

STANDARD ENVIRONMENTAL AND SOCIAL (E&S) CHECKLIST

Template for small stand-alone solar system

INTRODUCTION

This E&S Checklist template provides “pragmatic good practice” set of measures which should be tailored for the project and is designed to be user friendly and compatible with ESF requirements. The checklist-type format attempts to cover typical mitigation approaches to common works with localized impacts associated with standalone solar home systems.

OVERVIEW OF THE E&S CHECKLIST

The Standard E&S checklist has four main parts.

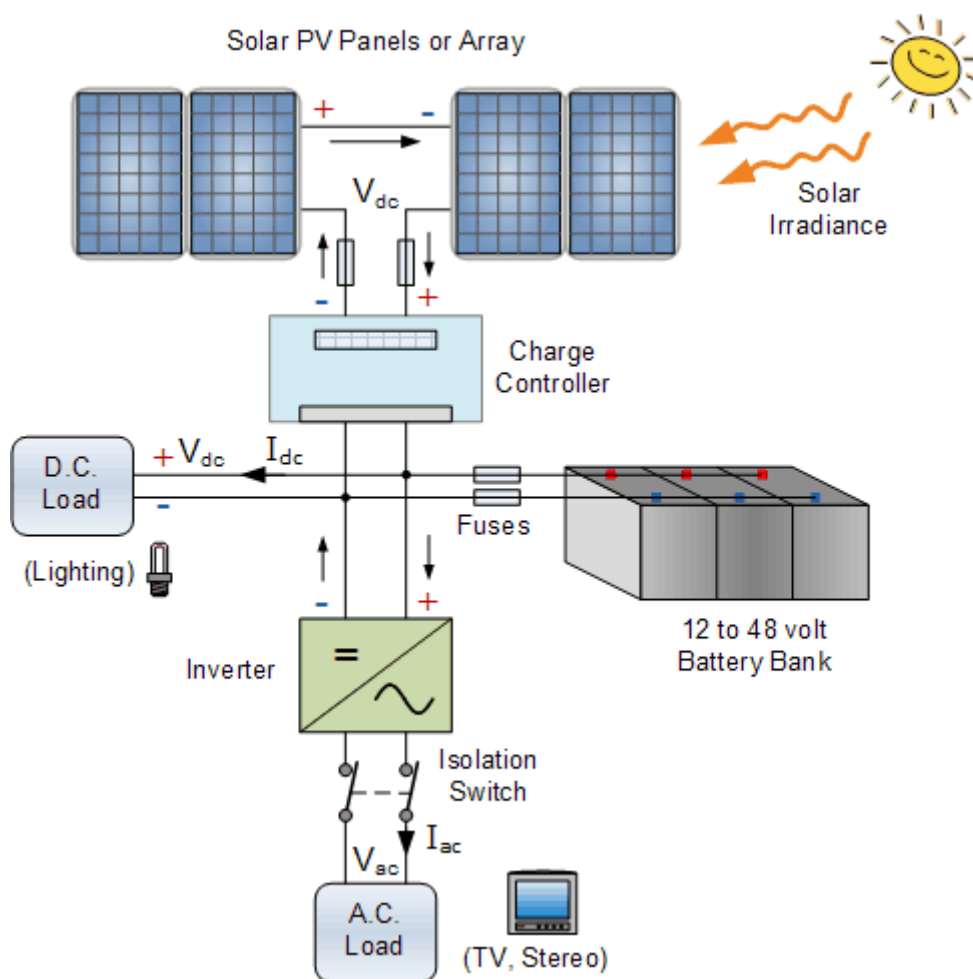
- Part 1 provides an overview of standalone solar home systems and the description of business models considered under ASCENT.
- Part 2 will be applicable to Pay as you go (PAYGo) and Productive Uses of Electricity models and recommends mitigation measures for the potential environmental and social risks and impacts.
- Part 3 will be applicable to Financial Intermediaries
- Part 4 will be applicable to public institution electrification and consists of the following three subparts i) general project and site information (“site-passport”), ii) potential environmental risks and impacts and their respective mitigation measures, and iii) a monitoring plan.

The checklist is supported by annexes with additional details.

PART 1 – OVERVIEW OF STAND-ALONE SOLAR SYSTEMS

ASCENT will support small solar home systems [SHSs]; The systems will typically be plug-and-play; comprising a solar panel, battery, and appliances, the system will come in one box and can be installed by the customer, typically on the roof of the buildings although on-ground is possible. A financing facility will be provided to support private sector led provision of solar home systems at individual households. Also, solar home systems at institutional facilities will be supported, but will remain of limited size.

A standalone photovoltaic (PV) system is an electrical system consisting of an array of one or more PV modules, conductors, electrical components, and one or more loads.



While a major component and cost of a standalone PV system is the solar array, several other components are typically needed. These include:

Batteries – Batteries are an important element in any stand-alone PV system but can be optional depending upon the design. Batteries are used to store solar-produced electricity for nighttime or emergency use during the day. Depending upon the solar array configuration, battery banks can be of 12V, 24V or 48V and many hundreds of amperes in total.

Charge Controller – A charge controller regulates and controls the output from the solar array to prevent the batteries from being overcharged (or over discharged) by dissipating the excess power into a load resistance. Charge controllers within a stand-alone PV system are optional but it is a good idea to have one for safety reasons.

Fuses and Isolation Switches – These allow PV installations to be protected from accidental shorting of wires allowing power from the PV modules and system to be turned “OFF” when not required saving energy and improving battery life.

Inverter – The inverter can be another optional unit in a stand-alone system. Inverters are used to convert the 12V, 24V or 48 Volts direct current (DC) power from the solar array and batteries into an alternating current (AC) electricity and power of either 120 VAC or 240 VAC for use in the home to power AC mains appliances such as TV’s, washing machines, freezers, etc.

Wiring – The final component required in, and PV solar system is electrical wiring. The cables need to be correctly rated for the voltage and power requirements.

Plug and play solar kit.

A plug and play solar kit are a type of solar power system that is designed for easy installation and use. These kits typically include solar panels, an inverter, and sometimes a battery, all of which are pre-wired and ready for immediate operation. These systems are often portable and can be used for a variety of applications, such as providing power in remote locations, for camping, or as a backup power source during outages.

Business Models

Four primary business models are commonly seen with small SHSs, and the provided measures will be separated as such due to the degree guidance being dependent on model type. The main models include:

- **Pay-as-you-go (PAYG):** Marketed for households wherein a lease-to-own model is applied. The small SHSs are leased to the end-user for a use fee or flat fee by an Energy Service Company. The end-user continues in this way until the system is fully purchased, typically in a time frame of six months to one year. Until the system is purchased by the end-user, the Energy Service Company maintains all responsibility for the E&S risks and impacts. In the case of a warranty period where quality standards or after-sale services are applied, E&S risks and impacts are still the responsibility of the Energy Service Company per the terms and conditions until expiry.
- **Cash sales.** Systems sold to customers on a cash basis. In this case, property gets transferred to the customer, with the seller's responsibilities being limited to warranty and after-sale services.
- **Productive Uses of Electricity:** Marketed for households and enterprises using electricity for income-generating activities. The small SHSs can be provided through the PAYG model or as cash sales. Until the system is purchased by the end-user, the Energy Service Company maintains all responsibility for the E&S risks and impacts. In the case of a warranty period where quality standards or after-sale services are applied, E&S risks and impacts are still the responsibility of the Energy Service Company per the terms and conditions until expiry.
- **Financial Intermediaries (FIs):** The Lender will provide the FI with credit lines or financial instruments that provide the FI with the ability to lend to Energy Service Companies delivering the small SHSs via cash sale or PAYG. The FI maintains all responsibility for the E&S risks and impacts until the end-user assumes full ownership of the system. Minimal screening requirements and technical assistance are provided for companies that receive this type of concessional lending.
- **Public Facility Electrification:** Marketed for larger SHS systems in the electrification of health and education facilities, and public buildings. The precise business model can take many forms. Historically, such systems were purchased by governments via public procurement. In this case, the Government acquires ownership of the systems and is responsible for any E&S requirement; the seller's responsibility is limited to after-sale services, as well as any manufacturer warranties. More recently, public facilities are being electrified via the energy-as-a-service business model. In this case, Energy Service Companies providing the SHS maintain ownership and responsibility of the system for each contract. This includes ESMSs addressing the appropriate E&S risks and impacts.

PART 2: PAYG AND PRODUCTIVE USES OF ELECTRICITY MODELS

The PAYG model engages in results-based financing where the Energy Service Company provides the small SHS unit to the end-user.

The Productive Uses of Electricity model can also be used for households and enterprises, including farms, for income-generating activities. This includes electricity for activities such as water pumping and refrigeration. The small SHSs can be provided through the PAYG model or as cash sales, thus the two models have been grouped together. solar systems cash sales can be part of the Pay-As-You-Go (PAYG) model, but they are typically a separate offering where customer will pay the full price of the solar system upfront, some companies offer both options to cater to different customer needs and financial capabilities.

Table 1 provides the recommended mitigation measures for Energy Service Companies to address potential environmental, social, and health and safety impacts and risks associated with the design, installation, and maintenance of small-scale solar panels for households under PAYG model and cash sales and those under the Productive Uses of Electricity model (limited size, such as 1-2 small panels).

The measures are developed with a primary focus on the Energy Service Companies responsible for their workers and the installation and maintenance of solar panels in both the installation and operation phases. Some potential impacts or risks have mitigation measures that the PIUs are responsible for and should be listed in the respective Project ESMF.

Table 1: mitigation measures for Energy Service Companies to address EHS risks associated with the design, installation, and maintenance of small-scale solar panels for households under PAYG

<i>Type of potential impact or risk</i>	<i>Summary Description</i>	<i>Mitigation measures</i>
Health Safety and Environment (HSE)	General	• At point of sale or lease, provide customers with in-person and written guidance on E&S risks and impacts, maintenance, and end of life disposal of the units and all associated components. This includes actions that should be performed by a trained worker and the potential health and safety risks to members of the household. • Solar panel installation and maintenance providers shall comply with all in-country environmental, health and safety (EHS) regulatory requirements, including all necessary permits and authorizations and any occupational health and safety (OHS) codes and requirements. • Solar panel installation and maintenance providers (contractor, company) shall implement a Health, Safety and Environment (HSE) Plan (which includes waste management as discussed below), in line with World Bank standards, that shall include necessary procedures, training, equipment, monitoring and supervision, reporting and required resources (both budget and designation of a HSE responsible person). The HSE plan should include a Worker Code of Conduct related to environmental, social, and health and safety risks, which includes both employee and employer responsibilities.
	Design, Installation and Maintenance	• Design, installation and maintenance shall follow solar panel manufacture's requirements and recommendations. • Design and installation shall ensure the structural elements are in accordance with national legal/regulatory requirements taking into consideration health and safety risks to household or building occupants and third parties, Solar panels should only be installed on structurally sound roofs that are unlikely to be damaged during the lifecycle of the solar energy systems. • Design, installation and maintenance shall be performed by competent professionals/workers having any required certifications/licenses and having received the applicable HSE training. • Design and installation shall comply with all necessary regulatory requirements and codes pertaining to fire safety and protection.

		• Design and installation shall be based upon reasonably expected environmental conditions and natural disasters for the site location, including wind speed, tornadoes, hurricanes, and seismic. The HSE plan should include a definition of environmental conditions for which installation or maintenance shall not occur. • Design, installation and maintenance shall be performed taking into account potential existing HSE related conditions and liabilities, including condition of roof (structural stability, etc.), electrical wiring non-compliant with regulatory/code requirements, presence of contamination (e.g., asbestos, lead based paint, solid or hazardous wastes, soil contamination, etc.), and presence of household members or third parties. • The HSE plan shall include procedures to address potential emergency conditions that may occur during installation or maintenance including worker or third-party health and safety accidents or spills or release of hazardous materials or waste.
Waste management (electronic waste, chemical pollution)	Used panels, batteries, and units (both lead acid and lithium ion) are hazardous waste. Improper recycling of lead acid batteries causes wide-scale lead pollution/poisoning, including air, soil, and water contamination; lead entry into the food chain resulting in diseases and fatalities.	• Establishment of an electronic waste management plan aligned with EHS requirements and GIIP. This includes safe and separate storage, transport, and disposal streams for hazardous and non-hazardous wastes, product take-back, collection points, repair, recycling of components, among others. • Incorporate the cost of the responsible management (including transport and recycling/disposal) of hazardous and non-hazardous waste into the subproject budgets. • All waste generated from the installation or maintenance shall be removed from the site, including packaging materials, wastes generated by installation, used or damaged batteries or solar panels, empty containers (e.g., adhesives, sealants, cleaning products, etc.) • Select and contract an authorized waste management service provider (e.g., transport, recycling, disposal), and include the applicable EHS requirements in the contract. • Maintain waste management records including type and amounts generated, transported, recycled, disposed, and waste service providers utilized. • Ensure proper storage, use and disposal of hazardous materials that may be used, such as those for sealants used for installation or for cleaning solar panels, • Ensure proper maintenance of all vehicles (e.g., trucks, etc.) used for installation and maintenance, including contracting with acceptable service providers that properly recycle or dispose of all wastes (e.g., waste oil, batteries, tires)

	Used printed circuit boards and electric cables are also electronic waste that pose E&S risks if not disposed of properly.	• Implement a training program to ensure all workers and contracted service providers understand their responsibilities related to waste management. <u>PIU</u> • Provide technical assistance (TA) and capacity building activities to adopt e-waste management solutions, workshops, and trainings. • Define existing (regional or national) frameworks for electronic waste management. • Ensure contractors providing solar system installation and maintenance implement proper waste management. • Collect and report of waste generation and disposal. • Promote the use of environmentally and socially sustainable solar equipment in terms of their manufactures and distributors. • Promote the sale of products that meet quality standards (e.g. VeraSol)
Worker Occupational Health and Safety (OHS)	Electrical related work	• Workers must be trained related to electrical equipment safely as workers face various risks including arc flashes, electric shock, and thermal burns. • Visually inspect all electrical equipment and wiring for potential issues (e.g., frayed or exposed cables, cords, etc.). • Insulated tools and equipment should be used. • Avoid standing in wet areas. • Recommend covering solar panels during lifting and installation to block the sun's light and heating of panels.
	Personal Protective Equipment (PPE)	• Workers exposed to potential electrical hazards must be provided with appropriate electrical protective equipment. • Workers should be trained in the use of the necessary PPE, required to use the PPE, and the PPE should be maintained in a safe and reliable condition and periodically inspected or tested (if applicable).
	Training	• Workers should receive training related to all potential OHS risks that may be encountered and the applicable risk protection measures to be implemented. Additional OHS training should be provided routinely to ensure adequate worker knowledge and capacity.

		• Companies should maintain a record of all OHS-related training provided to workers.
	Incident Management	• Workers shall be required to report any work-related incident, including accidents, injuries, and ideally near-miss events to i) applicable regulatory agency as required by law and ii) the PIU and their contracting agency as required by the World Bank Project financing agreement in addition to any material or significant HW incident being reports within 48 hours of the incident. • Workers should be provided with a standardized form for reporting such incidents/accidents. • Companies should undertake measures to assess and address each incident, such as corrective actions, remedies and/or compensation, and root cause analysis. • Significant incidents should be assessed by a root cause analysis by a person knowledgeable/competent in OHS. The analysis should at minimum: (i) establish what happened, (ii) determine the cause of what happened, (iii) identify measures necessary to prevent a recurrence. • Companies should update and/or undertake new worker training on measures to reduce the potential for re-occurrence of such incidents. • Companies should maintain records of all Health and Safety incidents.
Consumer Health/Safety	Safe installation of panels and batteries	• During installation and maintenance, appropriate measures should be taken to ensure third party safety (including members of household, etc.) such as ensuring no access/use of ladders or other equipment to access roofs or materials temporarily stored on ground, ensuring no third parties in area underneath where solar panels are raised to roof, ensuring proper disconnection of electricity or use of, as needed, during panel installation and maintenance. • Solar system installers should provide written documentation as to the use and maintenance of the solar systems, including specifically what type of actions should be performed by a trained worker and what are the potential health and safety risks to members of the household.
Labor Issues	Child or forced labor. Improper grievance redress for workers. Unfair	• No child or forced labor can be employed by companies. • A child over the minimum working age and under the age of 18 will not be employed or engaged in connection with the project in a manner that is likely to be hazardous or interfere with the child's education or be harmful to the child's health or physical, mental, spiritual, moral or social development.

	terms of employment.	• Companies should develop and implement a workers grievance redress mechanism. • Solar companies have HR policies that articulate clear and fair terms of employment and provide for no discrimination and equal opportunity. • Workers must have written contracts outlining their working arrangements including signed codes of contract. • Workers to be given training appropriate to the activities to be undertaken which should be recorded on the system or working procedure. • Workers are to be provided with access to facilities including gender segregated toilets. • Unskilled workers should be hired from the local community to maximize local benefits • Companies undertake due diligence to avoid procuring solar panels and related components from companies where there is risk of child labor, forced labor or serious safety issues.
Gender related risks	Women are disproportionately affected by lack of reliable access to energy. Gender-based violence Underserved female-headed households	• Gender-sensitive stakeholder engagement, ensuring equal presence of women. • Training on code of conduct to workers regarding expected behaviors and consequences. • Communities to be engaged on potential risks as part of stakeholder consultation. • SEA/SH responsive Grievance Redress Mechanisms in place.

PART 3: FINANCIAL INTERMEDIARIES

FI's will be provided with credit lines or financial instruments that provide the FI with the ability to lend to Energy Service Companies delivering the small SHSs via cash sale or PAYG. The FI maintains all responsibility for the E&S risks and impacts until the end-user assumes full ownership of the system. As such participating Financial Intermediaries (FIs) will be required to have an ESMS in place with procedures and processes for screening requirements and technical assistance provided for companies that receive concessional lending. The FI ESMS will be updated with the mitigation and monitoring measures listed in table 1 and 2 as applicable. This will be done in conjunction with the PIU offering TA and promoting an enabling environment as per Table 1.

while requirements can be established by the project for their FI, it is more advisable to follow a supportive (rather than prescriptive) approach including via the participation of the PIU (with TA, grants, etc). The FI's ES procedures of the ESMS should include SHS provisions, such as in:

- FI subprojects' screening, acknowledging applicable e-waste labor conditions, and community health and safety risks and mitigation options.
- including the necessary measures in the FI subprojects agreements, requiring they are assessed, prepared, and implemented to comply with the national e-waste laws, national E&S laws and international best practices for all identified E&S risks
- assessing and addressing e-waste incidents (e.g., explosion of stored e-waste batteries) in accordance with relevant aspects of the ESSs, modifying the FIs procedures should they not be adequate to address this increased risk and notifying the WB.FI may request E&S commitment from companies to identify and manage e-waste risks
- monitoring, keeping, and regularly updating e-waste-related information on FI subprojects, in a manner proportionate to relevant SHS E&S risks and e-waste risks identified.
- the risk categorization system for FI subprojects, if seen relevant, to enable significant e-waste risks to enter the systematic aggregation and analysis of portfolio ES risk.

The table below can be adapted as a checklist to onboard energy service companies to be provided with credit lines or financial instruments.

Table 2: checklist to onboard energy service companies

Company Environmental Commitments[i]	Yes	No	Comments
Does the company have an Environmental Policy/Strategy/Plan/Code of Practice			
Does the company have an Environmental Management Systems with stated plan of responsibilities/tasks/activities			
Does the company have an E-Waste Management Standard Operating Procedures?			
Compliance: Registration & Licenses[ii]			
Does the company /or its supplier have a contract agreement with e-waste collectors, transporters and recycling firms?			

Does the company have a Workplace Registration Certificate from regulator			
Does the company have worker insurance for its technical staff involved in the installation of solar products?			
Does the company provide appropriate PPEs to staff dealing with installation, repair and maintenance of solar products?			
Does the company undertake regular HSE training for employees handling solar products waste, including their batteries?			
Good International Industry Practices[iii]			
Does the company have a take-back collection scheme for products out of warranty?			
Does the company employ reverse logistic channels for collection, transportation and recycling and or disposal of its solar products from consumers?			
Does the company's solar products user manual and packaging include information on procedures for safe disposal of the product's battery at its End of Life (E-o-L)?			
Does the company disseminate information to the buyers on the negative environmental effects of solar products e.g., faulty panels and batteries at the point of sale (PoS)?			
Does the company have a monitoring system to document quantity/volume of units sold, volume of e-waste generated, and volume of faulty products recycled, refurbished/taken back to manufacturer?			

ENVIRONMENTAL SAFEGUARDS CHECKLIST FOR SSP RBF & Debt

Organization Name:

Location:

Due Diligence Date:

[i] This section refers to self-regulation and internal company policies and positioning on environmental management e.g., ISO 14001 EMS

[ii] This section deals with compliance to local legal and regulatory provisions.

[iii] The GIIP has referenced best industry practices from GOGLA's Consumer Protection Code & Lighting Global SHS QS v2.5

PART 4: PUBLIC FACILITY ELECTRIFICATION

The OGS systems used to electrify health and education facilities, as well as other public buildings, are typically component-based requiring professional installation, and in some cases bespoke design and system sizing to be undertaken through Engineering, Procurement, and Construction (EPC) contracts, which often include provisions for operation & maintenance (O&M) over a limited number of years. The PIU will put in place Service Contracts to cover the costs related to the O&M of the systems for a specified duration. The World Bank can provide performance-based grants to the government on the condition that timely payments are made to contractors. Given these systems are site specific the following information should be included as ESMP checklist.

GENERAL PROJECT AND SITE INFORMATION

[The following table may need to be updated based upon the specific project]

INSTITUTIONAL & ADMINISTRATIVE				
Country				
Project title				
Scope of project and activity (including summary of solar system(s) to be installed, who installs and form of contract				
Type(s)/form(s) of Financial Mechanisms for solar systems				
Total Allocated Budget (if applicable)				
Institutional arrangements (Name and contacts)	[Specify whether there will be any Independent Supervision, Verification, or use of FIs]	Project Management	Local Counterpart and/or Recipient	
Implementation arrangements (Name and contacts)	Environmental and Social Supervision	Local Counterpart Supervision	Local Inspectorate Supervision	Contactor

SITE DESCRIPTION (APPLICABLE TO PUBLIC INSTITUTION ELECTRIFICATION)				
Name of site(s) – <i>specify if there are multiple sites</i>				
Describe site location(s)	<i>Attachments: Site Map, Design schemes of the installations, Pictures of the site</i>			
Who owns the land?				
Description of relevant geographic, physical, biological, geological, hydrographic and socio-economic context (including all land uses of the site)				
Locations and distance for material sourcing (if needed)				
LEGISLATION				
Identify key national & local E&S legislation & permits that apply to project activity, including specifically installation of solar home systems	<i>(full details in the Annexes)</i>			
World Bank's Environmental and Social Framework (ESF)				
Identify relevant Environmental and Social Standards (ESSs) and other relevant				

Good International Industry Practice (GIIP) applicable to the project	
STAKEHOLDER ENGAGEMENT	
Describe when and where stakeholder engagement including public consultation process took place and key issues	<i>(full details in the Annexes)</i>
INSTITUTIONAL BUILDING	
Please describe key elements of the E&S capacity building program and institutions to be targeted as relevant	<i>(full details in the Annexes)</i>
ROLES AND RESPONSIBILITIES	
Please describe roles and responsibilities for the implementation of this E&S Checklist	

SUMMARY OF E&S RISKS AND IMPACTS AND POTENTIAL MITIGATION MEASURES FOR LARGER INSTITUTIONAL FACILITIES

For larger systems in public facilities relevant Environmental, Social, Health and Safety (ESHS) terms and conditions need to be included in specific bids and financing contracts, which may need to be adopted based upon the type of contract (e.g., loan, performance based, third party supervision/verification, etc.).

In terms of bids and contracts for solar panel installation and maintenance provides it is recommended to include (note first two are more related to only bids):

1. Summary of existing ESHS management system/plan/procedures
2. Summary of past ESHS performance such as:
 - a. Statement on past (within last 3 years) or existing non-compliance with in-country EHS regulatory requirements
 - b. Statement on past (within last 3 years) of any significant or materials ESHS incident or claim
3. Identification of designated HSE responsible person, including whether this is an existing employee and confirmation that a HSE person will be maintained for duration of project contract.
4. Requirement to comply with all applicable ESHS legal requirements, including any required certifications or licenses to workers involved.
5. Requirement to develop and implement an ESMP (as needed given the type of contracted service/works) which includes the measures mentioned in Part 3.2
6. Type of insurance or guarantee to remedy if damage done to house (e.g., roof, etc.) or third part during solar panel installation and maintenance.
7. Reporting (per Project ESCP on ESHS incidents/accidents, ESHS performance and contractor performance.
8. Worker ESHS Code of Conduct which states both worker and employer responsibilities.

Independent Verification or Supervision

If the project (sub-project) involves independent verification or supervision, then the contract should include appropriate ESHS terms and conditions. These must be established based on the full contract's type and framework/scope. The following presents primary aspects that should be included:

1. Inclusion of designated staff responsible for HSE aspects, with some relevant background/experience.
2. Design and use of some type of claim or inspection form/checklist that includes ESHS factors.
3. Definition of how verification/supervision shall be performed, for example, in office, site visits, telephone, etc.
4. Requirement to review and assess solar panel installation and maintenance provide ESHS performance report/documentation, including (but not limited to) waste management (collection, transport, recycling/disposal), ESHS training provided to workers, OHS incidents, damage to residence or third parties.

Table 2 provides mitigation measures to address potential environmental, social, and health and safety impacts and risks associated with the design, installation and maintenance of small-scale solar panels for public institutions (limited size, such as 1-2 small panels), primarily on roof tops although on-ground is possible. For bigger installations, these measures would need to be reviewed and updated as needed to reflect the results of some form of environmental and social assessment, considering the site-specific conditions and project design.

The measures are developed with a primary focus on the solar panel installation and maintenance company and their workers. Some measures are also listed for the Project PIU, but those must be considered (added to) those PIU responsibilities listed in the Project ESMF.

The measures should be used as part of the bidding document and subsequent contract for solar panel service providers.

Table 3: mitigation measures to address potential environmental, social, and health and safety impacts and risks associated with the design, installation and maintenance of small-scale solar panels for public institutions (limited size, such as 1-2 small panels of about 5-6 kWp)

<i>Type of potential impact or risk</i>	<i>Summary Description</i>	<i>Mitigation measures</i>	<i>Implementation responsibility [PIU / Solar panel installation and maintenance providers / others] Examples provided below</i>
Health Safety and Environment (HSE)	General (Design, Installation, and Maintenance)	• Solar panel installation and maintenance providers shall comply with all in-country environmental, health and safety (EHS) regulatory requirements, including all necessary permits and authorizations and any occupational health and safety (OHS) codes and requirements. • Solar panel installation and maintenance providers (contractor, company) shall implement a Health, Safety and Environment (HSE) Plan (which includes waste management as discussed below), in line with World Bank standards, that shall include necessary procedures, training, equipment, monitoring and supervision, reporting and required resources (both budget and designation of a HSE responsible person). The HSE plan should include a Worker Code of Conduct related to environmental, social, and health and safety risks, which includes both employee and employer responsibilities. Additional details for items within this plan are presented below.	<i>Solar panel installation and maintenance provider</i>

	Design, Installation, Maintenance	• For Solar units to be installed for individual household use, business or for public institutions. • Design, installation and maintenance shall follow solar panel manufacture's requirements and recommendations. • Design and installation shall ensure the structural elements are in accordance with national legal/regulatory requirements taking into consideration health and safety risks to household or building occupants and third parties, Solar panels should only be installed on structurally sound roofs that are unlikely to be damaged during the lifecycle of the solar energy systems. • Design, installation and maintenance shall be performed by competent professionals/workers having any required certifications/licenses and having received the applicable HSE training. • Design and installation shall comply with all necessary regulatory requirements and codes pertaining to fire safety and protection. • Design and installation shall be based upon reasonably expected environmental conditions and natural disasters for the site location, including wind speed, tornadoes, hurricanes, and seismic. The HSE plan should include definition of environmental conditions for which installation or maintenance shall not occur. • Design, installation and maintenance shall be performed taking into account potential existing HSE related conditions and liabilities, including condition of roof (structural stability, etc.), electrical wiring non-compliant with	<i>Solar panel installation and maintenance provider</i>
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		regulatory/code requirements, presence of contamination (e.g., asbestos, lead based paint, solid or hazardous wastes, soil contamination, etc.), and presence of household members or third parties. • The HSE plan shall include procedure to address potential emergency conditions that may occur during installation or maintenance including worker or third party health and safety accidents or spills or release of hazardous materials or wastes.	
Construction/Installation			
Waste management (electronic waste, chemical pollution)	Generation of construction waste from installation, including hazardous wastes such as used panels and used batteries Additional waste issues are related to plastic material, polystyrene residues, aluminum, copper, steel	<u>Solar system company installation and maintenance</u> • Incorporate the cost of the responsible management (including transport and recycling/disposal) of hazardous and non-hazardous waste into the subproject budgets. • All waste generated from the installation or maintenance shall be removed from the site, including packaging materials, wastes generated by installation, used or damaged batteries or solar panels, empty containers (e.g., adhesives, sealants, cleaning products, etc.) • Select and contract an authorized waste management service provider (e.g., transport, recycling, disposal), and include the applicable EHS requirements in the contract. • Companies to commit to a plan to reduce, repair, reuse, and recycle system components • Maintain waste management records including type and amounts generated, transported, recycled, disposed, and waste service providers utilized.	<i>Solar panel installation and maintenance provider and PIU</i>

		• Implement temporary storage of hazardous waste (e.g., at solar installers shop) that prevents commingling between other waste streams, stored in closed containers and appropriately labeled. • Ensure proper storage, use and disposal of hazardous materials that may be used, such as those for sealants used for installation or for cleaning solar panels, • Ensure proper maintenance of all vehicles (e.g., trucks, etc.) used for installation and maintenance, including contracting with acceptable service providers that properly recycle or dispose of all wastes (e.g., waste oil, batteries, tires) • Implement a training program to ensure all workers and contracted service providers understand their responsibilities related to waste management. <u>PIU</u> • Define existing (regional or country) frameworks for recycling batteries and used solar panels, including the availability of acceptable authorized recycling service providers. If adequate providers are not available, explore options to promote new providers. • Ensure contractors providing solar system installation and maintenance implement proper waste management. • Collect and report of waste generation and disposal. • Internal training on waste management processes • Promote the use of environmentally and socially sustainable solar equipment in terms of their manufactures and distributors.	
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		Promote reuse, recycling or energy recovery plastic treatment. Promote reuse, recycling or energy recovery in an equipped unit for polystyrene treatment	
Worker Occupational Health and Safety (OHS)	General	- Solar panel installation and maintenance providers shall comply with all in-country environmental, health and safety (EHS) regulatory requirements, including all necessary permits and authorizations and any occupational health and safety (OHS) codes and required worker certifications. - Solar panel installation and maintenance providers (contractor, company) shall implement a Health, Safety and Environment (HSE) Plan (which includes waste management), in line with World Bank standards, that shall include necessary procedures, training, equipment, monitoring/supervision, reporting and required resources (both budget and designation of a HSE responsible person). The HSE Plan should consider the following potential worker OHS risks: site access, access to roof, working at heights, slips/trips, lifting panels to roofs, third party protection, electrocution, PPE, heat/cold stress, first aid and emergencies, weather, lone working, airborne or communicable diseases (if/when working insider home), driving to and from site. Additional details for some specific measures are presented below.	<i>Solar panel installation and maintenance provider</i>

	Fall Protection	• Adequate fall protection measures shall be provided to workers and used. • Measures shall comply with all country requirements (including codes, etc.). • For fall distances of 2 meters or more one of the following methods is recommended: personal fall arrest systems, guardrail systems, safety net systems, or edge protection systems. Recommend more protective measures for steep roof slopes (e.g., slope > 4:12). For low-sloped roofs having ≤ 50-foot width it may be possible to use only a safety monitoring system for a fall protection system. • Avoid walking backward on the roof. • Avoid installing panels in windy or rainy conditions. • Keep the roof clear of hardware and trip hazards.	<i>Solar panel installation and maintenance provider</i>
	Ladder Safety (roof access)	• Choose the right ladder material. Aluminum and metal ladders are commonly used, but they're a hazard near power lines or electrical work. Instead, a fiberglass ladder with non-conductive side rails may be a better option near power sources. • Ladders should be placed on dry, level ground, away from walkways, doorways and windows; and at least 3 meters from power lines. • Preferably secure the ladder to the ground or rooftop for added stability. Avoid anchoring the ladder to gutters (if possible). If securing is not possible, then have someone hold the ladder in place while in use.	<i>Solar panel installation and maintenance provider</i>

		• Extension ladders should be angled at a ratio of 1:4 (base of the ladder 1 meter away from the structure for every 4 meters of height). • Straight or extension ladders should preferably extend a minimum of 1 meter above the rung that the worker will stand upon. • At least one hand (ideally both) should be used to grasp the ladder when progressing up and down the ladder. • For large installations, temporary scaffold stairways or a mobile scaffold may be necessary to provide access. A competent person should install scaffold stairs in line with the manufacturer specifications.	
	Lifting Solar Panels	• Solar panels should be lifted safely to the rooftops. • Workers should not climb ladders while carrying solar panels. Preferable lifting equipment, such as ladder hoists, swing hoists, or truck-mounted cranes/conveyors, should be used wherever possible. • If cranes are required for lifting, then it is recommended to follow GIIP recommendations such as U.S. General Industry standards at 29 CFR 1910.179 and 29 CFR 1910.180, and Construction standard at 29 CFR 1926.1417 for specific crane requirements.	<i>Solar panel installation and maintenance provider</i>
	Electrical related work (Applicable for grid connection and may larger standalone systems for institutional facilities).	• Workers must be trained related to electrical equipment safely as workers face various risks including arc flashes, electric shock, and thermal burns. • Visually inspect all electrical equipment and wiring for potential issues (e.g., frayed or exposed cables, cords, etc.).	<i>Solar panel installation and maintenance provider</i>

		• Mark energized electrical devices and lines with signage. • Check all electrical cords, cables, and power tools for frayed or exposed cords. • Double insulating/grounding all electrical equipment used in environments that are, or may become, wet. • Workers should look and be aware of overhead power lines and buried power line indicators. • De-energize and ground lines when working near them. • Insulated tools and equipment should be used. • Avoid standing in wet areas. • Locking out power on systems that can be locked out and tag all circuits being worked on at points where that equipment or circuit can be energized. • Recommend covering solar panels during lifting and installation to block the sun's light and heating of panels.	
	Personal Protective Equipment (PPE)	• Workers can be exposed to many hazards that require the use of the necessary PPE. This can include safety glasses, hard hats, gloves, slip resistant work boots, fall protection equipment, or other personal protective equipment used to protect against injuries and illnesses. • Workers exposed to potential electrical hazards must be provided with appropriate electrical protective equipment. • Proper eye protection (such as welder goggles and/or a full-face eye shield) should be used for workers performing welding operations. • Workers should be provided with the required PPE at no cost to workers.	<i>Solar panel installation and maintenance provider</i>

		Workers should be trained in the use of the necessary PPE, required to use the PPE, and the PPE should be maintained in a safe and reliable condition and periodically inspected or tested (if applicable).	
	Heat/cold stress	- Workers should be trained related to work in very hot weather (where hazards include dehydration, heat exhaustion, heat stroke) and cold weather. - Employers should monitor employees and workers should be trained to identify and report early symptoms of any heat-related or cold-related illness.	<i>Solar panel installation and maintenance provider</i>
	Handling Hazardous Materials and Wastes	- Proper handling and disposal of hazardous materials (such as cleaning chemicals for solar panels) and hazardous and e-wastes (used batteries, panels, etc.) should be required (see waste management and hazardous materials). - Workers should be trained in the measures that must be implemented while handling and transporting such materials and waste.	<i>Solar panel installation and maintenance provider</i>
	Training	- Workers should receive training related to all potential OHS risks that may be encountered and the applicable risk protection measures to be implemented. Additional OHS training should be provided routinely to ensure adequate worker knowledge and capacity. - Companies should maintain a record of all OHS-related training provided to workers.	<i>Solar panel installation and maintenance provider and PIU</i>

	Incident Management	• Workers shall be required to report any work-related incident, including accidents, injuries, and ideally near-miss events. • Workers should be provided with a standardized form for reporting such incidents/accidents. • Companies shall report all worker incidents/accidents to the applicable regulatory agency as required by law. • Companies shall report all worker incidents to the PIU and their contracting agency as required by the World Bank Project financing agreement. Any material or significant HS incident (e.g., death, loss-time at work, etc.) should be reported within 48 hours (about 2 days) of the incident. • Companies should undertake measures to assess and address each incident, such as corrective actions, remedies and/or compensation, and root cause analysis. • Significant incidents should be assessed by a root cause analysis by a person knowledgeable/competent in OHS. The analysis should at minimum: (i) establish what happened, (ii) determine the cause of what happened, (iii) identify measures necessary to prevent a recurrence. • Companies should update and/or undertake new worker training on measures to reduce the potential for re-occurrence of such incidents. • Companies should maintain records of all Health and Safety incidents.	<i>Solar panel installation and maintenance provider and PIU</i>
Hazardous Materials	Handling of hazardous materials	• Where practicable, avoid or minimize the use of hazardous materials.	<i>Solar panel installation and maintenance provider</i>

		• Prevent uncontrolled releases of hazardous materials to the environment or uncontrolled reactions that might result in fire or explosions. • Ensure proper storage, use and disposal of hazardous materials that may be used, such as those for sealants used for installation or for cleaning solar panels. • Train workers on the risks involved with hazardous materials used, the precautions that must be taken while handling such materials, the measures to be taken in case of spill or accidental release.	<i>and PIU</i>
	Presence of asbestos containing materials	• Asbestos containing material may be in several work locations where solar installations may occur, including roof and wall sheeting, ridges, barge capping, gutters, eaves and downpipes; electrical backing boards and some fuses and conduits in switchboards; or ceiling spaces (insulation, pipe lagging, delamination of roof). • Asbestos containing material that will likely to be disturbed be removed and replaced with non-asbestos materials prior to installation of the solar system. • Prior to any work, conduct a preliminary asbestos screening through specialized specialists to identify potential sites/areas with asbestos containing materials, including roof top shingles or protective coverings or in building walls where electrical cables will need to be installed. • If asbestos is considered likely present, then the installer should contact the PIU to confirm an appropriate course of action.	<i>Solar panel installation and maintenance provider and PIU</i>

		• If disturbance of such materials would be needed, then an authorized asbestos worker/provider should be used/contracted to define an acceptable course of action (e.g, asbestos management plan/procedure) • Asbestos will only be handled and disposed by skilled & experienced professionals	
Labor issues	Child or forced labor. Improper grievance redress for workers Unfair terms of employment	• No child or forced labor can be employed by companies. • A child over the minimum working age and under the age of 18 will not be employed or engaged in connection with the project in a manner that is likely to be hazardous or interfere with the child's education or be harmful to the child's health or physical, mental, spiritual, moral or social development. • Companies should develop and implement a workers grievance redress mechanism. • Solar companies have HR policies that articulate clear and fair terms of employment and provide for no discrimination and equal opportunity. • Workers must have written contracts outlining their working arrangements including signed codes of contract. • Workers to be given training appropriate to the activities to be undertaken which should be recorded on the system or working procedure. • Workers are to be provided with access to facilities including gender segregated toilets. • Unskilled workers should be hired from the local community to maximize local benefits.	<i>Solar panel installation and maintenance provider and PIU</i>

Land and related issues (installation) for larger systems for institutional facilities	If the installations need some on the ground (as opposed to rooftops), ensure the land use and ownership is suitable for installation.	• Photovoltaic installations on the ground must consider the protection of existing land uses. • Avoid environmentally and socially sensitive sites to the extent possible, where such avoidance is not possible specific mitigation will be required. • Specific biodiversity mitigation measures according to the mitigation hierarchy must be taken if interventions are within environmentally sensitive areas. The PIU should be involved (and issue its approval prior to any such works/decisions) to ensure appropriate actions/measures are in place. • Avoid areas significantly subject to natural hazards, such as low areas, near other utilities, etc. • If ground clearing or vegetation removal is required, all cleared bushes and trees should be removed unless specifically requested not by homeowner. • Cleared soils should be re-seeded using local non-invasive specie(s) that is approved by homeowner.	
	Land Acquisition, Voluntary Land Donation and Displacement (Not applicable to SHS)	• Exclude any projects which result in physical displacement • Avoid land, which is used for livelihood activities including agricultural land, pastureland etc. Should crops need to be destroyed additional assessment would be required and compensation provided if not under voluntary donation. • Voluntary Land Donation (VLD) Procedures to be applied in line with ESS5. Consideration should be given if the land is eligible for VLD, especially where individuals donate land for community infrastructure.	PIU

Consumer / user health and safety	Safe installation of panels and batteries	• During installation and maintenance, appropriate measures should be taken to ensure third party safety (including members of household, etc.) such as ensuring no access/use of ladders or other equipment to access roofs or materials temporarily stored on ground, ensuring no third parties in area underneath where solar panels are raised to roof, ensuring proper disconnection of electricity or use of, as needed, during panel installation and maintenance., • Solar system installers should provide written documentation as to the use and maintenance of the solar systems, including specifically what type of actions should be performed by a trained worker and what are the potential health and safety risks to members of the household.	<i>Solar panel installation and maintenance provider</i>
Traffic safety	Risk of traffic accidents and subsequent injuries or fatalities	Solar Installation/Maintenance • Ensure all vehicles (trucks, etc.) used are registered with a current license, and properly maintained and in sound working conditions. • Ensure all equipment and materials (going to the site) and all equipment, materials and waste (coming from the site) are properly stored in the vehicle to prevent excessive movement within or escape from the vehicle. • Ensure all drivers of vehicles have the necessary licenses (including any special ones for the size of trucks). • Prohibit drivers from use of any use of alcohol or impairing drugs while working. • Require any worker involved in or awhile of an accident involving a vehicle used for solar panel installation or maintenance (including personal vehicles) to report the	<i>Solar panel installation and maintenance provider and PIU</i>

		accident to their employer, and for the employer to report it to the PIU. PIU • Collaborate with local communities and authorities to improve signage, barriers, visibility and overall safety of roads, particularly along stretches near schools or locations where children are likely to be present.	
Gender related risks	Sexual Exploitation and Abuse/ Sexual Harassment (SEA/SH) Exclusion of women	• Gender-sensitive stakeholder engagement, ensuring equal presence of women. • Training on code of conduct to workers regarding expected behaviors and consequences. • Communities to be engaged on potential risks as part of stakeholder consultation. • SEA/SH responsive Grievance Redress Mechanisms in place.	<i>PIU</i>
Community Relations	Social tensions	• Stakeholder engagement with communities on potential social risks and expected behaviors of workforce. • Access to functional Grievance Redress Mechanism (which is SEA/SH responsive) • Hiring of local workers – especially for unskilled labor to minimize influx and maximize perceived benefits. • Workers to have signed code of conduct and received training on the code of conduct and expectations of their behaviors in relation to communities.	<i>PIU</i>

Supply chain	Awareness raising on E&S risks (e.g. child labor) in supply chains of solar equipment	Companies undertake due diligence to avoid using companies where there is risk of child labor, forced labor or serious safety issues.	PIU
Operation and Maintenance			
Waste management (electronic waste, chemical pollution)	Used panels, used batteries and units (both lead acid and lithium ion) are hazardous waste. Improper recycling of lead acid batteries causes wide-scale lead pollution/poisoning, including air, soil, and water contamination; lead entry into the food chain resulting in diseases and fatalities. Management of used batteries will be a significant risk. Used printed circuit boards and electric cables are also electronic waste that pose E&S risks if not disposed of properly.	Solar system company installation and maintenance - Incorporate the cost of the responsible management (including storage, transport and recycling/disposal) of hazardous and non-hazardous waste into the subproject budgets. - All waste generated from the maintenance shall be removed from the site, including packaging materials, used or damaged batteries or solar panels, empty containers (e.g., adhesives, sealants, cleaning products, etc.) - Select and contract an authorized waste management service provider, including applicable EHS requirements in the contract. - Maintain waste management records including type and amounts generated, transported, recycled, disposed, and waste service providers utilized. - Implement temporary storage of hazardous waste (e.g., at solar installers shop) that prevents commingling between other waste streams, stored in closed containers and appropriately labeled. - Ensure proper storage, use and disposal of hazardous materials that may be used, such as those for sealants used for installation or for cleaning solar panels,	<i>Solar panel installation and maintenance provider and PIU</i>

		• Ensure proper maintenance of all vehicles (e.g., trucks, etc.) used for installation and maintenance, including contracting with acceptable service providers that properly recycle or dispose of all wastes (e.g., waste oil, batteries, tires) • Implement a training program to ensure all workers and contracted service providers understand their responsibilities related to waste management. PIU • Define existing (regional or country) frameworks for repair, refurbish and recycling of batteries and used solar panels, including the availability of acceptable authorized recycling service providers. If adequate providers are not available, explore options to promote new providers. • Engage with industry, regulators, and NGOs to explore practical regional and country waste management solutions such as those with take-back, reverse logistics, or repair/refurbish/recycle capabilities • Ensure contractors providing solar system installation and maintenance implement proper waste management according to their commitment plans. • Collect and report of waste generation and disposal. • Establishment of a reparation network and replacement parts channel. • Promote the use of environmentally and socially sustainable solar equipment in terms of their manufactures and distributors. • Promote reuse, recycling or energy recovery plastic treatment.	
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Consumer/user health and safety	Safe use of panels and batteries	Solar maintenance providers • During maintenance, appropriate measures should be taken to ensure third party safety (including members of household, etc.) such as ensuring no access/use of ladders or other equipment to access roofs or materials temporarily stored on ground, ensuring no third parties in area underneath where solar panels are lowered or raised to roof, ensuring proper disconnection of electricity or use of, as needed, during panel installation and maintenance., • Solar system installers should provide written documentation as to the use and maintenance of the solar systems, including specifically what type of actions should be performed by a trained worker and what are the potential health and safety risks to members of the household. • For on-ground panels, ensure proper signalization of solar power systems and assess, in conjunction with homeowner, the need to isolation of equipment (e.g., fencing) PIU • Promote consumer education about proper and safe practices for use of solar equipment	<i>Solar panel installation and maintenance provider and PIU</i>

Water consumption and resource efficiency (for larger systems for institutional facilities)	Resource efficiency	• Implement measures for resource efficiency. • Communication campaigns and raising awareness on sustainable water management (especially for productive end users)	<i>Solar panel installation and maintenance provider and PIU</i>
Gender related risks	Women are disproportionately affected by lack of reliable access to energy Gender-based violence Underserved female-headed households	• Women employment within solar businesses as part of fair labor practices • Gender-sensitive stakeholder engagement. • Increase information and awareness of women that will allow them to enter renewable energy market. • Ensure that women entrepreneurs in the energy sector will have equal access to finance. • Acting for women to be seen and engaged as valuable partners along the entire value chain: design, marketing, sales, and after-sale services.	<i>Solar panel installation and maintenance provider and PIU</i>
Traffic safety	Risk of traffic accidents and subsequent injuries or fatalities	Solar Installation/Maintenance • Ensure all vehicles (trucks, etc.) used are registered with a current license, and properly maintained and in sound working conditions. • Ensure all equipment and materials (going to the site) and all equipment, materials and waste (coming from the site) are properly stored in the vehicle to prevent excessive movement within or escape from the vehicle. • Ensure all drivers of vehicles have the necessary licenses (including any special ones for the size of trucks). • Prohibit drivers from use of any use of alcohol or impairing drugs while working.	<i>Solar panel installation and maintenance provider and PIU</i>

		• Require any worker involved in or awhile of an accident involving a vehicle used for solar panel installation or maintenance (including personal vehicles) to report the accident to their employer, and for the employer to report it to the PIU. PIU • Collaborate with local communities and authorities to improve signage, barriers, visibility and overall safety of roads, particularly along stretches near schools or locations where children are likely to be present	
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Table 4: Monitoring plan for finance through procurement

Impact	Measurements (incl. methods & equipment)	Frequency	Implementation responsibility	Budget Required
Community Health and Safety				
Third party (including home residents) safety during the work.	Method: - Visual observation and photographic documentation of safety measures. - Visual observation for installing warning signs, barricading of working areas (e.g., safety tapes, fencing/barricades) to prevent unauthorized access of to the working areas (especially point of access to roof). - Visual observation and documentation of measures taken to ensure proper installation, including no damage to roofs that could result in either structural damage/strength or infiltration of water (rainfall) or pests - Provide written summary of Do's and Don'ts for household members during installation Indicators - Number of household sites with photographic documentation - Number of households confirming receipt of installation do's and don'ts - Number of homeowner grievances related to damage to roofs (structural damage/strength) or infiltration of water (rainfall) or pests - Number of project's recorded injuries and accidents	Daily basis during construction work and regular field inspection visits	Contractor, PIU (Site management and HSSE team)	

Traffic Safety	Method: - Site inspection, visual observation and photographic documentation of traffic safety measures Indicators: - Number of vehicles with confirmed up-to-date registration - Number of drivers with confirmed up-to-date driver license, - Number of drives provided with basic driving safety measures - Number of project's recorded traffic related injuries and accidents	Daily basis during construction	Contractor, PIU (Site management and HSSE team)	
Child labor	Method: - Site inspection, checking and documentation of contractor employee records to demonstrate regular monitoring of child 14-18 Indicators: - Number of recorded employees below the age of 18 - Risk assessment in place for children aged 14-18 - Monitoring reports in place for children aged 14-18 covering health, working conditions and hours of work in place.	Weekly site inspection	Contractor, PIU (Site management and HSSE team)	
External stakeholder engagement:	- Highlights, including formal and informal meetings, and information disclosure and dissemination—to include a breakdown of women and men consulted and themes/ issues/ concerns coming from various stakeholder groups, including vulnerable groups (e.g., disabled elderly, children, etc.) and resolution of issues.	Monthly	Contractor, PIU (Site management and HSSE team)	

External stakeholder grievances	- Number of grievances and date submitted, action(s) taken and date(s), resolution (if any) and date, and follow-up yet to be taken grievances listed should include those received since the preceding report and those that were unresolved at the time of that report. Grievance data should be gender disaggregated.	Continuous Monthly	Contractor, PIU (Site management and HSSE team)	
Complaints Handling	Method: - The complaints register will be kept on site, and this will feed into the GM. Details of complaints received will be incorporated into the audits as part of the monitoring process. Indicators: - Number of Reported Grievances - Percentage of Reported Grievances closed out in agreed timelines	Weekly	Contractor, PIU (Site management and HSSE team)	
GBV and SEA issues	Indicators - Number of reported and registered cases of the SEA/SH through project GM. - Number of reported cases of Contractor' noncompliance to PSEA/SH obligation on work sites.	Weekly	Contractor, PIU (Site management and HSSE team)	
Environmental Impacts				
Production, proper disposal and disposal of work's debris and waste materials.	Method: - Inspection, records, and photographic documentation Indicators: - Document signed by homeowner that all wastes have been properly removed from the site after installation or maintenance - Documentation on waste type and amounts generated, transported, recycled and disposed	Daily during construction works and regular site inspection	Contractor, PIU (Site management and HSSE team)	

	- Presence of waste receipts from certified waste recycle or disposal company			
Soil and groundwater contamination	Method: - Inspection and photographic documentation Indicators: - Visible change in soil color - Battery stored in insulated area from the ground. - Hazardous chemicals stored directly on the ground	During installation	Contractor, PIU (Site management and HSSE team)	
Occupational Health and Safety				
Lifting Operations	Method: - Visual inspection to ensure that all lifting activities in the work site are executed safely and as per the standard lifting safety rules. - Visual inspection that safety distance from lifting sites is adhered Indicators: - Records, photo documentation, and number of lifting accidents	Daily	Contractor, PIU (Site management and HSSE team)	
Falling from ladders	Method: - Visual inspection to ensure that ladder safety requirements are implemented according to OSH requirements. Indicators: - Number of injured workers from falling from ladders - Number pf PPEs and presence of helmets and adherence to PPEs	Continuous/Daily	Contractor, Environmental Specialist,	
Electricity Operation	Method: - Visual inspection to ensure that all electricity safety rules are implemented, followed, and communicated.	Daily	Contractor, (Site management and HSSE team)	

	- Ensure that only skilled workers who are authorized (including certified if required) perform any electrical operations through qualification inspections. Indicators: - Unqualified workers performing electrical work. - Records and number of workers not adhering to suitable OHS measures. -			
Manual Handling	Method: - Visual inspection to ensure that all manual handling activities, including lifting of solar panels to roofs, are performed according to the OSH requirements - Ensure that the implementation of the safety techniques to control the manual handling risk is monitored continuously. Indicators: - Number of injured workers from manual handling	Daily	Contractor, (Site management and HSSE team)	
Chemicals and Hazardous Substances and Wastes	Method: - Visual inspection to ensure batteries are well placed in a safe and proper ventilated room with appropriate fire extinguisher and conduct regular monitoring. - Visual inspection to ensure proper battery recycling and disposal procedures are implemented. - Record any noncompliance and take photographic proof. Indicators: - Records of hazardous wastes and E-wastes in undesignated zones - Chemicals, wastes and hazardous substances are not labelled.	Daily	Contractor, (Site management and HSSE team)	

	- Number of workers not wearing suitable PPEs while handling chemicals and wastes			
Asbestos	Method: - Implementation of asbestos screening before solar installation - Inspection by skilled & experienced professionals to ensure asbestos and asbestos containing materials Indicator: - Number of sites with asbestos containing materials	Regular site inspections		
Work related accidents and injuries.	Method: - Inspection and photographic documentation Indicator: - The record of injuries and accidents indicating the number of injured workers in the project report specifying cause and location.	Daily	Contractor, (Site management and HSSE team)	
Poor onsite housekeeping leads to illness and disease.	Method: - Visual inspection - Site inspection Indicator: - Presence of clean water and soap - Presence of pests - Presence of wastes at undesignated areas - Reports on illness and diseases.	Weekly site inspection	Contractor, (Site management and HSSE team)	
Fire incident	Indicator: - Number of firefighting system inspection - Number of reported incidents/fire events due to electrical supply or use	Daily	Contractor, (Site management and HSSE team)	

Worker's dissatisfaction/issues	Method: - GM reports Indicators: Number and type of GM and solved GM related to work issues	Continuous/daily	Contractor	
Other operation and maintenance issues				
Operation and Maintenance (Staff Health and Safety and community health and safety)	Method: - Ensure some monitoring measures are implemented during operation and maintenance. Indicator: - Number of complaints due to misfunctions of PV - Number of water cuts - Number of maintenance times - Number of injuries	Continuous daily	Contractor and Facility Administration	
Operation and Maintenance (Training to facility staff)	Method: - Training on how to handle solar panels, clean them, proper PPEs, and safety measures, etc. Indicators: - Number of trainings received by facility workers.	Prior to handing the project to the facility administration.	Contractor and Facility Administration	

ANNEXES

- *Site map*
- *List all relevant national environmental regulations & permits applicable to the project*
- *Design schemes of the installations*
- *Pictures of the site*
- *Capacity building program*
- *Stakeholder consultation records*