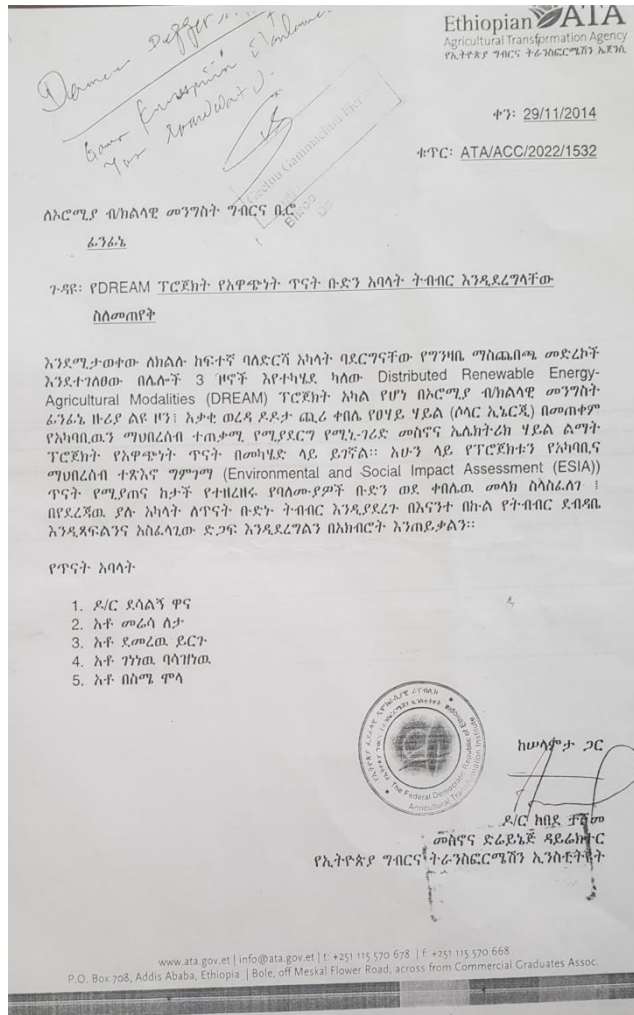
**Recommendations:** As soon as the project proponent is identified the project implementation schedule covering all project activities should be communicated to the community well ahead of time. For example, solar panel installations, designation of command areas for irrigation, and time and modalities for compensation for land take should be communicated to the community and local administration in time. This should be done at least three months before the commencement of solar power plant installations. Water contaminations due to increased use of chemicals and siltation could pose health and environmental hazards and eventually undermine the environmental and economic aspects of the proposed projects. Therefore, timely monitoring of environmental and social risk management plans should be strictly followed. To avoid potential conflicts which might delay the project implementation, the potential project proponent should work in close cooperation with the local administrations to establish 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. There should be a continuous monitoring for biophysical and social impacts of the projects so that the developer or any project proponent could draw a lesson for future investments.

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# Annexes

## 1. Annex 1: Letters to Regional and local government offices



Lakk WQ/159/Q1

Guyyaa 12/12/2014

Wajjir Qonna Aana Aqaqitiif

Dukaam

Dhimii: - Deegaarsa akka gotaanif gaafachuu ilaalata

Akkuma armaan oltii ibsuufi yaalameetti Biroon Qonna Oromiyaa Xalayaa Lakk 4-13/45/06 guyyaa 9/12/2014 barressaniin Aana keessaan keessaatti

Qorannoo Humna Soolaarii namoota gaggeestuu barbaadaniin:-

1. Dr. Dasaalany Wanna
  2. Obbo Mareessaa Laataa
  3. Obbo Damaaraw Yirguu
  4. Obbo Gannaano Basazineew
  5. Obbo Basimee Molla ta'u isaan waan nu beeksisanif isiin kanuma
- hubaachuun degaarsa barbaachisa ta'e akka gotaanif ni beeksiifna.



Nagaa wajjiin

*[Handwritten signature]*  
Dhiheessaa Aanaa Gammadaa  
Xalayaa 12/12/2014  
Aminaa namaa  
Ridu 1/17  
-at xif A.R. 002

Bul/M/N/Oromiyaa G/A/Oromiyaa  
L. Minneetti Waajira  
Qonna A/Aqaqii  
Dh. 13/45/06 guyyaa 9/12/2014  
G. 13/45/06 guyyaa 9/12/2014

Lakk *159/Q1*  
Guyyaa *12/12/2014*

**Wajjira Bulchiinsaa Ga'ida D/Cirrii tiif**

Dodotaa Cirrii

Dhimmi isaa :- Ogeessota qorannoo dhimma jallsii geggeessan gara keessanitti erguu ta'a.

Akkuma armaan olitti ibsamuuf yaalameetti hojiin misooma jallsii soolaariin akka geggeffamuuf mareen gara garaa isinii wajjiin geggeeffamaa turun isa beekamaadha.

Kanaafuu bu'a qabeessummaa isa fi dhibbaa inni qabu gadi fageenyaan qorachuuf ogeessota dhimmiicha qoratan xalayaa lakk. WQ/159/Q1 gaafa guyyaa 12/12/2014 nuuf barra'ee giddu gala godhaachuun ogeessota armaan gadii :-

1. Obboo Damarawu Yirguu
2. Obboo Gannaano Basazineew

Aanaa irraa

1. Obboo Bojaa Tolasa
2. Obboo Kaasuu Fiqiree

Gara keessanitti waan ergineef deggersa barbaachisuu akka gootaanif cimsinee isin beeksiifna

G/G

Wajjira Bulchiinsaa A/Aqaqii tiif

Duukam

1. Obboo Damarawu Yirguu
2. Obboo Gannaano Basazineew



Nagaa wajjiin

*[Handwritten signature]*  
Aminaa namaa  
Ridu 1/17  
-at xif A.R. 002

## 2. Annex 2 Consulted Woreda officials list

S No	Name	Position	Phone No
1	Ato Alemayehu Chala	Head, Agriculture and natural resource	095463008
2	Ato Demis Merga	Head, transport	0920838696
3	Ato Zerihun	Head , Environmental protection	0913534638
4	Ato Getachew lemesa	Head, water resource	0916016684
5	Ato Deme Asefa	Head, small scale and micro finance	0912952838
6	Ato Tomuka Yadesa	Head, culture and tourism	0910578899





Gandaa Yaarii Ganda olcinni Ohimma potojetti Soolarii  
Bihdarii maati taasisame.

- Sa'ad marii, iddo marii foonaa ETC
- Akkuma armaan oliitti ibsamuuf yidarametti yaada haasawaa bantiisa kan taasisise obbo Bojjaad wajjira
- ma qommuu ta'u, yaada ta'uunsa ijaos haaluma dura marii nnee ohimma kana maatii ohaabbata kana uualiiin hirmaannaa ho'aa taasisuun kan hojjattan qoo ta'e akkisa ganda kamaatti kanfina bu'uraalee miidoma FKM MLB ilaolchisee fermuuta ibinif kemmuu ni danda'u rennee amanaa.
- yaada kaasuu potojetti kana maatii hammaa amantuu mnaa fobdu? qoo amaantanii jiraatta yaada ba'aa kaasati.
- yaada obbo haamaasoo buubura:- nuti akka ganda kanaatti buayye harka janceessummaan beekamaa. baroota buayye akbootti fabeenya tui nutti fayyadamaa jira. kanaafuu ohaabbanni kun akka ganda keenyatti nuti shufuun gammachuu gullaan fabeera.
- yaada caalaa hayiluu:- maannan keenya kafa ijaatti jallisiin fayya lamaa hin turre. Akbootti fabeenyootuu maannee biroo ima shufee fayyadamaa ture. sababni daos paanpii bitachuu humna uaan hin fabeef. kanaafuu potojettiin kun shufuun nuti gaarii'ha. kana amma hojjachuu ni danda'eenya rennee amanaa.
- yaada obbo Alamaayyoo Daggajuu:- gammachuu jayya maan kan ka'e tutuu keessaniituu nan ga'atee. kanaaf har'a erga shufantii amma ibin biraa wantii lubatti nu seebisu hin jiru.
- yaada Abbo Gutaraa:- potojettiin kun nuti shufuun gammachuu gullaan fabeera.
- yaada Jafarii Hirphoo:- nuti akka maanda maatooti ohimma kanaaf haalduree hojii kanaaf ta'uu xumuruu turkee, ammas hojii kanaaf ibti gaafatamummaa ni # fufhanna.
- yaada keessumma ta ma kename:- nuti akka hojjatoota shobba ta kanaatti sedarta adnaatti wantoota xumuruu fabeera kunta xumuraaduu ture. ohaabbanni kun ohaabbaa adnaattiin secho ma uaan ta'ee fakkoo gara fuula maatii shufuu maalufis maala fermuutaas kanuumaachuu barbaadchisaacha. kanaaf fexhi haama daos hubachuuun barbaadchisaacha senna amanaa.
- # baradii fashii meetaan kireesitu?
- kan gannaa fashii = 5000 x 4 = 20000
- kan bonaa fashii = 8000 x 4 = 32000
- yaada bulchaa gandaa ibhee haamaasoo:- haala keessumma soolarii kanaa nutteessun amma uaan hin san keenye. qoo bonaa iddo idaa mirreessuu ni danda'eenya. kanaaf bakki idaa ogessa adda nuti haq barfamu. nuti akka gandatti akka lafaatiif/ bakka bu'uun nura jiraata. inni iddo Taambarii adnaati adda nuti bahuu fabeera.
- yaada keessumma ta ma kename:- haalli sochii keessantii nama gammachuu uaan jiru kunla lafaa ibinif xumuruu.



Magaalada Bulo		Mallatto
1	Birruu Taddaasa	B'FKUU
2	Abuuah Bazzaa	M. N. A
3	Abloo Tiksee	Ab doo
4	Gammaluu Shuufuu	cemme
5	Doftee Gosee	<del>Amg</del>
6	Lisaanuu Guree	<del>Amg</del>
7	Masjii Hursi	<del>Amg</del>
8	Astaa Bacia	<del>Amg</del>
9	Caanuu Fartisa	<del>Amg</del>
10	caalaa Hayiluu	<del>Amg</del>
11	Dabaaqaa Xaajaa	<del>Amg</del>
12	Reggaara Xaafaa	<del>Amg</del>
13	Teediroos	Regga
14	Taabor Surtuu	<del>Amg</del>
15	Alloo Jootee	<del>Amg</del>
16	Callaa Guroo	Amg
17	Gosaa Baqqaale	<del>Amg</del>
18	Qeexo Katamaa	<del>Amg</del>
19	Juuxaa midkaxsoo	Golloo
20	Goollo Habeebee	<del>Amg</del>
21	Dabala Bamuu	<del>Amg</del>
22	Guutuu Hammasoo	<del>Amg</del>
23	Guutuu Abbaayee	<del>Amg</del>
24	Gussata Guree	<del>Amg</del>
25	Sabaa ee Bamuu	<del>Amg</del>
26	Kabbada Baqqada	<del>Amg</del>
27	Seetuu Abbaayee	<del>Amg</del>
28	Takkuu Hayiluu	<del>Amg</del>
29	Jannuu Baqqaale	<del>Amg</del>
30	Mammoo Daggoo	<del>Amg</del>
31	Daloo Baqqaale	<del>Amg</del>
32	Darajee Lammaa	<del>Amg</del>






	magaa Abbaa	mallattoo
32	Abbuu Dirboo	<del>30</del>
33	Toluu obholu	<del>31</del> 34
34	<del>Beddotu</del>	<del>32</del>
35	Mugusee Saadee	<del>33</del>
36	Warguu Baneaa	<del>34</del>
37	Mammash Amomuu	<del>35</del>
38	Gammemuu Kumastoo	<del>36</del>
39	irraawoo Jimaa	<del>37</del>
40	Hirphoo Lammii	<del>38</del>
41	Shaanbun Gaarar	<del>39</del>
42	Jamaan Asabaa	<del>40</del>
43	Daalhi Abooyee	<del>41</del>
44	Abrahaam Hirphoo	<del>42</del>
45	Shaanbaa Bayisaa	<del>43</del>
46	Abbuu Baggaboo	<del>44</del>
47	Dochaa Gure	<del>45</del>
48	Mammashu Foruisee	<del>46</del>
49	Lammuu Hayiluu	<del>47</del>
50	Samaa Myaane	<del>48</del>
51	Lammii Girmaa	<del>49</del>
52	banuu Jimaa	<del>50</del>
53	Abbaa Shekkaara	<del>51</del>
54	Tolasa Gaaran	<del>52</del>
55	Ararsaa Gure	<del>53</del>
56	Hammusoo Babbaraa	<del>54</del>
57	Gosa midhaksaa	<del>55</del>
58	Golburoo Gobeneechaa	<del>56</del>
59	Innee Hammusoo	<del>57</del>
60	<del>Abba</del> Bostaana Alamuu	<del>58</del>
61	Takkaa Baqullaa	<del>59</del>
62	Tafariir Hirphoo	<del>60</del>



## 4. Annex 4. Water Laboratory result



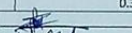
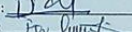
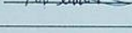
**ADDIS ENVIRONMENTAL SERVICES**  
WATER & WASTE WATER QUALITY TESTING LABORATORY

**LABORATORY TEST REPORT**


Client:	Geoscince Consultancy plc.	Lab Ref:	AES/LAB/22/196
Location:	Region: Oromia.	Sample No:	22/196-1
	Zone/Town: Finfine Zuria.	Wereda:	Akaki.
Project /Institution:	Moko.	Water use:	Domestic Use.
Source of Water	Awash River.	Sample Delivered on:	Aug 30,2022
Sample point (Site):	Dodota Chire (MW 01).	Test report issued on:	Sep 06,2022
Sample Collected by:	Geoscince Consultancy plc.	Contractor:	Geoscince Consultancy plc.

**Test Description: Selected Physicochemical Tests**

No	Parameters	Unit	Value	WHO Maximum Allowable Concentration for Drinking
1	Odour	-	Odourless	Unobjectionable
2	E.Conductivity	µS/cm	175	2000
3	PH	Log 10	7.12	6.5-8.5
4	TDS	Ppm	87.6	1000
5	Total Alkalinity	mg/l CaCO <sub>3</sub>	55	200
6	Ammonium, NH <sub>4</sub>	mg/l	0.01	1.5
7	Bicarbonate, HCO <sub>3</sub> <sup>-</sup>	mg/l HCO <sub>3</sub> <sup>-</sup>	65	-
8	Calcium, Ca	mg/l	141	200
9	Chloride, Cl <sup>-</sup>	mg/l	7	250
10	Carbonate	mg/l	30	-
11	Fluoride, F	mg/l	0.89	1.5
12	Magnesium, Mg	mg/l	2	150
13	Manganese, Mn	mg/l	0.02	0.5
14	Nitrate, NO <sub>3</sub>	mg/l	1.7	50
15	Nitrite, NO <sub>2</sub>	mg/l	0.2	1
16	Phosphate, PO <sub>4</sub>	mg/l	0.1	-
17	Potassium, K	mg/l	3.3	-
18	Sodium, Na <sup>+</sup>	mg/l	29	200
19	Sulfate, SO <sub>4</sub>	mg/l	Nil	250
20	Total hardness	mg/l CaCO <sub>3</sub>	40	300
21	Total Iron, Fe	mg/l	0.1	0.3

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

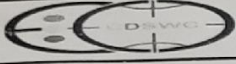



Page 1 of 1



**ADDIS ENVIRONMENTAL SERVICES**

Tel. 0118681459, 0116631773, 0935401532, 0911244918  
 Email: info@addisenvironmental.com, addisenvironmental@gmail.com  
 www.addisenvironmental.com

## 5. Annex 5: Soil Laboratory report

	Company Name: <b>Ethiopian Construction Design &amp; Supervision Works Corporation</b> በኢትዮጵያ የኮንስትራክሽን ዲዛይንና ስ-ፐርሲዥን ሥራዎች ኮርፖሬሽን		
	Title: <b>Soil Fertility Test Report</b>	Document No: OF/ECDSWC/0921	Issue No.1
Client:-Geoscience Consultancy PLC		Client Ref:-SF/018/2022	
Project:-		Reported Date:-07/10/2022	
Source of Sample:-MOKKO			
Location:-DoDoTA-CHIRE			
Date of Collection:-26/08/2022			
Date Received :-30/08/2022			
Test Requested:-pH-H <sub>2</sub> O,Exch.Bases,Av.P,AV.S,Micronutrients(Fe,Mn,Cu,Zn)			
Laboratory Number	0920/15	Test Method	
Profile Code	Bessmemolla MS2		
Depth (cm)	0.40	Potentiometric	
pH-H <sub>2</sub> O (1:2.5)	7.15	Olsen	
Available Phosphorus (Av.p) (mg P <sub>2</sub> O <sub>5</sub> /kg soil)	252.41	KH <sub>2</sub> PO <sub>4</sub> Ext.Turbidimetric	
Available Sulfur (Av.S) (mg/kg soil)	119.39		
<b>Micronutrients</b>	9.64	DTPA Ext. & Instrumental	
Fe (mg/kg soil)	4.27		
Mn(mg/kg soil)	1.01		
Cu(mg/kg soil)	0.13		
Zn(mg/kg soil)	2.15		
Exch.Na(meq/100gm of soil)	3.73	Ammonium Acetate Ext. and Instrumental	
Exch.K(meq/100 gm of soil))	53.05		
Exch.Ca(meq/100 gm of soil)	13.26		
Exch.Mg(meq/100 gm of soil)			
REMARK: The Soil sample is collected and submitted to the laboratory by the client.			
Reported by <u>Tseganesh K.</u> 	Checked by <u>Tseganesh K.</u> 	Approved by <u>Bethlehem K.</u> 	
Lab Expert	Senior Soil Expert	Soil Fertility Lab S/P Manager Representative	
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.			

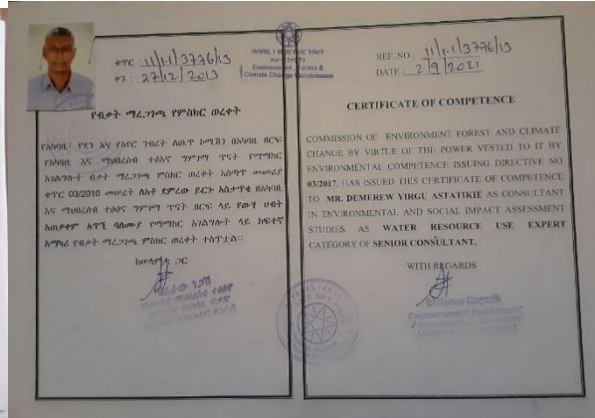
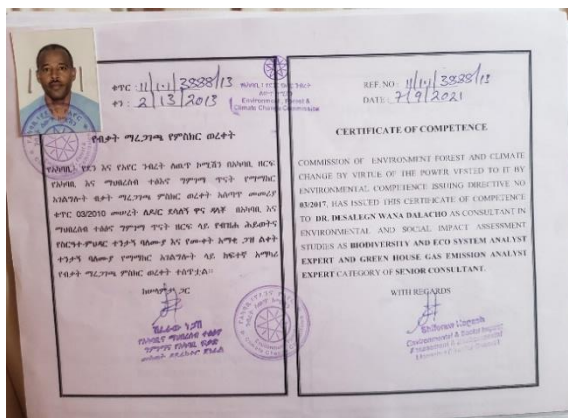


## 6. Annex 6: Competency certificates Geoscience consultancy firm



### Experts License

Dr Desalegn Wana, Senior ESIA consultant, Biodiversity & Ecosystem Analyst    Mr Demirew Yirgu, Senior consultant (Water resources use expert)



### Ms Hana Atsbha, Pollution expert

### Mr Wondyfraw Girmachew, Social affairs expert

