

Initial Environmental Examination

Project Number: 42091-032
March 2021

Afghanistan: Water Resources Development Investment Program - Project 1

(Solar Panel Installations – NCB 0047)

Prepared by the Ministry of Finance and the Ministry of Agriculture, Irrigation and Livestock for the Asian Development Bank.

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Acronyms and Abbreviations

°C	Degree Celsius
MAIL	Ministry of Agriculture Irrigation and Livestock
NVDA	Nangarhar Valley Development Authority
ADB	Asian Development Bank
ARAZI	Afghanistan Independent Land Authority
BC	Before Construction
BPHS	Basic Package of Health Services
BSk	Cold Semi-arid Climate
CBs	Circuit breakers
CDTA	Capacity Development Technical Assistance
CSO	Central Statistics Office
CTs	Current transformers
CVTs	Capacitor voltage transformers
DBO	Design, Build and Operate
DC	During Construction
DEWATS	Decentralized Wastewater Treatment System
EMP	Environmental Management Plan
ERP	Emergency Response Plan
GW	Giga watts
Ha	Hectares
HPP	Hydro Power Plant
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IUCN	International Union for the Conservation of Nature
KM	Kilo-Meter
kV	Kilo volt
LPG	Liquefied Petroleum Gas
MEW	Ministry of Energy and Water
MM	Millimeter
MoPW	Ministry of Public Works MSDS
MW	Mega watts
MWh	Megawatts Hour
NEPA	National Environment Protection Agency
NREL	National Renewable Energy Laboratory O&M
OSHA	Occupational Safety and Health Administration
PCB	Poly-Chlorinated Biphenyls
PM	Particulate Matters
PO	Project Owner
POPs	Persistent Organic Pollutants
PPE	Personal Protection Equipment
PV	Photovoltaic
RE	Renewable Energy
SIGAR	Special Inspector General for Afghanistan Reconstruction
SPP	Solar Power Project
SWMP	Storm Water Management Plan
TCO2	Tons of Carbon Dioxide
TOR	Terms of Reference
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

Solar system is often considered to be a better option instead of other forms of alternative energy because they are durable and exhibit long term economic benefits. The driving factors for selecting the specific technology are regional feasibility, water demand, system efficiencies, and initial and long-term costs. The solar water Irrigation system could also be run through electricity when it is needed. To run the system through electricity it will need four to five transformers of 400kv. The reservoir will be connected through a power house of a 12 Rm5g Inverter.

Nangarhar Value Development Authority NVDA Project wants to pump the water from the main canal of Jalalabad to the Sub Canals with 28 m head along 330 m horizontal distance at Pump Station 1 and 34 m head along horizontal distance of 385 m at Pump Station 2. The reservoir for solar water Irrigation system will need total 35 submersible Pumps. Each Submersible pump will need 400 solar panels in order in order to pump the required water. The total number of panels will be 14,000. The capacity of each solar panel will be 300 watt.

The Nangarhar solar panel installation site area is not located at the vicinity of the sensitive ecosystem, for instance national forests, wildlife sanctuaries, etc. Evidence of agricultural and residential usages have not been visible at the site. There are some natural plants observed which are not scarce type and are commonly available in the surrounding area. For the aquatic environment, common fishes are available in the nearby Kabul River and no vanishing species are affected by the project. The ecological survey of the site confirmed the nonappearance of scarce and ecologically significant fauna and flora. Therefore, the project does not have serious environmental concerns.

This Initial Environmental Examination (IEE) for the combined NCB -047 Solar Panel Installation is prepared as part of the Nangarhar Valley Development Authority Water Resources Development Investment Program (WRDIP), of project in Afghanistan. The WRDIP will contribute to enhancing the smooth flow and equitable distribution of irrigation water to the private and state-owned lands located in Surkh Rud, Behsood, Bati Kot, Ghani Khel and Mohmand Dara districts of Nangarhar Province.

The Government of Afghanistan (GoA) entered into a Framework Financing Agreement (FFA) with Asian Development Bank (ADB) under the Tranche 1 of Multi-Tranche Financing Facility (MFF) to finance the Water Resources Development Investment Program (WRDIP). The purpose of this investment program is to increase the productivity of irrigated agriculture and improve environmental sustainability due to improved water resources management through infrastructure development, capacity building and institutional strengthening.

This IEE has been prepared to identify and assess potential environmental impacts. Under the (ADB) the Project is classified as Environmental Category B. Category B projects require environmental assessment in the form of an initial environmental examination (IEE). IEE findings are then used to determine if an environmental impact assessment (EIA) is needed. If it is not, the IEE becomes the final environmental assessment report.

This IEE has been developed following the ADB Safeguard Policy (2009) guidelines for the development of IEE and environmental assessment reports. The purpose of this IEE is to assess the environmental condition of NCB -047 Solar Panel Installation including its potential impacts, the ecological analysis of the site, the formulation of mitigation measures, the institutional requirements and environmental monitoring for the project. This IEE concludes that this project will not have adverse significant environmental and social impact.

Introduction

Solar system is often considered to be a better option instead of other forms of alternative energy because they are durable and exhibit long term economic benefits. The driving factors for selecting the specific technology are regional feasibility, water demand, system efficiencies, and initial and long-term costs. The solar water Irrigation system could also be run through electricity when it is needed. To run the system through electricity it will need four to five transformers of 400kv. The reservoir will be connected through a power house of a 12 Rm5g Inverter.

The NVDA component comprises rehabilitation of the 72 km Nangarhar main canal and associated structures. This will contribute to enhancing the smooth flow and equitable distribution of irrigation water to the private and state-owned lands located in Surkh Rud, Behsood, Bati Kot, Ghani Khel and Mohmand Dara districts of Nangarhar Province. Facilitating a more equitable and efficient distribution of irrigation water across the whole area of this canal will result in improved agricultural productivity from increased yields, expanded irrigated area, and increased cropping intensities.

NVDA Project wants to pump the water from the main canal of Jalalabad to the Sub Canals with 28m head along 330m horizontal distance at Pump Station 1 and 34m head along horizontal distance of 385m at Pump Station 2. The reservoir for solar water Irrigation system will need total Thirty-five Submersible Pumps. Each Submersible pump will need 400 solar panels in order in order to pump the required water. The total number of panels will be 14000. The capacity of each solar panel will be 300watt.

Along with this stuff we also need 12 Rm5g Inverter made of Taiwan. The capacity of each inverter will be 85hp. For each of Submersible pumps 200 solar panels stand will be needed. The total sum of the solar panels stand will be 7000.

The Contract covers the installation of solar system, Machinery needed by canal directorate and civil work along the main canal of the Nangarhar Valley Development Authority in Nangarhar Province. To pump the ground water during the summer season to irrigate the agriculture land near to project vicinity.

Civil work (Installation of Solar panel): The two pumping stations needs to operate through solar panel to irrigate 4500 ha of land in Farm e hadda located southwest of Jalalabad city. That will create job opportunities for almost 8000 people, due to this work the temperature will be reduced, local economy will grow, etc. Also, we have a need to pump 2cum water to the first pumping sub-canal from pump station no.1 and then 1cum water to second sub-canal through pump station no.2.

The Government of Afghanistan (GoA) entered into a Framework Financing Agreement (FFA) with Asian Development Bank (ADB) under the tranche 1 of Multi-Tranche Financing Facility (MFF) to finance the Water Resources Development Investment Program (WRDIP). The purpose of this investment program is to increase the productivity of irrigated agriculture and improve environmental sustainability due to improved water resources management through infrastructure development, capacity building and institutional strengthening.

This Project's Initial Environmental Examination (IEE) report and Environmental Management Plan (EMP) has prepared following the recommendation of the ADB Safeguard Policy (2009). This IEE describes the environmental condition of the NCB-047 solar panel installation, and includes the potential impacts, the mitigation measures formulation, and the institutional requirements preparation and environmental monitoring for the project.

Purpose and objective of the IEE

The main objective of this study is the assessment of the environmental condition of NCB-047 solar panel installation. The study was carried out in compliance with the environmental

requirements of ADB, as well as the environmental laws and regulations of the Islamic Republic of Afghanistan. International conventions, as ratified by the country, were also considered when applicable. The purpose of this IEE is to:

- identify and assess the significance of potential environmental impacts that may occur as a result of the construction, commissioning, operation, and decommissioning phases of the Project;
- to assess cumulative impacts resulting from other projects being developed in parallel and in the vicinity; and
- to propose measures that can be implemented to enhance positive impacts and mitigate negative impacts.

Scope of IEE Study

Within the scope of this IEE study, the assessment of the potential environmental impacts of the construction and operation of the planned solar panel installation in Farm e hadda located southwest of Jalalabad city. On the basis of the existing environmental baseline of the project area, the potential environmental impacts have been determined and propose mitigation measures of the Solar panel installation Project during design, construction, operation and decommissioning phases. Alternate options, as well as appropriate mitigation and monitoring measures, were considered to reduce possible adverse impacts to acceptable limit.

This IEE aims to strengthen environmental management practices of the project by implementing IEE in three stages; i.e. feasibility, construction and operations stages. The boundaries of solar panel installation IEE study include: -

- the larger-scale longer-term environmental baseline description (climate, hydrology, history of human occupation etc.) and impacts (cumulative, environment-on- project);
- province or district where solar installation project is located for baseline description relying on secondary census data;
- construction site and adjacent area for assessment and management of construction impacts; and
- Potential quarry site and adjacent area for assessment and management of quarrying impacts.

Methodology

This IEE follows the methodology outlined in the ADB Guidelines; ADB Safeguard Policy Statement (2009), June 2009 (SPS 2009) and environmental Laws of the Government of Afghanistan. The experiences of other studies in preparing IEE documentation for solar sector have also been reviewed. This IEE is prepared based o review of preliminary design, collection of selected primary data, review of secondary data and information, field visit and stakeholder consultations.

Due to non-existence of air, water and noise devices, the survey did not conduct for them but for physical, ecological, archaeology environment and socio-economic data all secondary sites have been surveyed along with the analysis of the secondary data.

The below activities have been carried out for the purpose of this IEE:

- Desk review of project related data such as TOR, reports, maps, etc.
- Using of checklist for project related data collection.
- Afghanistan government environmental laws and legal frameworks review.
- Site visits for data collection, interviews and review.
- Stakeholder's engagement

Structure of Report

The remainder of this report consists of the following sections:

- Introduction
- Policy, legal, and administrative framework
- Description of the project
- Description of the environment
- Analysis of Alternatives
- Anticipated impacts and mitigation measures
- Environmental management plan, i.e. mitigation plan and monitoring plan
- Public consultation and information disclosure
- Grievance redress mechanism
- Climate risk assessment and management
- Findings and recommendations
- Conclusion

Legal Policies and Institutional Framework

The NVDA project is embedded within the following framework, presented in brief outline format.

Table 1: Comparison of International and local Air Quality Standards*

Pollutants	USEPA		WHO/IFC		Afg. NEQS	
	Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
SO ₂	3 hrs	0.5 ppm	24 hr	20 ug/m ³	NA	NA
	1 hr	75 ppb	10 min	500 ug/m ³		
CO	8 hrs	9 ppm (11 mg/m ³)			NA	NA
	1 hr	35 ppm (43 mg/m ³)				
NO ₂	Annual Mean	100 ug/m ³ (53 ppb)	1 yr	40 ug/m ³		NA
	1 hr	100 ppb	1 hr	200 ug/m ³	NA	
O ₃	8 hrs	0.07ppm (148 ug/m ³)	8 hrs	100 ug/m ³	NA	NA
PM ₁₀	24 hrs	150 ug/m ³	1 yr	20 ug/m ³	Annual Mean	401 ug/m ³ **
			24 hr	50 ug/m ³	24 hrs	247 ug/m ³ **
PM _{2.5}	Annual Mean	15 ug/m ³	1 yr	10 ug/m ³	NA	NA
	24 hrs	35 ug/m ³	24 hr	25 ug/m ³		

* Afghanistan has not established its own ambient AQ standards and the Government is still in the process of adoption of standards (Urban Air Quality Management Report, ADB, 2006). Therefore the **standards highlighted in green** for each respective pollutant are the most **stringent** based on a comparison between two international regulations i.e. USEPA and WHO/IFC and thus shall be applicable for the proposed project.

** High PM₁₀ concentrations have been measured in initial samples under the ADB Kabul Air Quality Management (KAQM) Project in 2004 and in previous short-term studies conducted during 2003 by an Environmental and Industrial Health Hazard (EIH) Special Support Team (SST).

Table 32: Comparison of International and Local Noise Standards

Category of Area/Zone	Limit in dB(A) Leq			
	AFG- NEQS		WHO/IFC	
	Day Time	Night Time	Day Time	Night Time
Residential area (A)	NA	NA	55	45
Commercial area (B)	NA	NA	70	70
Industrial area (C)	NA	NA	70	70
Silence zone (D)	NA	NA	55	45

*The standards **highlighted in green** for each respective Area/Zone are the most **stringent** based on absence of local regulations and standards for Noise; therefore, international regulations shall be applicable for the proposed project.

Afghanistan

Legal System

The following laws of GoIRA govern the way in which the environmental management of the project must be implemented, in order to proceed. Constitutional articles pertaining to environmental management are:

Article 40: Private Property

- (i) Property is immune from invasion.
- (ii) No person shall be forbidden from acquiring and making use of a property except within the limits of law.
- (iii) Nobody's property shall be confiscated without the provisions of law and the order of an authorized court.
- (iv) Acquisition of a person's property, in return for a prior and just compensation within the bounds of law, is permitted only for securing public interests in accordance with the provisions of law.
- (v) Inspection and disclosure of a private property are carried out only in accordance with the provisions of law.

Article 51: Compensation

- (vi) Any person suffering undue harm by government action is entitled to compensation, which he can claim by appealing to the court.
- (vii) With the exception of situations stated in the law, the state cannot claim its right without the order of an authorized court.

Article 15: Environment

- (viii) With the exception of situations stated in the law, the state cannot claim its right without the order of an authorized court.
- (ix) The state is obliged to adopt necessary measures for safeguarding forests and the environment.

International Environmental Agreements

The Constitution binds the state to abide by the UN charter, international treaties, international conventions that Afghanistan has signed, and the Universal Declaration of Human Rights (Article 7).

International agreements relevant to environmental management of water resources development to which Afghanistan is a party are (listed in order by the year in which each came into force):

- I. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES, 1975) – international cooperation to control trade in species threatened with extinction or in danger of becoming so; in species whose trade interferes with regulation of trade in extinction-threatened species; and in species identified by a party under national-level trade control to prevent/restrict exploitation, for which international cooperation is needed;
- II. Convention on the Conservation of Migratory Species of Wild Animals (also called Convention on Migratory Species, CMS, and the Bonn Convention, 1983) – conserve terrestrial, marine and avian migratory species throughout their ranges;
- III. UN Convention on Biological Diversity (1993) – objectives are to conserve biological diversity; promote sustainable use of biological diversity; and (iii) seek more fair and equitable sharing of the benefits of genetic resource utilization;
- IV. UN Framework Convention on Climate Change (1994) – aims to stabilize greenhouse gases in the atmosphere at levels that will not change climate systems in dangerous ways;
- V. UN Convention to Combat Desertification (1996) – aims to combat desertification and mitigate drought effects in countries experiencing serious drought or desertification;
- VI. Kyoto Protocol (2005) – extends the Convention on Climate Change;
- VII. Paris Agreement on Climate change (2015).

In addition, Afghanistan has signed but not ratified:

- (i) UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (1970) – aims to protect cultural property against theft and promotes restitution of stolen items;
- (ii) Ramsar Convention on Wetlands (1975) – promotes conservation and sustainable use of wetlands;
- (iii) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal (1992) – aims to reduce movement of hazardous waste between nations, prevent transfer of such waste from developed to less developed countries (LDCs); minimize waste amounts and toxicity; promote environmentally sound management at or near generation sites; assist LDCs in environmentally sound management of their wastes; does not address radioactive waste;
- (iv) Memorandum of Understanding Concerning Conservation Measures for the Siberian Crane (1993) – aims to protect the species (*Leucogeranus leucogeranus*) through concerted, coordinated actions to prevent disappearance of remaining populations;
- (v) UNIDROIT Convention on Stolen or Illegally Exported Cultural Objects (1995) – attempts to fill gaps in the UNESCO convention by making the final owner of a stolen cultural item who cannot show due diligence responsible for restitution;

- (vi) UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage (2006) – safeguard, ensure respect for, and raise awareness at local, national, international levels, and provide international cooperation and assistance.

National Legislation, Policies, and Regulations

The GIROA adopted its first environmental framework, the Environment Act of 2005, with the goal of ensuring that environmental issues were addressed as an integral part of the development process, and the Act established the National Environmental Protection Agency (NEPA). Legislators continued this new theme, leading to the drafting of an enhanced Environmental Law in 2006, which was subsequently approved in 2007.

Environment Act (2007) sets forth national administrative roles and coordination with provincial authorities; establishes management frameworks for natural resource conservation, biodiversity, drinking water, pollution control, environmental education, and defines enforcement tools.¹

Regulation on evaluation of environmental and social impacts/Ministry of Justice (2017) Official Gazette No. 1276 (9 December 2017); have 52 pages, 18 articles and 3 chapters, subject environmental protection, or environmental policy. And its classifications are Hierarchical classification (regulation), Public Law (The constitution) sectorial classification (environment), scientific classification (National Law). The sectorial classification of 2017 regulation are following in this IEE with other NEPA regulations.

National Environmental Impact Assessment Policy (2007) follows on from the Environment Law and sets forth a policy vision, principles, strategy, and process for environmental assessment in Afghanistan. The emphasis is on ensuring that projects with potentially significant impacts are identified to the national environmental regulator, the National Environmental Protection Agency (NEPA), and follow adequate due diligence procedures. The document provides a range of additional useful information on NEPA and environmental assessment in the Afghanistan context.

Environmental Impact Assessment Regulations. Official Gazette No. 939 (Mar 2008). Schedule I that list project types likely to have significant impacts (Category 1) or potentially adverse impacts (Category 2); and the industries likely to give rise to pollution. Schedule II provides the clearance certificate application form.

The definition of EIA as described in the Environmental Law is: ‘EIA refers to the procedures used for evaluating the likely environmental and consequent social impacts, both beneficial and adverse, of proposed projects, plans, policies or activities where there is a possibility of significant adverse effects arising as a result, in order to improve the quality and development impact of such projects by identifying ways of improving project selection, siting, planning, design and implementation’.

National EIA Policy - An Integrated Approach to EIA in Afghanistan. NEPA created this policy to provide guidance to project proponents while undertaking development projects that may have potential impacts on the environment. They also provide guidance on how the public should be consulted and define the roles and responsibilities of various stakeholders in that process.

NEPA developed this policy to stipulate broad guidelines for project proponents on integrating EIA into the process of development, and identified procedures to address environmental consequences and involve necessary institutions in the process of project implementation.

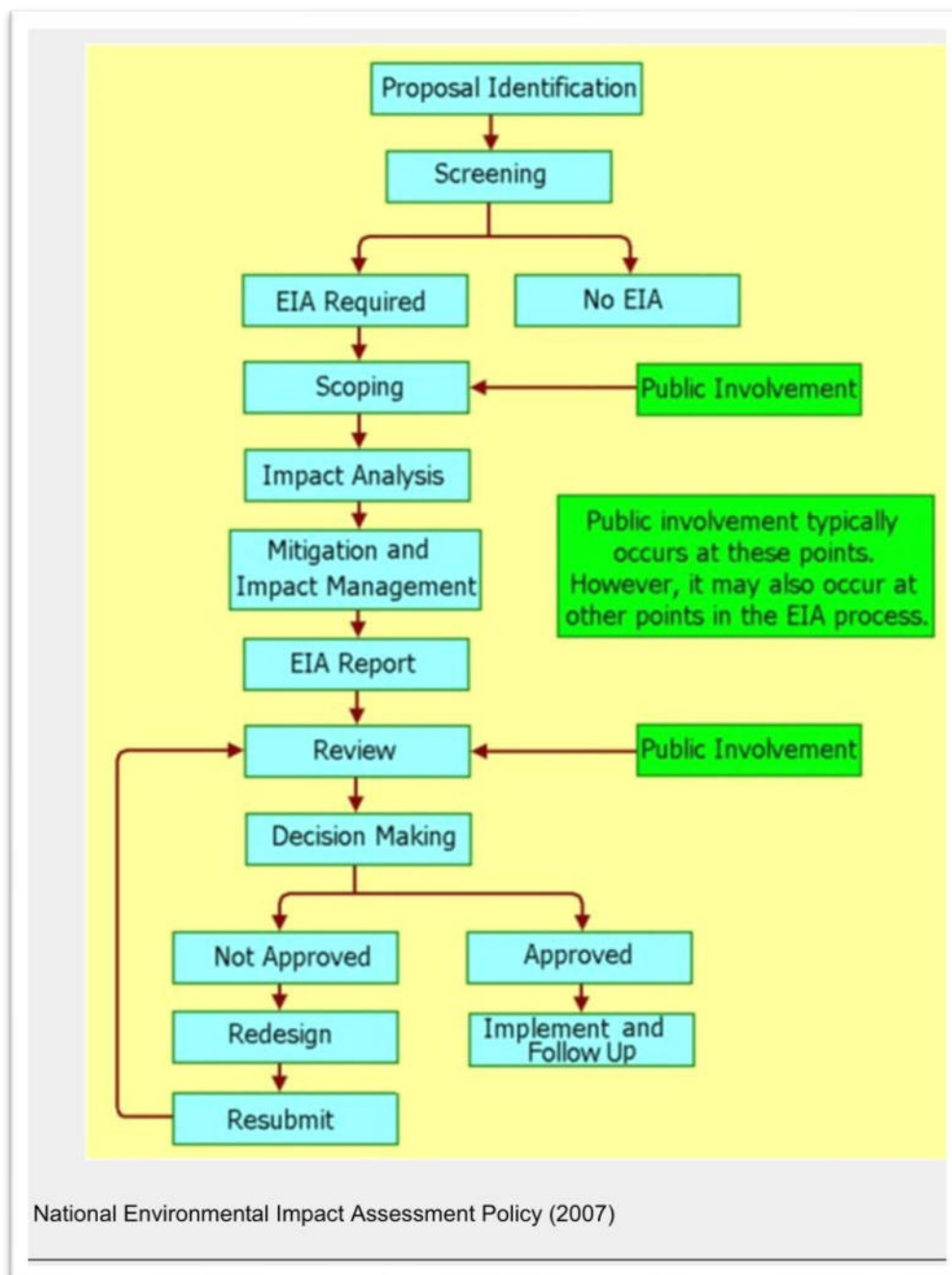
The systematic process to identify, predict and evaluate the environmental effects of proposed projects, plans or policies given in the National EIA policy is described in Figure 1. The policy also describes the timeline for approval of different stages of EIA process as shown in Figure 2.

Under Article 20 of the Environment Law, NEPA shall appoint an EIA Board of Experts to review, assess and consider applications and documents submitted by proponents for obtaining permits and make

¹Taylor, D. A. 200). Policy: new environment law for Afghanistan. *Environmental Health Perspectives*, 114(3). <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1392251/>

technical recommendations in regard to whether to issue permits, as well as the conditions that should be attached to any permit that is granted.

Figure 1: Schema for the EIA Process in Afghanistan

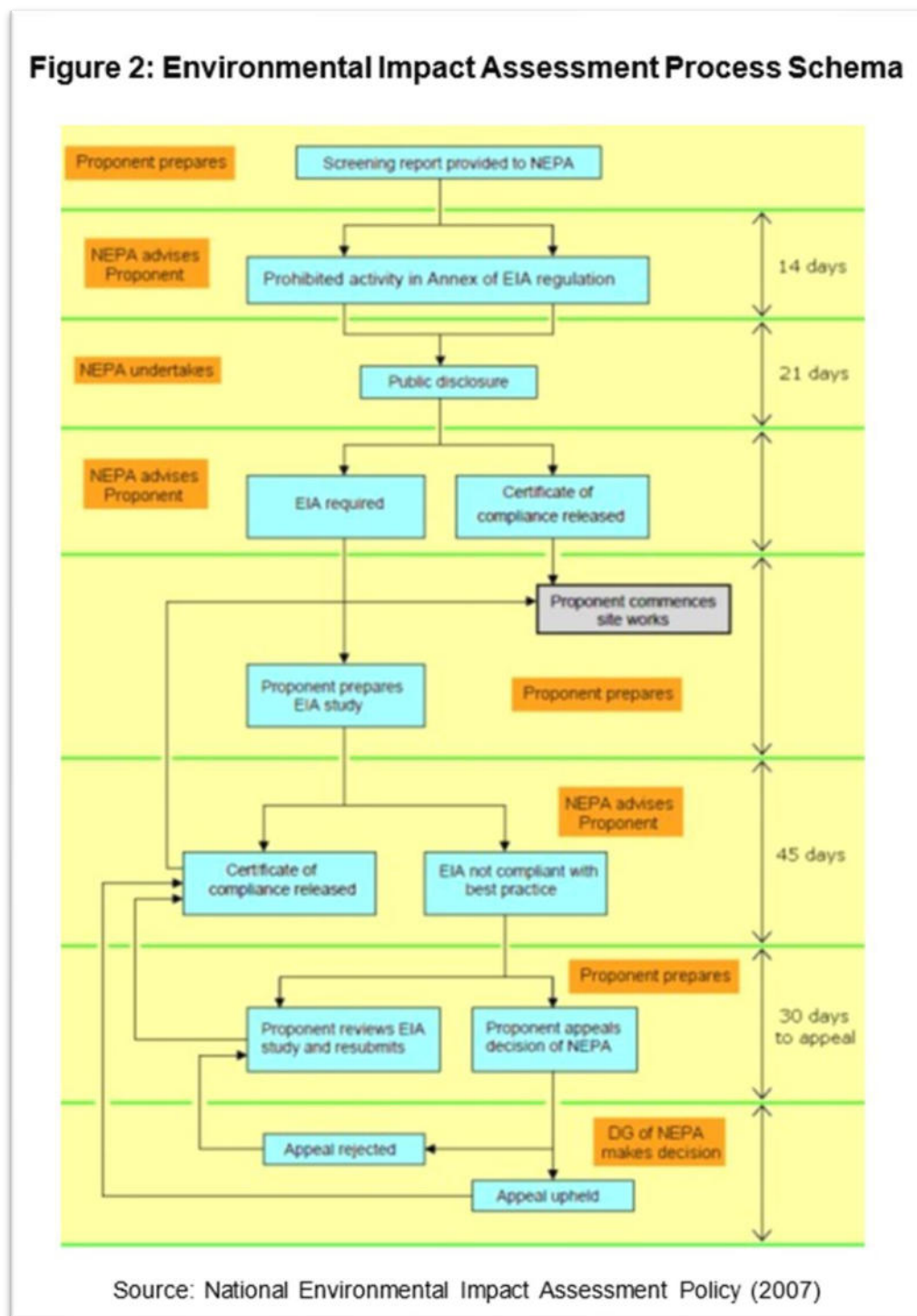


National EIA policy provides a project screening list which categorizes different projects based on the likelihood of the significance of the impacts stemming from particular projects. Projects with potentially adverse impacts are generally divided into the following two categories:

Category 1 Activities: Set out in the National EIA Policy 'Project Screening Lists', are those activities likely to have significant adverse environmental impacts that are sensitive, diverse, or unprecedented, and that will impact a broader area than the sites or facilities subject to the physical works of the activity.

Category 2 activities: Set out in the National EIA Policy 'Project Screening Lists', are those activities likely to have potential adverse impacts on human environments or environmentally sensitive areas that are less adverse than those of Category 1 activities, are site-specific, and in most instances are not irreversible.

Figure 2: Schema for the EIA Process in Afghanistan.



National EIA policy, Category 1, Section F: Water Supply and Treatment, states that water supply schemes and treatment plants with a total cost of \$400,000 USD as a project are likely to have significant adverse impacts.

Once the application form and other relevant documents are submitted to NEPA, according to the agency EIA regulations, NEPA will: (i) issue a Certificate of Compliance, with or without conditions, or (ii) advise the applicant in writing to review the technical reports and address the concerns of NEPA.

Administrative Guidelines for the Preparation of Environmental Impact Assessments (June 2008). These guidelines were prepared as a companion to the 2008 Regulations, to guide proponents on interacting with NEPA, on public consultation, and roles and responsibilities of stakeholders.

The Environmental Law establishes a clear legislative framework and defines the overarching role of NEPA as an independent agency for environmental governance in the country. NEPA has overall responsibility to address policy and legal issues as well as environmental management in coordination with other related departments.

In coordination with other government offices and external agencies, NEPA is in the process of drafting and updating environmental regulations and guidelines for the country's environmental management. Presently, there exist the following environmental laws, regulations, guidelines and policies:

- (i) Environmental Law (2005 and 2007), and;
- (ii) National Environmental Impact Assessment Policy "An Integrated Approach to Environmental Impact Assessment in Afghanistan," November 2007.

The Environment Act was approved by the Cabinet in December 2005. The Environment Act was developed by NEPA over a period of two years with the assistance of international experts, including extensive stakeholder consultation with concerned ministries, quasi-government agencies, civil society and other interested parties. The Environmental Law was approved by the National Assembly and became part of the Islamic Republic of Afghanistan Official Gazette No. 912, dated 25 January 2007.

The Act has been promulgated to give effect to Article 15 of the Constitution of Afghanistan and provide for the management of issues relating to rehabilitation of the environment and the conservation and sustainable use of natural resources, living organisms and non-living organisms.

The Environmental Law contains a specifically designed legal framework needed to sustainably manage Afghanistan's natural resources and rehabilitate its damaged environment. The law also clarifies institutional responsibilities and contains the compliance and enforcement provisions required to allow the Government to enforce the legislation. The law is a fundamental prerequisite to enable NEPA to fulfil its mandate. The primary objectives of the law are to:

- (i) Improve living conditions and protect the health of humans, fauna, and flora;
- (ii) Maintain ecological functions and evolutionary processes;
- (iii) Secure the needs and interests of present and future generations;
- (iv) Conserve natural and cultural heritages; and, facilitate the reconstruction and sustainable development of the national economy.

The Environmental Law (2007), Article 19, provides a legal framework for public consultation during environmental assessment.

Article 19, public participation²: Affected persons may express their opinion on a proposed project, plan, policy or activity, preliminary assessment, environmental impact statement, final record of opinion and comprehensive mitigation plan, before the approval of the project, plan, policy or activity, and the proponent must demonstrate to the NEPA that affected persons have had meaningful opportunities, through independent consultation and participation in public hearings, to express their opinions on these matters on a timely basis.

NEPA shall not reach a decision on any application for a permit until such time that the proponent has demonstrated to the satisfaction of NEPA that copies of the document has been distributed to affected persons, informed the public that the document is being made available for public review by advertising the document and displaying a copy of it for inspection, and convened and recorded the proceedings of a public hearing.

² The Environmental Law of the Islamic Republic of Afghanistan 2007.

After NEPA has reviewed the conditions set forth in item 3 above, NEPA shall reach a decision, inform the public of that decision and make available any relevant documentation or information for public review.³

In December 2014, the Access to Information Act was signed by the President of Afghanistan. It has four objectives:

- (i) To ensure the right of access to information for all citizens from the government and non-government institutions;
- (ii) To observe Article 19 of International Covenant on Civil and Political Rights (i.e. freedom to seek, receive and impart information and ideas of all kinds etc.) consistent with the tenets and provisions of Islam; Article 3, Afghanistan Constitution;
- (iii) To ensure transparency and accountability in the conduct of governmental and nongovernment institutions;
- (iv) To organize request processing and provision of information.

Water Law (2009). The Water Law states that water is owned by the public and that the Government is responsible for water protection and management. It assigns responsibilities to government institutions for management and protection of water resources, water ownership, and regulates water ownership fees, rights, permits, and usage.

Afghanistan's water law is one component of the country's strategy to integrate its water systems and institutions. The water law recognizes the key role of local Water Users Associations in the protection and management of water resources. The MEW has responsibility for setting up Water User Associations (Article 10), and MAIL has the task of setting up Irrigation Associations (Article 11). Throughout years of conflict, NGOs developed and maintained strong links with rural communities in all provinces. The Afghanistan Urban Water Supply and Sewerage Corporation (AUWSS) proposes broadening their role to coach Water Users Associations and members of Community Development Councils in conservation techniques and water management systems. In particular, the AUWSS advocates end-user participation in decision making relating to water resource management, operation and maintenance of water supply systems and agreeing water use allocations.

Law on the Protection of Historical and Cultural Properties, Issue No. 828 (2004). After defining the material falling within its scope, the law sets forth the State's interest and rights in such materials, specifies prohibited and regulated activities involving such materials, and establishes enforcement measures such as penalties and fees.

Pesticide Regulations (1989). Afghanistan has had pesticide regulations since 1989, but they have never been enforced due to lack of resources. A draft Pesticide Law dating from 2009 has yet to be enacted.

Environmental Standards. Afghanistan has not established national environmental standards or guidelines for air quality, noise, or water quality in respect of human health, aquatic health, irrigation, soil, etc. In the absence of national standards, an accepted international practice is to follow the guidance provided by IFC (2007) Environmental, Health, and Safety Guidelines. The Ministry of Mining, for example, uses this publication in its environment, health, and safety regime. World Health Organization (WHO) standards are routinely used for drinking water quality.

The Law on Land Expropriation sets out the provisions governing the expropriation or acquisition of land for public interest purposes, such as the establishment/construction of public infrastructure or for acquisition of land with cultural or scientific values, land of higher agricultural productivity and large gardens.

³ Unofficial English translation

Accordingly, the Law declares that:

- (i) Acquisition of a plot or portion of a plot land for public use is decided by the Council of Ministers and is compensated at fair value based on current market rates (Article 2).
- (ii) The right of the owner or land user will be terminated three months prior to the start of civil works on the project and after the proper reimbursement to the owner or person using the land has been made. (Article 6); and
- (iii) The value of land, value of houses and buildings on the land and value of trees and other assets on the land will be considered for compensation (Article 8;) and compensation is determined by the Council of Ministers.

ADB

a) Policies

Safeguard Policy Statement (2009). SPS 2009 is ADB's safeguards policy document. It describes the common objectives and policy principles of ADB's safeguards and outlines the delivery process for ADB's safeguard policy. SPS 2009 promotes sustainability through protection of people and the environment from the adverse impacts of projects, and by supporting the strengthening of country safeguard systems. It presents a consistent, consolidated framework for environment, resettlement, and indigenous people's safeguards.

Public Communications Policy (2011): guides ADB's efforts to be transparent and accountable to the people it serves, which it recognizes are essential to development effectiveness. The policy recognizes the right of people to seek, access, and impart information about ADB's operations, and it aims to enhance stakeholders' trust in and ability to engage with ADB, through proactive disclosure, presumption in favor of disclosure, recognition of the right to access and impart information and ideas, country ownership, limited exceptions, and the right to appeal.

b) Guidance

Selected References for Good Practice in Environmental Safeguards Implementation (2014). This internal Central and West Asia Department document presents internet hyperlinks to exemplary environmental safeguards documents (IEEs, EIAs, EARFs, etc.) prepared for projects in these countries.

IFC Environmental, Health and Safety Approaches for Hydropower Projects

The Environmental, Health, and Safety (EHS) guidelines of the International Finance Cooperation (IFC) are technical reference documents with general and industry specific examples of good international industry practice⁴. The EHS guidelines contain the performance levels and measures that are generally considered to be achievable in new facilities by existing technology and reasonable costs. EHS guidelines shall be used for environmental assessments.

The following environmental impacts are addressed:

- (i) Terrestrial habitat alteration;
- (ii) Aquatic habitat alteration;
- (iii) Electric and magnetic fields;
- (iv) Hazardous materials;
- (v) Revegetation of disturbed areas with native plant species;
- (vi) Removal of invasive plant species during routine vegetation maintenance;
- (vii) Avian and Bat Collisions and Electrocutions;
- (viii) Aquatic habitat alterations due to associated access roads;

⁴ International Finance Cooperation (2018) Environmental, Health, and Safety Approaches for Hydropower Projects

- (ix) Removal of riparian vegetation;
- (x) Sedimentation and turbidity of water courses;
- (xi) Electric and magnetic fields;
- (xii) Storage and use of hazardous materials (PCB in transformer stations);
- (xiii) Occupational health and safety.

The following mitigation measures are proposed:

- (i) Transmission infrastructure and access roads shall be sited out of terrestrial habitats;
- (ii) Avoidance of construction activities during the breeding season;
- (iii) Revegetation of disturbed areas with native plant species;
- (iv) Avoiding clearing in riparian areas;
- (v) Avoiding use of machinery in the vicinity of watercourses;
- (vi) Aligning transmission corridors to avoid critical habitats (e.g. nesting grounds, migration corridors);
- (vii) Maintaining 1.5 meter (60-inch) spacing between energized components and grounded hardware or, where spacing is not feasible, covering energized parts and hardware;
- (viii) Providing alternative sources of water;
- (ix) Assuring provision of adequate environmental flows;
- (x) Modifying operating regimes to ensure timely provision of critical services;
- (xi) Watershed management measures;
- (xii) Providing fish passages/ladders and supporting fish hatcheries to ensure fishing livelihoods and fish populations are maintained.

Environmental impacts related to rehabilitation and construction of irrigation canals are discussed in Section F. Mitigation measures are proposed in this Section using IFC EHS guidelines accordingly.

Environmental Screening and Categories

a) ADB

ADB water resources projects and subprojects are screened using a rapid environmental assessment checklist filled out for the components. This checklist captures the type; location, sensitivity, scale, nature, and magnitude of potential environmental impacts, and availability of cost-effective mitigation measures. Based on the checklist findings, the project or component is assigned to one of the following ADB environmental categories.

Category A – likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An EIA, including an environmental management plan (EMP), is required. The raising of the Dahla Dam has been categorized as Category A, impacts are adverse and cannot be mitigated on site. An EIA report has been prepared accordingly. All hydropower developments are categorized as “Category A” according to ADB environmental assessment guidelines (2003).

Category B – Potential adverse environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for Category A projects. An initial environmental examination (IEE), including an EMP, is required. However, the proposed project comes under **Category B**.

Category C – A proposed project is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed.

b) Government of Afghanistan

NEPA brought the new regulation on Environmental and Social Impact Assessment in the beginning 2018 with annexes to follow while preparing the IEE and EIA reports. In addition to this regulation, other regulations that have been introduced recently are Noise Pollution Prevention and Control Regulation, Water Quality Prevention and Control Regulation; Hospital Waste Management Regulation. Regulation

on Solid Waste (Domestic) Management and Hazardous Waste Management Regulations are in the final process of approval.

As per the Interim EIA Regulation 2008, (construction or upgrading of irrigation or drainage projects serving 15,000 ha or more) falls under Category I, requiring to prepare and submit the Screening Report to NEPA to determine whether the project needs to undertake the Environmental Assessment or can proceed with the approval of the Screening Report itself.

Recently in the beginning of 2018, NEPA promulgated the Environmental and Social Impact Assessment Regulation and as per this new regulation, irrigation projects with more than 15,000 ha command area put in Category II requiring to conduct IEE study.

As per this new regulation, the validity of environmental clearance is of three years and it is the responsibility of the project proponent to inform NEPA the date of initiation of the construction activities as well as the date of start of operation of the project. The proponent should submit monitoring report every year to NEPA during construction and operation of the project.

The proponent of the following projects shall require conducting the IEE study and preparing a report as per the prescribed format (Annex VI of regulation), and in accordance with the procedures outlined for IEE in this regulation, prior to application for environmental clearance to the authority or authorized concerned authority.

Project Description

The NCB-047 irrigation projects are located in Nangarhar Province. NVDA Project wants to pump the water from the main canal of Jalalabad to the Sub Canals with 28 m head along 330 m horizontal distance at Pump Station 1 and 34 m head along horizontal distance of 385 m at Pump Station 2. The reservoir for solar water Irrigation system will need total 35 Submersible Pumps. Each Submersible pump will need 400 solar panels in order in order to pump the required water. The total number of panels will be 14,000. The capacity of each solar panel will be 300 watt. Along with this stuff we also need 12 Rm5g Inverter made of Taiwan. The capacity of each inverter will be 85 hp. For each of Submersible pumps 200 solar panels stand will be needed. The total sum of the solar panels stand will be 7,000.

Figure 3: Subproject location.



Project Layout and Scope

The solar system is typically designed for hotter and milder climatic regions. The long term costs and ability to adapt to changing demands should be implemented to the feasibility of the system. The overall life of the system depends on it being maintained kept clean and securely mounted and

protected from strong winds, lightening and hail storm, and falling objects such as tree branches. The overall life time of the complete system should be designed and maintained to last 25 years. The system should be inspected at least once a week.

Recycling plants, HVAC system (heating, air conditioning), plants of water supply procurement, irrigation system, dewatering system, pressurizing units and fire-fighting system.

SKD -Z: axially split volute casing centrifugal pumps for horizontal installations, coupled with electric motor, with elastic coupling, coupling cover and rigid base frame

Hydraulic design optimized with FEM-C FD systems, structural analysis performed with FEA systems. Axially divided volute: simplified service thanks to the possibility to remove the cover and inspection the pump's rotor without remove e the pump itself from the application. The motor unit and the rotating part of the pump can be taken away without removing the pump body from the system piping.

Double entry radial impeller dynamically balanced.

Stainless steel shaft dimensioned according to DIN 743 and covered with stainless steel sleeves.

Pumps provided of double wear ring: impeller side wear rings and casing side wear rings warrant wear on the rings only (replaceable) and protect impeller and pump body.

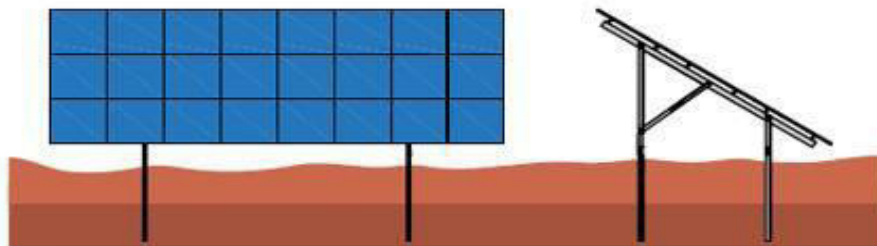
Seal within pump body and cover with fiber gasket for easy and fast maintenance.

Two-component epoxy coating: corrosion resistance corresponding to C3M cycle according to EN 12944-6 (C 5M cycle on request).

The proposed structure for the PV installation has been considered as fixed structure which is a robust, flexible and economically effective system.

The amount of cutting and filling has not been quantified yet, and it is included under the bidder's responsibility to determine that. Since the plant is to be built following the slope of the hill it is not envisage that much cut & filling will be required, although some land compaction and minor grading shall be required for solar structures erection and as well as for internal roads and drainage some minor cutting and filling will be also needed.

Figure 4: Proposed fixed structure (as a sample) for the solar PV installation.



Site Preparation

Topographical survey and geotechnical investigations will be conducted by the contractor.

Contractors are therefore advised to understand the site conditions with a visit to the project site before submitting their bids.

Construction site: contractors should have to established project Store, site office and residence for the Client, Consultant representative at NVDA- Nangarhar inside a bounded compound near the project construction site on main road for the total duration of project period. Security has deployed in 3 shifts of 2 armed securities and 1 supervisor. Bounded compound will have 3 gates at different sides out of which 2 will be facing to main road and 1 will be at other side. Inside the compound there will be house for accommodating Contractor's expertise accompanied with Site & Store Office with sufficient empty yard for storing the project materials. Nearest Hospital is springhare private Hospital, located around 1-km from the Store Compound located on ring road of Jalalabad. Facilities to the Employer's project team shall be provided as per the requirement furnished in contract document. As unskilled workers will be recruited locally hence, they will be released to their homes on finishing of daily routine work hours.

- 1 Contractor offices have sufficient numbers of rooms with sufficient space to accommodate contractors' supervisor and engineers in each bedroom. And following welfare facilities is constituting:
 - Clean potable bottled water is available from local market.
 - Washing facility is available in the accommodations with drainage system connected to local municipal drainage.
 - Sufficient Toilets available with drainage system.
 - Blanket, mattress, plastic bucket and mugs is provided to each expertise.
 - Electricity and air conditioners is adequately placed in the accommodation.
 - Proper sanitation is established in the accommodation to maintain health and hygiene.
 - Gas cylinders and stove is available for cooking food.
 - First Aid box.
 - Fire-fighting equipment.

The site preparation shall include all the work as required for installation of a utility scale solar PV plant as per international practices. This shall essentially include but not be limited to:

Earthwork

Following the site visit prior to bidding and based on previous experience, Contractors are expected to estimate the volume of earthwork required. Site may require:

- Clearing of weeds, chopping down of small bushes and tree
- Demolitions
- Levelling of land with excavation and back filling of soil
- Movement of soil for levelling within the site or by bringing soil from borrow pits
- Grading the soil with south slope, this may be clear after topographical survey
- Trenching
- Construction of culverts on cross flow, if required
- Compaction of minimum 98% shall be required
- Rock blasting

Land Cleaning

This includes the extraction and removal in designated areas of all stumps, weeds, plants, debris, trash, land waste and any other undesirable material. Depending on the type of terrain of each area, the amount of topsoil to be removed and poured into the dump must be determined to ensure there is no organic material.

If dumping is carried out of the area affected by the project, the Contractor shall obtain, by their means, suitable sites for this purpose, and should also provide the Employer copies of contracts with the Employers of the affected lands.

Leveling and Grading

Depending on the site conditions land grading shall be performed in order to achieve the correct leveling and soil base preparation for solar array erection as well as roads and buildings construction. Since selected site is uniformly sloped works will be minimum although proper drainage will need to be implemented to cater with storm water management.

These activities also include the extraction and removal in designated areas of all trees and stumps. Should external materials be brought for esplanades fillings they shall meet the following specifications:

- Organic material less than 0.2%
- Total soluble salts less than 0,2%
- Maximum size less than 100 mm
- Analysis according to ASTM D-422-63 - Method for particle-size analysis of soils.
- Cross sieve n°10 less than 80%,
- Cross sieve n°40 less than 75%,
- Cross sieve n°200 less than 25%.
- Liquid limit (Atterberg Limits) $LL < 30$ (ASTM D4318).
- Plastic limit (Atterberg Limits) $PL < 10$ (ASTM D4318).

The fillings are made of layers with a maximum thickness of 0.3 m. After extending the material shall be compaction to a density greater than or equal to 95% of the maximum obtained in the Modified Proctor Test (in the absence of another value in the project or Private Technical Specification), proceeding if necessary to the wetting or drying to obtain the required density.

Trenches and Pits Excavations

The excavations dimensions will adjust to drawings, in any case, cannot be lower than these.

When performing digging foundations, axis must be centered with respect to the armatures or structure. When the terrain features force to perform shoring, or water removal, these tasks will be in the Contractor's scope.

Internal Roads and Pathways

All roads shall be designed and constructed to allow smooth on site transportation and delivery of all project components to installation location and heavy equipment to their respective work locations.

The design must be approved by Employer, to serve expected traffic and geotechnical land characteristics, the Contractor will be responsible to design them taking into account the needs during construction and O&M.

Main approach and internal roads shall be designed for a life of 25 years. Roads shall be constructed at minimum 250 mm above ground with required cutting of soil, grading to the given slopes, backfilling and due compaction.

In general terms, it is necessary to provide cross slope at roads to ensure that rain water will be discharged into drains along the path, the usual value is near 2%. Also, the water recollected at the longitudinal drains must be carried until a point where it could be evacuated or stored.

For designing access roads, general longitudinal slope must be less than 8 %. To design the radius of curves, it is necessary to consider the size of trucks to carry materials for construction (concrete, steel, gravel, sand, others), PV panels, electrical equipment (cabinet, transformers, inverters, others). As a general consideration 15 meters' radius in the internal line shall be kept.

If a culvert(s), and /or tunnel(s), trench(s) or any other underground services are crossing roads and railways, other ducts and channels, etc. these shall be constructed as bridges calculated for heavy truck loading.

Gravel Roads

Gravel road materials are defined as granular material, continuous particle size, used as a firm layer. It can be artificial gravel consisting wholly or partly crushed particles in the minimum specified in each case. Natural Gravel consists mainly of crushed particles.

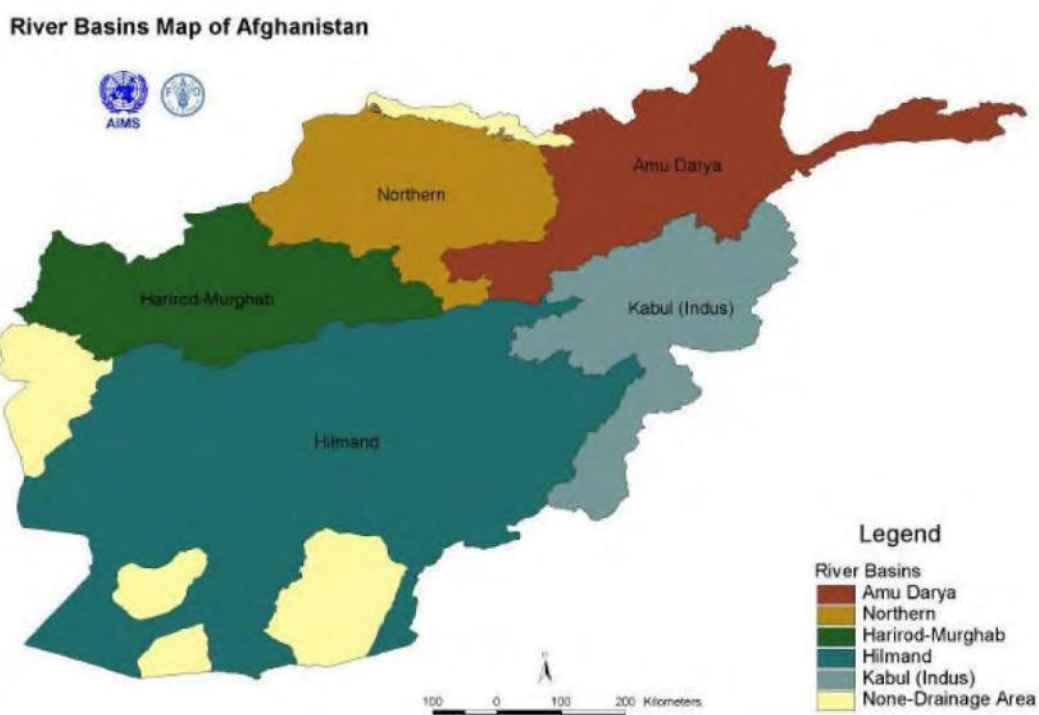
Environmental Baseline

Physical Resources

Surface Water

Most hydrologic and climatic data-collection activities in Afghanistan were interrupted in the early 1980s because of war and civil war and therefore, most investigations have made considerable use of remotely sensed data and, where available, historical records to investigate the water resources of the country (Mack, 2010).

Figure 5: Afghanistan rivers basins map (UN-FAO, 2012).



The nearest water body close to subproject is the Kabul River which is located 11 km away from subproject area. The Kabul river tributaries such as Logar River, Pajsheer River, Surkhrod River and Kunar River.

Due to outbreak of Covid-19 the CPMO's environment team could not visit the site for data collection. Hence, no water analysis has been undertaken for the subproject area. Moreover, the water of Kabul river basin in Jalalabad city has been analyzed two years back in May, 2018 by DACCAR for (Jalalabad-Kunar and Ghazni-Sharana 220 kV Transmission Line Projects). The below table represent the physical laboratory test results.

Table 1: Kabul Rivers Water Physical Test Analysis.

No	Province	District	Source	EC (μS/cm)	TDS (mg/l)	pH	Turbidity	ORP (mV)	Sample Date
1	Nangarhar-Jalalabad	Surkh Rod	Kabul River	461	317	8.03	15.87	182	12/05/18

The depth of ground water in subproject area is 40 meter. Due to Covid 19 the team did not visit the site and no water analyzed has been undertaken for groundwater. Water quality data will be collected before the start of civil work to establish baseline condition of the study area and will be included as appendix with IEE study

Acoustic Environment

The noise baseline in the subproject area varies and is from low to moderate. Outside the Jalalabad City the noise level low. The noise level in most of the transmission line route is 50- 70 dBA. The main source of noise at subproject area is road traffic.

Air quality

Due to outbreak of Covid-19 the CPMO's environment team could not visit the site for data collection. Hence, no air analysis has been undertaken for the subproject area air quality data will be collected before the start of civil work to establish baseline condition of the study area and will be included as appendix with IEE study.

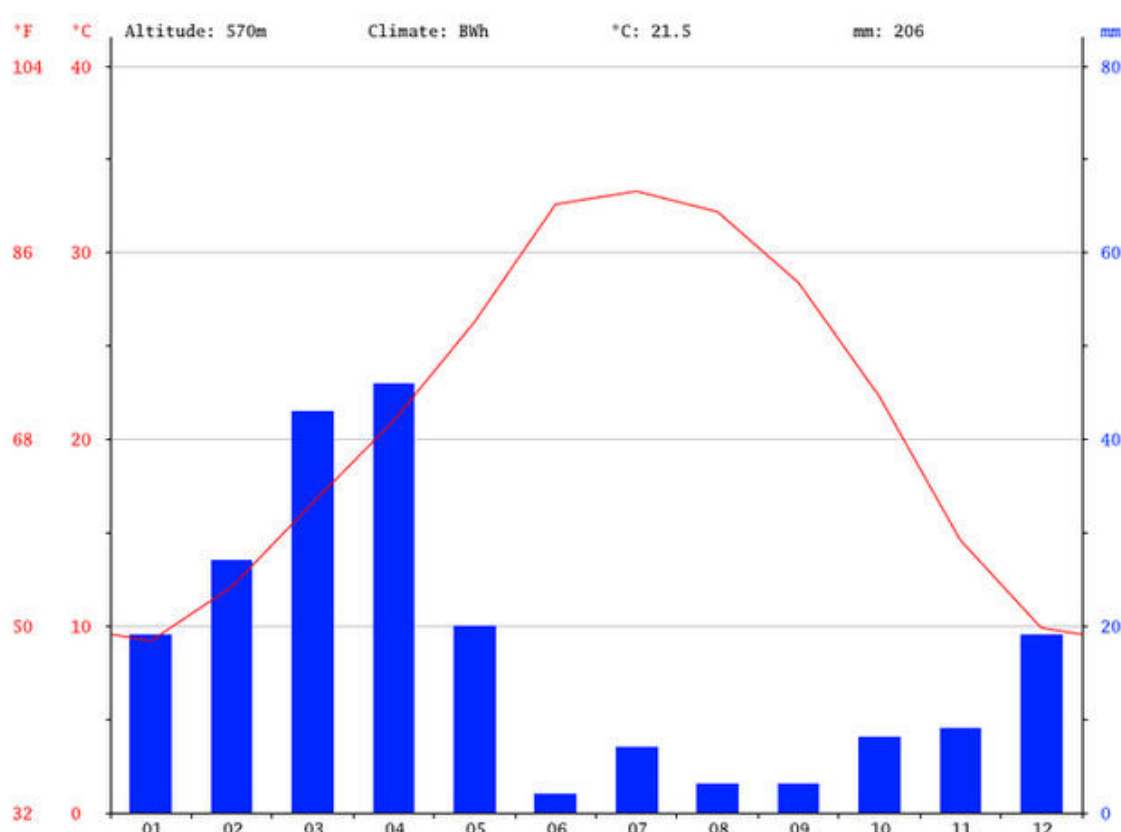
Topography and Geology

Nangarhar is 599 m above sea level and covers an area of 7,616 km². More than half (54.8%) of the province is mountainous and 39.5% is flat land. The province is divided into 21 districts. The provincial capital is Jalalabad with a population of about 205,423.

Climate Condition

In Jalālābād, the summers are long, sweltering, dry, and clear and the winters are cold and mostly clear. Over the course of the year, the temperature typically varies from 34°F to 100°F and is rarely below 26°F or above 105°F. Based on the beach/pool score, the best time of year to visit Jalālābād for hot-weather activities is from mid-May to mid-September.

Figure 6 Nangarhar Province Climate graph.



The hot season lasts for 4.0 months, from May 16 to September 17, with an average daily high temperature above 90°F. The hottest day of the year is July 4, with an average high of 100°F and low of 79°F.

The cool season lasts for 3.0 months, from December 4 to March 5, with an average daily high temperature below 61°F. The coldest day of the year is January 24, with an average low of 34°F and high of 51°F.

The length of the day in Jalālābād varies significantly over the course of the year. In 2020, the shortest day is December 21, with 9 hours, 51 minutes of daylight; the longest day is June 21, with 14 hours, 28 minutes of daylight.

Land Use

The project selected area is currently free and is not suitable for irrigation purposes. The area is plain covered by stones and gravel with no wildlife and indigenous people living near the project area. Therefore, has minimal land use adverse impacts. There are some natural plants observed which are not scarce type and are commonly available in the surrounding area.

Afghanistan is located in the middle of Central Asia within a zone of high seismic activity. For the purposes of seismic resistant design, all the design institutes use the new seismic code: "Norms and Regulations for Construction in Seismic Zones". The present norms establish the requirements showed to designing and construction new and reconstruction buildings in areas with seismic intensity VII, VIII, IX (by Medvedev Sponheuer Karnik (MSK)-scale) and more. In this project case the seismic activity is grade VIII (8) points in accordance with this local standard regulation. Several micro earthquake studies near Kabul, Afghanistan, showed clusters of earthquake epicenters near or along the trace of the Nangarhar faults.

The project site does not have any visible surface water available neither the nearby surrounding area, except Kabul River that runs at 15km distance of the site. The underground water is available at 20 meters.

Biological Environment

Afghanistan has the unique distinction of being the original home of a very large number of plant and animal species, a majority of which are endemic. Afghanistan retains a wide variety of fauna. Though, most of the country is subject to some degree of land degradation, notably that resulting from some 30 years of war, deforestation and desertification.

Afghanistan is a home to diversity of species like, 119 species of mammals, 460 species of birds, four species of reptiles, and hundreds of species of insects and fish. 137 species of wildlife have been listed as either vulnerable or endangered on the ICUN Red List 2015. The actual number of threatened species may be higher than they said, nevertheless, as fundamentally no wildlife research has been undertaken in Afghanistan for many years.

a) Flora

According to local people and site visits of PIO engineers, the flora of the study area are thorn, white thorn, Giant Wild Rye, Menthe pulegium, and wild plants.

b) Fauna

The main reptiles in subproject area are snake, lizard, and scorpions. The main amphibian are frog, tortoise, and Crocodile Alligator. The main mammals are jackal, wolf, fox, squirrel, rabbit, bats, wild hare and mice and rats in the subproject area. The main birds are dove and Afghani snow finch.

c) Fishes

The nearest river close to project area is the Kabul River. Kabul River basin is dominated by a variety of cyprinid snow trout (Schizothoracini) and cobitids. Based on FAO report in the past production from the fish farms in Darunta (in 4 KM distance from solar project command area) and the adjacent Darunta Reservoir, reached 30 tons in 1973. In 1992 the Darunta Dam was extremely damaged in the war and recent statistics are not available.

Socioeconomic Environment

Nangarhar province which is located in the eastern part of Afghanistan. More than half of province is mountainous (55%) while the rest is made up of flat or semi-mountainous land.

Nangarhar last known population is 1 574 000 (year 2018). This was 4.505% of total Afghanistan population. In this year, Nangarhar population density was 206 p/km². If population growth rate would be same as in period 2006-2018 (+1.68%/year), Nangarhar population in 2020 would be: 1 627 251.

People in the project area live in the traditional Afghan house or part of a shared house, occupied by an extended family. These conditions are quite uniform. Houses are made of traditional material and therefore it can be said that the age of the premises is relatively young.

Nangarhar University is the only government university which have nearly 6,000 students. A number of schools operate in the province, providing basic education to both boys and girls. The overall literacy rate (6+ years of age) increased from 29% in 2005 to 31% in 2011. The overall net enrolment rate (6–13 years of age) increased from 39% in 2005 to 51% in 2011.

The Jalalabad Airport is located next to the city of Jalalabad. It serves the populations of Nangarhar, Kunar, Nuristan, and other nearby provinces. The Kabul–Jalalabad Road runs throughout the province, linking Kabul with Jalalabad and extending east through Khyber Pass to Peshawar. It is one of the busiest major roads in Afghanistan.

Nangarhar can be called the food basket of Afghanistan. The good climate in this province provides good environmental condition various crops during different seasons. There is a trend to increased vegetable production due to market demand and its price. DAI, RI, GAA, and ICARDA are the main organizations promoting agriculture in the area. Most farmers have livestock with sheep and goats being dominant.

Figure 7: Nangarhar province agriculture crops and import, export crops.

Main Agricultural Crops		Important Export Crops
Fruit and Nuts	Grape	
	Orange, Watermelon	
	Walnut/Mulberry	
Grains	Wheat, Maize	Grape, Watermelon
Vegetables	Onion, Potato	Walnut
Industrial	Cotton, Sugarcane	Potato, Pomegranate

The project site and the nearby areas have no cultural and historically important sites. There is no signs and details of archeological findings at the site.

Anticipated Impacts and Mitigation Measures

This Chapter assesses the project for key environmental and social aspects, identifies significant potential impacts that may be caused by the project activities and proposes appropriate mitigation measures to address these impacts.

Impact Assessment Methodology. The significance of potential impacts was assessed using the risk assessment methodology that considers impact magnitude and sensitivity of receptors, described below. Tools used, number of stakeholders interviewed, etc.

Impact Magnitude. The potential implications of the project have been categorized as major, moderate, minor or nominal based on consideration of the parameters such as i) duration of the effect; ii) the spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria.

The magnitude of each potential impact of the Project has been identified according to the categories outlined in Table 2.

Table 2: Parameters for Determining Magnitude

Parameters	Major	Moderate	Minor	Minimal
Duration of potential impact	Long term (beyond the project period)	Medium Term Lifespan of the project (within the project period)	Limited to construction period	Temporary with no detectable potential impact
Spatial extent of the potential impact	Widespread far beyond project boundaries	Beyond next project components, site boundaries or local area	Within project boundary	Specific location within project component or site boundaries with no detectable potential impact
Reversibility of potential impacts	Potential impact is effectively permanent, requiring considerable intervention to return to baseline	Benchmark needs a year or so with some responses to come back to baseline	Baseline returns naturally or with limited response within a few months	Baseline remains constant
Legal standards and established professional criteria	Breaches national standards and or international guidelines/obligations	Complies with limits given in national standards but violates international lender guidelines in one or more parameters	Meets minimum national standard limits or international guidelines	Not applicable
Likelihood of potential impacts occurring	Occurs under typical operating or construction conditions (Certain)	Happens under worst-case (negative consequences) or best case (positive impact) working conditions (Likely)	Occurs under abnormal, exceptional or emergency conditions (occasional)	Unlikely to happen

Sensitivity of Receptor. The sensitivity of a receptor has been determined based on a review of the population (including proximity/numbers/vulnerability) and the presence of features on the site or the surrounding area. Each detailed assessment has defined sensitivity to the topic. Criteria for determining receptor sensitivity of the Project's potential impacts are outlined in Table

Table 3 Criteria for Determining Sensitivity.

Sensitivity Determination	Definition
Very Severe	Vulnerable receptor with little or no ability to absorb proposed changes or minimal opportunities for mitigation.
Severe	Vulnerable receptor with little or no ability to absorb proposed changes or limited opportunities for mitigation.
Mild	Vulnerable receptor with some ability to absorb proposed changes or moderate opportunities for mitigation
Low	Vulnerable receptor with good ability to absorb proposed changes or/and excellent opportunities for mitigation

Assessing Significance. Following the assessment of impact magnitude and determining the quality and sensitivity of the receiving environment or potential receptor, the significance of each potential impact was established using the impact significance matrix shown in Table 4.

Table 4: Criteria for Determining Impact Significance.

Magnitude of Impact	Sensitivity of Receptors			
	Very Severe	Severe	Mild	Low
Major	Critical	High	Medium	Negligible
Moderate	High	High	Medium	Negligible
Minor	Medium	Medium	Minor	Negligible
Minimal	Negligible	Negligible	Negligible	Negligible

Anticipated impacts and mitigation measures have been discussed considering following four key phases of this SPP project:

- Design site evaluation phase
- Construction phase
- Operation Phase
- Decommissioning phase

Impacts during Design and Site Evaluation

Solar energy site evaluation and design impacts such as site characterization and monitoring are generally temporary and of relatively lesser magnitude. These activities are conducted at a less significant scale than those at the construction and operation stages. Possible impacts from these activities have presented below. The impacts includes ground clearing (removal of vegetative cover), vehicular and pedestrian traffic, and drilling to characterize subsurface conditions (e.g., soils, depth to groundwater).

Surveys conducted during this phase to evaluate the presence and/or significance of cultural resources in the area would assist developers in designing the project to avoid or minimize impacts to these resources.

The below potential impacts might result from the project site evaluation activities.

Physical Environment

Impacts on Acoustic Environment and Mitigation Measures

Activities related to the site evaluation will generate low levels of intermittent and temporary noise. Drilling tasks, if required, and the use of larger equipment related with drilling activities, will generate the most noise during this phase, but impacts would be much lower than those that could occur during construction.

Sitting and design considerations that mitigate impacts include: The contractor should take measurements to assess the existing noise levels at the project site and compare them with the expected noise levels associated with the project. Nearby residences and likely sensitive receptors should be identified at this time. Wherever feasible, integrate low-noise systems, such as ventilation systems, pumps, generators, compressors, and fans.

Impact of/on	Extent of impact
Acoustic environment	=Low

Impacts on Air Quality and Mitigation Measures

Impacts to air quality during site activities will be limited to temporary and local generation of vehicle and equipment emissions and fugitive dust from vehicle traffic and ground disturbances. These impacts are unlikely to cause an exceedance of air quality standards, or impact climate change.

Sitting and design considerations that mitigate the impacts include: Surface access roads and on-site roads with aggregate materials, wherever appropriate. Minimize the amount of disturbance and areas cleared of vegetation. Stage construction to limit the exposed area at any one time, whenever practical. Require emission control devices on drilling and other equipment and specify use of low-sulfur fuels to reduce emissions.

Impact of/on	Extent of impact
Air quality	=Low

Impacts on Soils and Geologic Resources (including Seismicity/Geo Hazards) *And Mitigation Measures*

Surface disturbance and use of geologic materials are minimal during the site activities phase, and soils and geologic resources are unlikely to be affected. Site characterization activities would also be unlikely to activate geological hazards or increase soil erosion.

Sitting and design considerations that mitigate impacts include:

- Identify soil properties, engineering constraints, corrosive potential, and facility design criteria.
- Identify and avoid areas with unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and Geologic structure).
- Develop a site grading and management plan to identify areas of disturbance, areas of cut and fill, slope during and after grading, existing vegetation, and measures to protect slope, drainages, and existing vegetation in the project area.
- Develop an erosion control and re-vegetation plan to delineate measures to minimize soil loss and reduce sedimentation to protect water quality.
- Minimize the amount of land disturbed as much as possible by using existing roads, and
- Disturbed areas. Minimize unnecessary vegetation removal. Stage construction to limit the exposed area at any one time, whenever practical.

- Place access roads to follow natural topography, and avoid or minimize side hill cuts.
- New roads should avoid going straight up grades in excess of 10%. Design roads with eventual reclamation in mind.
- Pave roads used for construction traffic, if feasible.
- Locate facility structures to comply with the setback requirements of the site grading and drainage plan to avoid disturbing natural watercourses.
- Use special construction techniques in areas of steep slopes, erodible soils, and stream crossings.
- Design runoff control features to minimize soil erosion.
- Construct drainage ditches only where necessary. Use appropriate structures at culvert outlets to prevent erosion (TEEIC, 2017).

Impact of/on	Extent of impact
Soils and Geologic Resources	=Low

impacts on Water Resources and Mitigation Measures

Minimal impacts are anticipated on water resources, local water quality, water flows, and surface water/groundwater. Very little water is likely be used or generated during the construction phase. Any water needed could be trucked in from off-site (i.e. Kabul River). The following are examples of mitigation measures that could be applied to reduce water resource impacts.

- Research the area hydrogeology. Find out areas of groundwater discharge and recharge and their potential relationships with surface water bodies and groundwater quality. Avoid creating hydrologic conduits between two aquifers.
- Identify sustainable yields of groundwater and nearby surface water bodies.
- Identify and avoid unstable slopes and local factors that can cause slope instability (groundwater conditions, precipitation, seismic activity, slope angles, and geologic structure).
- Limit the withdrawal of water at the facility so it does not exceed the sustainable yield.
- Develop a contingency plan to prevent potential groundwater and surface water contamination.
- Develop a storm water management plan to ensure compliance with regulations and prevent off-site migration of contaminated storm water or increased soil erosion.
- Minimize the planned amount of land to be disturbed as much as possible. Use existing roads.
- Where access roads would cross a dry wash, the road gradient should be 0% to avoid
- Diverting surface waters from the channel.
- Do not alter or restrict existing drainage systems, especially in sensitive areas such as erodible soils or steep slopes. Cross water bodies at right angles to the channel and/or at points of minimum impact (TEEIC, 2017).

Impact of/on	Extent of impact
Water resource	=Low

Hazardous Materials and Waste Management

Impacts from use, storage, and disposal of hazardous materials and waste will be minimal (because of the minimal amounts of hazardous materials used) to nonexistent if appropriate management practices are followed. Following mitigation measures will help minimize the waste impacts:

- Develop a hazardous materials management plan addressing storage, use, transportation, and disposal (interim and final) for each item in the comprehensive list.
- Develop a waste management plan identifying anticipated solid and liquid waste streams and addressing determination, inspection and waste minimization procedures, storage locations, and waste-specific management and disposal requirements. Include a recycling strategy to be practiced by workers during all project phases.
- Prepare a comprehensive list of all hazardous materials to be used, stored, transported, or disposed of during all phases of activity.
- Develop a spill prevention and response plan for addressing storage locations of
- Hazardous wastes, spill prevention measures, training requirements, waste-specific spill response actions, spill response kits, and notifications to authorities.

Impact of/on	Extent of impact
Hazardous Materials and Waste Management	=Low

Biological Environment

Impacts to ecological resources (vegetation, aquatic biota, wildlife, special status species, and their habitats) will be minimal during site construction because of the limited nature of the activities.

Surveys conducted during this phase to evaluate the presence and/or significance of ecological resources in the area would assist PIU in siting and designing the project and routing the rights-of-way (

to avoid or minimize impacts to these resources (e.g., wetlands, species and birds). Siting and design considerations that will mitigate impacts include:

- Review existing information on species and habitats in the project area. Contact appropriate agencies early in the planning process to identify potentially sensitive ecological resources that may be present in the project area.
- Ensure protection of important resources by establishing protective buffers to exclude unintentional disturbance.
- Educate workers regarding the occurrence of important resources in the area and the importance of their protection, including the appropriate regulatory requirements.
- Develop a spill management plan.
- Minimize the amount of land disturbance and develop and implement stringent erosion and dust control practices.
- Develop site fencing.

Impact of/on	Extent of impact
Biological Environment	=Low

Socioeconomics

Site evaluation activities are temporary and limited and would not result in socioeconomic impacts on employment, local services, or property values.

There may be visual impacts from the presence of equipment and access roads, potentially impacting the recreational experience. Site evaluation activities are unlikely to affect mining activities, military operations, or aviation.

Impact of/on	Extent of impact
Socio-economics	=Low

Human Health and Safety

Occupational and public health and safety risks normally associated with construction and outdoor activities exist, but are very limited during the construction phase because of the limited range of activities and number of workers. Siting and design considerations that mitigate impacts include:

Conduct a safety assessment to describe potential safety issues (site access, construction, work practices, hazardous materials, security, transportation of heavy equipment, traffic management, emergency procedures, wildlife encounters, and fire control and management) and measures to mitigate them.

Develop and implement a health and safety program for workers and the public, addressing all of the safety issues identified in the assessment and all applicable safety Standards.

Consult with local planning authorities regarding traffic and traffic hazards. Address specific issues (e.g., school bus routes and stops) in a traffic management plan or in the Health and safety program.

Fence the site to prevent public access (TEEIC, 2017).

Impact of/on	Extent of impact
Human health and safety	=Low

Impacts during Construction

Considering scale and nature of construction activities, and low sensitivity of the environment it is expected that the project will have site-specific impacts on area's topography and soils. The magnitude of impacts related to air and water pollution, noise and vibration is likely to be from minimal to site-specific as there are no sensitive receptors in the project area. Minimal impacts are anticipated to biological environment due to low biodiversity in the project area. Social impacts of the project during construction will include job opportunities for local population, and economic benefits for small businesses involved in catering, and farmers selling agricultural products to construction camps. The details of the impact assessment during construction phase are provided below.

Physical Environment

Impacts on Topography and Mitigation Measures

All utility-scale solar energy facilities require relatively large areas for solar radiation collection when used to generate electricity at utility-scale. Solar facilities may interfere with existing land uses such as pastures, irrigated and uncultivated lands, wild animal habitats and burro management, military uses, and minerals production. Solar facilities could also impact the use of nearby specially designated areas such as wilderness areas, areas of critical environmental concern, or special recreation management areas. In this instance, these impacts are minimal in this project. Proper siting decisions can help to avoid land disturbance and land use impacts.

Magnitude of cut and fill impacts is minimal. Since the plant is to be built following the slope of the hill, excessive cut and fill is not envisaged. Therefore, the project soil erosion and topographic impacts are minimal, although some land compaction and minor grading shall be required for solar structures

erection. For the internal roads and drainage some minor cut and filling will be also required with minimal negative environmental impacts.

Access road will be linking national road with solar park main entrance. The useful width of the access road must be at least 6 meters and must be paved with bitumen or concrete asphalt, to ensure a good transit during construction and during operation and maintenance phase. This will have positive impact on air dust and pollution.

Internal main roads will have the most frequent traffic during construction and plant O&M. This network includes the roads along the perimeter, all roads connecting buildings and installations other than field inverters, and mainly from north to south to connect the buildings and the electrical substation. The useful width of these main roads must be at least 5 meters. This main road network must be pavement with bitumen or concrete asphalt, to ensure a good transit during construction and during operation and maintenance phase. This main road is the axis to the secondary roads to arrive to main equipment (inverters and transformers).

As mentioned above the proposed structure for the PV installation is fixed structure therefore, a geotechnical examination is important to be conducted to determine soil characteristics for the solar structure foundation sizing. The geotechnical examination results recommendation needs to be considered strictly to make sure the foundation frame is erected strong enough to accommodate the panel, wind and other stresses.

For the site office the land clearing, leveling and grading is recommended to be minimized. The temporary site facilities for the Employer's Representative shall be structurally sound and compatible with the weather conditions on the site. The facilities shall be provided with the services necessary for their operation, such as electrical energy, potable water supply, sewers, drainage system with soak pit, fire extinguishing system, etc. The site office will be completely restored after the completion of the construction works in accordance to the project owner recommendations. All temporary structures should be handled according to the project requirement, and land must be leveled and re-contoured to the original condition or better. All debris and any other material should be removed from the site to the nearest waste management plant.

Impacts to land use could occur during construction if there were conflicts with existing land use plans and community goals; conflicts with existing recreational, educational, religious, scientific, or other use areas; or conversion of the existing commercial land use for the area (e.g., agriculture, grazing, mineral extraction). This is not the case for NCB-047.

Existing land use during construction would be affected by intrusive impacts such as ground clearing, increased traffic, noise, dust, and human activity, as well as by changes in the visual landscape. In particular, these impacts could affect recreationists seeking solitude or recreational opportunities in a relatively pristine landscape. Farmers will not be affected by this project as the land is not suitable for agriculture purposes.

An unexpected discovery of cultural resources during any phase of the project shall result in a work stoppage in the vicinity of the find until the resources can be evaluated by a professional archaeologist. Workers should be educated on the consequences of unauthorized collection of artifacts. During all phases of the project the equipment and vehicles should be kept within the limits of the initially disturbed areas.

Ground disturbance and vegetation removal could result in visual impacts that produce contrasts of color, form, texture, and line. Excavation for foundations and ancillary structures; trenching to bury pipelines; grading and surfacing roads; clearing and leveling staging areas; and stockpiling soil and spoils (if not removed) would (1) damage or remove vegetation, (2) expose bare soil, and (3) suspend dust. Soil scars and exposed slope faces would result from excavation, leveling, and equipment movement. Invasive species could colonize disturbed and stockpiled soils and compacted areas.

Following specific mitigation measure will help in this phase of the project:

- Obtain/borrow material from authorized and permitted sites.
- Avoid creating excessive slopes during excavation and blasting operations.

- Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.
- Save topsoil removed during construction and use to reclaim disturbed areas, as soon as it is possible to do so.
- Stabilize soils during final landscaping of project site.

Impact of/on	Extent of impact
Topography	=Low

Impacts on Acoustic Environment and Mitigation Measures

Noise of construction and transportation will have negative impact on communities and workers. Noise could cause hearing loss, impair the ability to communicate and hear high frequency sounds and even permanent hearing loss. During construction of the plant, there would be noise from construction equipment. The levels would range from about 70 decibels (dB) for a paving breaker to about 85 dB from large trucks. The noise must not exceed the Occupational Safety and Health Administration (OSHA) permissible exposure limit of 90 dBA. There are many ways to reduce and control worker exposure to noise in workplace where the noise is excessive:

- **Engineering Control:** this involve replacing or modifying equipment, or bringing relevant changes at the source of noise or along the noise transmission path. The contractor must make sure that the low noise level machinery and tools are utilized. Maintain and lubricate equipment and machinery (oil bearings) in accordance to its respective manufacturer recommended periods. Place a noise barrier such as curtains and sound walls between the employees and noise source. And isolate or enclose the noise source.
- **Administrative Control:** this includes changes in the schedule or workplace that eliminate or minimize the labors exposure to noise. The contractor must schedule the noisy machinery operation when fewer workers are exposed in case possible, limit the time a worker spends near a noisy source, and provide a quiet area where employees can gain relief from noise sources. Furthermore, the control of the noise exposure through distance is often a simple, inexpensive and yet effective administrative noise control way. To be precise, for every double of the distance among the workers and noise source the noise could be reduced by 6 dBA (OSHA, 2017).

Work outside the usual working hours/day will have negative impacts in terms of noise and disturbances on communities. Therefore, it is recommended that no construction should be allowed during night time (5PM to 6AM) particularly the construction material transportation or night construction work could be limited to relatively quiet activities, such as interior work. As people are not living nearby the project site the construction noise effects are minimal. However, if the noise still exceeds the allowable limits the above mentioned steps should be followed. In addition, vehicle traffic on unpaved roads should be avoided as far as possible. Furthermore, operation of vehicles nearby the river stream is recommended to be minimized. The contractor must have sound level meter at site to continuously monitor the noise level.

As the project doesn't envisage huge excavation and the area doesn't have huge rocks therefore blasting operations should be avoided to the extent possible. Blasting process is associated with the generation of ground vibrations, noise, dust, fumes and fly-rocks. The environmental impacts of ground vibrations, noise and fly-rock pose a great challenge to the safety of the nearby structures and the people. A proper blast design ensures effective utilization of the energy of the explosives

and is therefore will mitigate the environmental impacts. Following mitigation measures are necessary to consider for blasting process:

- Develop blasting management plan.
- Monitor ground heave, block movement.
- Closer holes spacing, use smaller diameter holes.
- Good perimeter control blasting to minimize over-break.
- Use blasting mats to contain the blast, prevent flying rocks and suppress dust.
- Observe geology, look for open seams.
- Videotape blast rounds and watch for little problems, in order to prevent bigger problems.
- Inform the near communities in advance.
- Provide safe area for the workers.

Additional key mitigation practices for noise impacts that could apply to all phases of this solar project include:

- Limit noisy activities (including blasting) to the least noise-sensitive times of day (weekdays only between 8 a.m. and 6 p.m.).
- Whenever feasible, schedule different noisy activities (e.g., blasting and earthmoving) to occur at the same time, since additional sources of noise generally do not add a significant amount of noise. That is, less-frequent noisy activities would be less annoying than frequent less-noisy activities.
- All equipment should have sound-control devices no less effective than those provided on the original equipment. Muffle and maintain all construction equipment used.
- Notify nearby residents in advance when blasting or other noisy activities are required.
- To the extent feasible, route heavy truck traffic supporting construction activities away from residences and other sensitive receptors.
- Post warning signs in high-noise areas and implement a hearing protection program for work areas where noise exceeds 90 dBA.

Impact of/on	Extent of impact
Acoustic Environment	=Low

impacts on Air Quality and Mitigation Measures

During the construction of project, fugitive dust comes from blowing exposed soil or other particles. Fugitive dust becomes an issue as the land is cleared and graded, and as delivery trucks and other vehicles and equipment travel on dirt or gravel roadways in the construction area. The dust becomes a nuisance in nearby neighborhoods, a face and lung irritant, or a visual obstacle in nearby streets. The dust must be suppressed, and this is usually done by spraying unpaved roads with water and stabilizing exposed soil areas.

Vehicle and diesel generator emission will have negative impact on environment.

Therefore, vehicles and generators should be kept in good working condition and properly maintained, in order to minimize the exhaust emissions. The dust emissions should be minimized by methods, such as spraying water on soil, where required and removal of dirt and mud from vehicles wheels before leaving the project site and the loading plants. In addition, the vehicle should move in slow speed in the site and on unpaved roads to avoid excessive dust emissions. Attention should be given to conserve water during the construction and operation. The construction and operation worker should be provided with liquefied petroleum gas (LPG) for cooking and heating if required, and the

usage of fuel wood should not be allowed. Generators and vehicles used in this project should have exhaust mufflers to minimize the exhaust and noise.

Emissions generated during the construction phase include vehicle emissions; diesel emissions from large construction equipment and generators; volatile organic compounds release from storage and transfer of vehicle/equipment fuels, small amounts of carbon monoxide, nitrogen oxides, and particulates from blasting activities; and fugitive dust from many sources such as disturbing and moving soils (clearing, grading, excavating, trenching, backfilling, dumping, and truck and equipment traffic), mixing concrete, storage of un-vegetated soil piles, and drilling and pile driving. Therefore, measures need to be taken to mitigate these emissions.

Below mitigation measures could help in all phases of the project to control the air quality particularly during the construction phase:

- Use dust abatement techniques on unpaved, un-vegetated surfaces to minimize airborne dust and during earthmoving activities, prior to clearing, before excavating, backfilling, compacting, or grading, and during blasting.
- Post and enforce speed limits to reduce airborne fugitive dust from vehicular traffic.
- Limit access to the construction site and staging areas to authorized vehicles only through the designated treated roads.
- When possible, schedule construction activities during periods of low winds to reduce Fugitive dust.
- Cover construction materials and stockpiled soils if they are a source of fugitive dust.
- Train workers to handle construction materials and debris during construction and dismantlement to reduce fugitive emissions.
- Keep soil moist while loading into dump trucks.
- Keep soil loads below the freeboard of the truck.
- Minimize drop heights when loaders dump soil into trucks.
- Tighten gate seals on dump trucks.
- Cover dump trucks before traveling on public roads.
- When feasible, shut down idling construction equipment (TEEIC, 2017).

Impact of/on	Extent of impact
Air quality	=Medium

Impacts on Soil and Mitigation Measures

Construction of this solar facility requires small amount of clearing and grading work, and results in soil compaction, potential alteration of drainage channels, and increased runoff and erosion. Use existing roads to the maximum extent feasible to avoid additional surface disturbance.

The surface disturbance, heavy equipment traffic, and changes to surface runoff patterns could cause soil erosion. Impacts of soil erosion could include soil nutrient loss and reduced water quality in nearby surface water bodies. Following mitigation measures could help minimize the adverse environmental impacts on soil during construction phase:

- Save topsoil removed during construction and use to reclaim disturbed areas upon completion of construction activities whenever possible.
- Avoid creating excessive slopes during excavation and blasting operations.
- Closely monitor construction near aquifer recharge areas to reduce potential contamination of the aquifer.
- Obtain borrow material from authorized and permitted sites.

- Dispose of excess excavation materials in approved areas to control erosion and minimize leaching of hazardous materials.

Impact of/on	Extent of impact
Soil	=Medium

Impacts on Water Quality and Mitigation Measures

Use of or spills of chemicals at solar plant (for example, dust suppressants, dielectric fluids, herbicides) could result in contamination of surface or groundwater. Furthermore, the chemicals used in the manufacturing process are caustic and toxic. There is always the risk of some kind of spill which could result in these chemicals leeching into the soil and contaminating ground water. It is important to notice that this risk is not unique to solar panel manufacturers.

The biggest single issue with the plants themselves appears to be the use of significant amounts of water for cooling purposes. Solar plants are often constructed in arid areas and Place great strains on what are already limited local or regional water resources. Some “wet cooling” plants use more water per unit of electricity produced than a conventional fossil fuel plant. Where the NCB-047 solar panels do not need water cooling as it is not a concentrated solar thermal plant, hence this impact is negligible.

It is worth to mention, that photovoltaic power plants consume only one hundredth of the volume of water used by fossil fuel plants for day-to-day operations. Water would be used for dust control when clearing vegetation and grading, and for road traffic; for making concrete for foundations and ancillary structures; and for consumptive use by the workers. Water is likely to be obtained from nearby Kabul River.

Water quality could be affected by:

- Activities that cause soil erosion.
- weathering of newly exposed soils, that could cause leaching and oxidation, thereby releasing chemicals into the water.
- Discharges of waste or sanitary water; and
- Untreated groundwater used to control dust could deposit dissolved salts on the surface, allowing the salts to enter surface water systems.

Surface and groundwater flow systems could be affected by withdrawals made for water use, wastewater and storm-water discharges, and the diversion of surface water flow for access road construction or storm-water control systems. Excavation activities and the extraction of geological materials could affect surface and groundwater flow. The interaction between surface water and groundwater could also be affected if the surface water and groundwater were hydro-logically connected, potentially resulting in unwanted dewatering or recharging of water resources.

There is the risk of contamination and pollution of ground and surface water sources from spills and airborne chemicals such as dust suppressants. Fairly large amounts of water are also needed to keep receivers and panels, etc. clean. In arid settings, this impact is high as any increase in water demand can strain available water resources, while for the NCB-47 the Kabul River can be used as a suitable water source. Following mitigation measures can help reduce the adverse impacts on water quality:

- Apply erosion controls relative to possible soil erosion from vehicular traffic and during construction activities (e.g., jute netting, silt fences, and check dams).
- Regularly monitor rights-of-way (ROWs), access roads, and other project areas for indications of erosion.

- Use dust suppression techniques to minimize impacts of vehicular traffic and wind on roads and exposed soils.
- Reclaim or apply protective covering (e.g., vegetative cover) on disturbed soils as quickly as possible.
- Clean and maintain catch basins, drainage ditches, and culverts regularly.
- Refuel in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Use drip pans during refueling to contain accidental releases and under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the project site.
- Limit herbicide/pesticide use to non-persistent, immobile herbicides/pesticides.
- Keep all equipment and vehicles within the limits of the previously disturbed areas (TEEIC, 2017).

Impact of/on	Extent of impact
Water	=Low

Solid waste management

The waste during construction such as machinery filters, used oil, fuel storage and etc. will have negative impacts on environment, for which the contractor must ensure to use and store it properly. And the environmental performance of the contractors need to be monitored accordingly. The waste management plan needs to be a part of Contractors Environmental Management Plan approved by the Engineer or project implementation unit for both the construction and site office waste management.

The industrial and solid waste would be generated during construction phase. Some of the solid wastes would likely be nonhazardous such as packaging materials, containers, and equipment's assembly wastes and construction crews. The industrial wastes would include minor amounts of fuels, spent vehicle and equipment fluids (hydraulic fluids, lubricating oils, battery electrolytes), and spent solvents. The hazardous materials include compressed gases used for welding, cutting, brazing, etc., heat transfer fluids, dielectric fluids, coolants and oils (for steam turbines), chemicals for treatment of the steam cycle, and compressed gas cylinders of hydrogen (for stirling dish engines only). These materials would be handled in accordance to its MSDS guidelines and should be transported off-site for disposal to the nearest waste management plant. Following mitigation measure could reduce the impacts of wastes during construction and other phases of the project:

- Implement plans for hazardous and waste materials management, spill prevention and response, storm-water management, and pesticide management.
- Train employees to promptly contain, report, and/or clean up any oil or hazardous material spill.
- Provide secondary containment for all on-site hazardous materials and waste storage, including fuel.
- Containerize and periodically remove wastes for recycling or for disposal at appropriate off-site permitted disposal facilities.
- Provide portable spill containment and cleanup equipment in all vehicles.
- Select pesticides/herbicides that are low in human toxicity, known to be effective against the target species, and have minimal effects on non-target species and the environment.
- Keep vehicles and equipment in good working order to prevent oil and fuel leaks.

- Document accidental releases as to cause, corrective actions taken, and resulting environmental or health and safety impacts (TEEIC, 2017).

Impact of/on	Extent of impact
Solid waste	=Low

Natural Disasters Mitigation Measures

Biological Environment

The likely biological adverse impacts of the project are minimal. The site area is not located at the vicinity of the sensitive ecosystem, for instance national forests, wildlife sanctuaries. Only small amount of temporary impacts in form of acoustic and air quality might degrade the recreational experience of the visitors which can be reduced through mitigation measures discussed above. Evidence of agricultural and residential usages have not been visible at the site.

Dust settling on vegetation may alter or limit plants' abilities to photosynthesize and/or reproduce. Although the potential for an increase in the spread of invasive and noxious weeds would occur during the construction phase due to increasing traffic and human activity, the potential impacts could be partially reduced by interim reclamation and implementation of mitigation measures.

There are three types of naturally grown plants available at the site which are not unique and are common in the area. Unnecessary removal of plants should be avoided. Impacts on vegetation can be of two basic kinds:

- Direct impacts of vegetation removal or damage during construction.
- Indirect impacts on vegetation from air pollution or surface water impacts caused by the power plant

For the aquatic environment, common fishes are available in the nearby Kabul River and no vanishing species are affected thus the project doesn't have adverse biological impacts. Seasonal Grasshoppers are observed at the site which are also not endangered insects and are vastly available in the area. The ecological survey of the site confirmed the nonappearance of scarce and ecologically significant fauna and flora. Therefore, there are no serious biological concerns with the implementation of this project.

Following mitigation measures during construction could reduce the adverse impacts on environment:

- Conduct blasting for raw materials only within specified times and at specified distances from sensitive wildlife or surface waters as specified by IFC/NEPA.
- Maintain noise-reduction devices (e.g., mufflers) in good working order on vehicles and construction equipment.
- Refuel in a designated fueling area that includes a temporary berm to limit the spread of any spill. Use drip pans during refueling to contain accidental releases and under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the construction site.
- If trucks and construction equipment are arriving from locations with known invasive vegetation problems, establish a controlled inspection and cleaning area to visually inspect arriving construction equipment to clean the vehicles to remove and collect noxious weed seeds that may be adhering to tires and other equipment surfaces.
- Where feasible, initiate interim site reclamation activities as soon as possible after construction activities are completed. Reclaim these areas using weed-free native

shrubs, grasses, and forbs. Use local designed seed mixes in re-vegetation/stabilization efforts. Where feasible, re-vegetate the project area with grasses or forbs to limit dust generation (TEEIC, 2017).

Impact of/on	Extent of impact
Biological Environment	=Low

Socioeconomic Environment

There are no indigenous people living near the project site. Thus, there is no concerns of resettlement and indigenous people. Therefore, this project is classified as category C for both involuntary resettlement and indigenous peoples based on ADB Safeguard Categories (ADB2, 2017) with no negative social resettlement impacts.

Direct positive impacts would include the creation of new jobs for construction workers and the associated income and taxes generated by the solar project. Indirect impacts would occur as a result of the new economic development, and would include new jobs at businesses that support the expanded workforce or provide project materials, and associated income and taxes. This project development activity could also potentially affect property values, either positively from increased employment effects or negatively from proximity to the solar field and any associated or perceived environmental effects (noise, visual, etc.). Local people hiring will have positive socio economic impacts on the community. As of most of the Nangarhar population is jobless. It is therefore, recommended to hire local labor for the construction phase of this project.

During construction, lights might be needed for long winter workdays or for second shift work. Light might be needed for equipment laydown areas, parking, construction roadways, and work areas used at night. Floodlights might be used, but they should be shielded and directed at the areas that need light and not allowed to spill off-site or shine into the sky.

Impact of/on	Extent of impact
Socio-economics	=Medium

Human Health and Safety

The workers and equipment safety risks impacts are high during construction. To mitigate these impacts, the staffs must have essential protective equipment (i.e. PPE) and must be provided with safety training.

All safety precautions should be taken into consideration during the construction phase of the project to minimize the safety hazards and risk of accidental electrocution. Standard clearance distance of 3.7 meter from the live wires and buildings should be considered for the buildings trees, and etc. Furthermore, all the equipment, particularly transformers considered for this solar project should meet the noise standards. In addition, all workers should be equipped with the PPE during the construction phase of the project.

Potential impacts to worker and public health and safety from solar energy project construction would be similar to those expected for any construction project with earthmoving, large equipment, transportation of oversized materials, and construction and installation of industrial facilities. In addition, health and safety issues include working in potential weather extremes, and possible contact with natural hazards, such as uneven terrain and dangerous plants, animals, or insects.

Impact of/on	Extent of impact
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Impacts during Plant Operation

Operations activities that may cause environmental impacts include operation of the solar energy facility, power generation, and associated maintenance activities that would require vehicular access and heavy equipment operation when components are being replaced. Potential impacts from these activities are presented below, by the type of affected resource.

Physical Environment

Impacts on Acoustic Environment and Mitigation Measures

Sources of noise during operations would be mechanical and aerodynamic noise from the power block, solar tracking devices, solar dish engines, transformer and switchgear noise from substations, corona noise

vehicular traffic noise, and maintenance facility noise.

This solar plant will not create excessive noise, pollution, odor and gas emissions during operation. In addition, solar provides clean and sustainable energy hence it has positive impact on environment. Following measures will help mitigate noise impacts:

- Apply both engineering and administrative noise mitigation measures discussed above the construction section.
- Limit noisy activities to the least noise-sensitive times of day (weekdays only between 8 a.m. and 6 p.m.).
- Whenever feasible, schedule different noisy activities to occur at the same time.
- All equipment should have sound-control devices no less effective than those provided on the original equipment. Muffle and maintain all construction equipment used.
- To the extent feasible, route heavy truck traffic supporting construction activities away from residences and other sensitive receptors.
- Provide noise relief area for worker to rest
- Post warning signs in high-noise areas and implement a hearing protection program for work areas where noise exceeds 90 dBA.

Impact of/on	Extent of impact
Acoustic Environment	=Low

Impacts on Air Quality and Mitigation Measures

There are no direct emissions to air from solar facility operation. Minor volatile organic compound (VOC) emissions are possible during regular maintenance activities, such as mirror washing or replacement. Vehicular traffic will continue to produce small amounts of fugitive dust and emissions during the operations phase. As the plant is photovoltaic solar energy plant hence, the power block emissions from process boilers (combustion-related criteria pollutants and hazardous air pollutants) and cooling towers do not exist. The operation emissions will not likely exceed air quality standards nor will have any significant adverse impact on climate change.

The solar plant operation will have positive impacts on the air compared to other fossil sources. The estimated life-cycle emissions for photovoltaic systems are among 0.07 and 0.18 pounds of carbon dioxide equivalent per kilowatt-hour. This is much less than the lifecycle emission tolls for coal (1.4-3.6 lbs. of CO₂E/kWh) and natural gas (0.6-2 lbs. of CO₂E/kWh) (IPCC, 2011) hence improving the environment by reducing the CO₂ emission.

Impact of/on	Extent of impact
Air quality	=Low

Impacts on Soils and Mitigation Measures (including Seismicity/Geo Hazards)

During operation of the plant, the soil and geologic conditions would stabilize with time.

Soil compaction and erosion are both likely to continue to take place along the access roads. Within the project area, soil erosion, surface runoff, and sedimentation of nearby water bodies will continue to occur during operation, but to a lesser degree than during the construction stage, and the impact is expected to be small once equilibrium is achieved. Following mitigation measures will minimize these impacts:

- Use dust abatement techniques on unpaved, un-vegetated surfaces to minimize windblown erosion.
- Apply erosion controls to minimize and prevent soil erosion from vehicular traffic.
- Maintain vegetative cover within road rights-of-way (ROWs) to prevent erosion and periodically monitor ROWs to assess erosion.
- Clean and maintain catch basins, drainage ditches, and culverts regularly.
- In areas of potential wind erosion, apply gravel to access road surfaces.
- Conduct routine site inspections to assess the effectiveness of and the maintenance requirements for erosion and sediment control systems.

Impact of/on	Extent of impact
Soil quality	=Low

Impacts on Water Quality and Mitigation Measures

Withdrawals of surface water and/or groundwater are expected to continue during the operations phase. Impacts to water resources during the operation and maintenance phase would also include possible degradation of water quality resulting from vehicular traffic and machinery operations during maintenance (e.g., erosion and sedimentation) and wastewater disposal. (TEEIC, 2017).

The panels dust washing water needs to be drained properly into the plant drainage system and the suspended particles must not go into the nearby Kabul River. Waste water has negative environmental impacts if not managed properly. The plant must have appropriate sewage handling system. Septic tanks or Decentralized Wastewater Treatment System (DEWATS) system need to be constructed to accommodate the waste water generated by the solar plant operation staff. The treated water can also be reused as a water source for the site.

The waste water must not be allowed to flow directly to the river as based on the UNFPA (2013), Kabul Socio-demographic and Economic Survey more than 57% of Nangarhar district households do not have access to improved sources of drinking water hence using river water for this purpose.

Before the flooding season the drainage and flood runoffs must be cleared and cleaned.

General mitigation practices that could apply to any or all phases of a solar energy project include:

- Apply erosion controls relative to possible soil erosion from vehicular traffic and during construction activities (e.g., jute netting, silt fences, and check dams). Regularly monitor access roads, and other project areas for indications of erosion.
- Use dust suppression techniques to minimize impacts of vehicular traffic and wind on roads and exposed soils.

- Reclaim or apply protective covering (e.g., vegetative cover) on disturbed soils as quickly as possible.
- Clean and maintain catch basins, drainage ditches, and culverts regularly.
- Refuel in a designated fueling area that includes a temporary berm to limit the spread of any spill.
- Use drip pans during refueling to contain accidental releases and under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the project site.
- Limit herbicide/pesticide use to non-persistent, immobile herbicides/pesticides.
- Keep all equipment and vehicles within the limits of the previously disturbed areas (TEEIC, 2017).

Impact of/on	Extent of impact
Water quality	=Low

Hazardous Materials and Waste Management

Industrial wastes are produced during routine operation (cleaning agents, dielectric fluids, and solvents). These wastes should be put in containers, characterized and labeled, possibly stored briefly, and transported by a licensed hauler to an appropriate permitted off-site disposal facility as a standard practice.

Exclusive to photovoltaic technologies, some high-performance solar cells may contain small amounts of cadmium, selenium, and arsenic, and are only hazardous if the solar cell is broken. Damaged cells would need to be characterized and managed as hazardous waste (TEEIC, 2017). Impacts could result if these wastes were not properly handled and were released to the environment.

The domestic solid wastes created by plant operation staff has negative impacts and should be managed properly and must be transported to the nearest waste management plants. The solar plant must have appropriate solid waste collection and disposal measures. The waste oils and chemicals should be disposed in accordance with their respective Material Safety Data Sheet (MSDS). The MSDS sheets must be available at the site for all chemicals and oils used in the site.

The main component of most PV modules is silicon, which is not naturally harmful, but parts of the manufacturing process do involve toxic chemicals and similar are batteries, which need to be carefully handled and regulated to prevent environmental damages.

The recyclable and unrecyclable waste from the site should be separated and transferred to the recycling plants. No open burning should be allowed at the site. In addition the hazardous waste such as batteries acid contaminated rags, soil contaminated by the oil/chemical, oil contaminated rags and etc. Should be kept separate and handled according to the nature of the waste. Non-toxic recyclable waste should be sent to recycling plants. Toxic waste such as batteries acid contaminated rags, soil contaminated by the oil/chemical, oil contaminated rags and etc. should be stored separately, and handled according to MSDS.

Oil and chemical leakage pose negative impacts on the environment. Therefore, plant must have channels and drainage points to collect any leaked oil from the transformers and other apparatus. Any soil contaminated by the oil/chemical spillage will be removed and disposed appropriately in accordance to the MSDS of the spilled oil/chemical.

Many electrical properties contain mineral oil and other fluids for the purpose of insulation and heat extraction. Electrical transformers are a major source of used mineral oil. The main types of transformers and oil filled equipment are:

- Power transformers
- Voltage transformers (VTs) and Current transformers (CTs)
- Capacitor voltage transformers (CVTs)

- Circuit breakers (CBs)
- Switchgear
- Capacitors
- High voltage bushings

During the operation of the transformer the oil go through electrical stress and eventually wears out. The life expectancy of it can be as long as 30+ years in some cases and mostly reusable. Transformer oil disposal therefore need not occur in locations where the used oil is destroyed, because in most cases it can be recovered. Except for oil highly concentrated with PCB (which should not be used in this project), used transformer oil can avoid disposal in favor of reuse.

Poly-Chlorinated Biphenyls (PCB) analysis detects the presence of PCB in transformer oil samples. These toxic organic pollutants were used extensively in transformers for decades because of their ideal properties for use in transformers. PCBs are persistent organic pollutants (POPs), i.e. chemical substances that are persistent, bio-accumulate and adversely affect human health and the environment (UNEP1, 2002). Therefore, PCB containing equipment are not allowed to use in the project based on the ADB's Prohibited Investment Activities List. This will positively impact the environment.

Environment unfriendly industrial waste accumulation risk is exist in the operation period.

The preventive maintenance of the plant might require the replacement of some equipment parts, and lubricants which results in creation of used spare parts such as batteries and used lube oil. These kind of solid and liquid waste, must be treated in accordance to the government rules. This practice must not create any environmental impact on the local people and areas.

Impact of/on	Extent of impact
Hazardous material	=Low

Biological Environment

Impacts on Fauna, Flora and Mitigation Measures

The plant operation will not have any major negative biological impacts during operation.

The site is not located near any sensitive ecosystem and wildlife sanctuaries. No endangered species are affected by the project operation. The wastewater, lubricant and other potential toxic water must not go to Kabul River as it might damage the fishes, agriculture and as well as the people whom use this river as a drinking water source. No endangered insects are affected by the operation of this project.

During operation, adverse ecological effects could occur from (1) disturbance by equipment noise and human activity; (2) site maintenance (e.g., washing solar collectors and vegetation control); (3) exposure of biota to contaminants; and (4) mortality of birds from colliding with the project facilities and/

During operation of a solar energy facility, wildlife could still be affected by habitat fragmentation due to the presence of the fenced solar energy facility, utility rights-of-way (ROWs), and access roads. In addition, the presence of this solar energy development project and its associated access Roads and ROWs may increase human use of surrounding areas, which in turn could impact ecological resources in the surrounding areas through:

- Introduction and spread of invasive vegetation,
- Disturbance,
- Mortality of wildlife from vehicles,
- Increase in hunting (including poaching), and

- Increased potential for fire.

Avifauna. Birds burning risk is mostly associated with concentrated solar rays (Solar Thermal Energy Plants). The bird's feathers ignite mid-air, after flying through a concentrated beam of sunlight. Such birds can be burned to death.

Additionally, bird's mortality problem manifests itself in a lake effect, in which birds and their insect prey can mistake a reflective solar facility for a water body, or spot water ponds at the site, then hone in on it. Birds can be burned as they pass through concentrated sunrays that are reflected off thousands of mirrors toward a solar power tower, where water is boiled to produce electricity-generating steam (Upton, 2014).

The problem of bird deaths at solar plant is a complex one. Some solar developers have been powering down bright lights that had attracted insects at night, or switching to LEDs, and using nets to keep birds at bay. It is recommended to monitor solar plant effects on birds throughout the year. Some mitigation measures include clearing vegetation around solar towers to make the area less attractive to birds, retrofitting panels and mirrors with designs that help birds realize the solar arrays are not water, suspending operations at key migration times, turn off all unnecessary lighting at night to avoid attracting migratory birds and preventing birds from roosting and perching at the facilities. Furthermore, restoring bird habitat elsewhere to draw birds away from the solar facilities is also recommended, which could help the rails and another species to recover (Upton, 2014).

Following mitigation practices will prevent the adverse ecological impacts:

- Depending on the ecological resources present, consider steps to minimize the amount of vehicular traffic and human activity.
- Report observations of potential wildlife problems, including wildlife mortality, to the appropriate wildlife agency.
- Use drip pans during refueling to contain accidental releases.
- Educate workers regarding the occurrence of important resources in the area and the importance of their protection, including the appropriate regulatory requirements.
- Reduce habitat disturbance by keeping vehicles on established access roads and by minimizing foot traffic in undisturbed areas.
- Regularly monitor the solar field, access roads, and ancillary facilities for invasive
- Nonnative plant species establishment. Initiate control measures immediately upon evidence of invasive species introduction or spread.
- Limit herbicide/pesticide use to non-persistent, immobile herbicides/pesticides and apply only in accordance with label and application permit directions and stipulations for terrestrial and aquatic applications.
- Apply spill prevention practices and response actions in refueling and vehicle-use areas to minimize accidental contamination of habitats.
- Address spills immediately per the appropriate spill management plan, and initiate soil cleanup and soil removal if needed.
- Turn off all unnecessary lighting at night to avoid attracting migratory birds (TEEIC, 2017).

Impact of/on	Extent of impact
Biological Environment	=Low

Socioeconomic Environment

Solar photovoltaic (PV) system provides significant social and environmental benefits in comparison to the conventional energy sources, thus contributing to sustainable development of societies. The new solar plant can provide new jobs and business in the area and bring economic benefit to the

community, particularly during construction. The increase in temporary and permanent jobs would result in more money spent locally. The power plant developer may make numerous purchases in the area for materials or services. New homes for permanent power plant workers may be built.

Local people hiring for the operation of the plant will have positive socio economic impacts on the local communities. As of most of the Nangarhar population is jobless, and not much has changed since then. Capacity building training to be provided for locally hired workers for better operation of the project which will subsequently have positive impacts on local people in terms of their skills development and future jobs prospects. As the unemployment rate is high in this district hence, hiring from the local people for this project O&M will have positive socioeconomic impact on the people.

Stray light at night from power plant building lighting, and other site lighting is very often a concern, particularly for power plants proposed to be located outside urban areas. It is also possible that noise or light from a power plant could disturb farm families or reduce the productivity of local farm animals. A power plant's lighting design can ensure that there will be little or no illumination spilling onto adjacent properties. This can be done through the use of low-emission light fixtures, placement of lights only where needed for safety and security, and shielding the fixtures so that they aim the light only at certain areas.

Impact of/on	Extent of impact
Socio-economics	=Low

Occupational Health and Safety Impacts and Mitigation Measures

The workers and equipment safety risks impacts are high during operation. To mitigate these impacts, the operation and maintenance (O&M) staffs must have essential protective equipment and must be provided with safety training. There must be fire extinguishers in place in a variety of places that are at risk of material fires and flammable liquid fires. The foam extinguishers contains is nonconductive of electricity (must be nonconductive), so it reduces the risk of electric shock if the fire contains electrical equipment. The site must be equipped with first aid kits. The fire exits and alarms must be clearly identified in the site. In addition the site must have clearly identified fire assembly areas.

Personal electrocution risk is high in case if the safety procedures are not followed. To mitigate the risks the metal frames of all the equipment should be grounded for the personal safety measures. In addition, the following safety procedures should be followed before doing the maintenance of the energized equipment:

- De-energize the equipment which needs repairing or maintenance
- Perform the circuit switching and isolation of the equipment
- At point of isolation, the rack must be locked off and breakers must be tagged. The tag and safety lock should be placed at points of isolation.
- Discharge equipment to be worked on and place safety grounds to protect personnel.
- On completion of the work and prior to return of system to normal, remove safety grounds and make sure: that equipment is in a safe condition to energize, and, personnel have been informed that equipment is going to be energized.

The site must have a comprehensive range of substation and plant safety equipment including insulating matting, lifesaving kits & rescue rods, voltage detectors, insulated gloves, arc flash clothing (suite), protective gear and etc.

The Emergency Response Plan (ERP) should be made available at the solar plant. The plant team must be provided with safety trainings and there must always be an occupational safety supervisor available at the site to make sure the safety precautions are always adhered by the workers. The safety and security precaution signs must be installed in all danger places of the solar plant.

Impact of/on	Extent of impact
Health and safety	=Low

Impact on Infrastructure

The project can potentially have glint and glair effect on such receptors as roads, dwellings, and aviation. Specifically, vehicles driving Kabul – Turkam Highway, and people living in Nangarhar village can be impacted. The project design have to consider smart planting of trees on the perimeter of the solar plant to mitigate glint and glare and minimize shading losses. The project will not have impacts on aviation as no airport exists in the vicinity of the project.

Impact of/on	Extent of impact
Infrastructure	=Low

Impacts during Decommissioning of the Plant

Most of the solar panels have 25 years warranty and most likely need to be replaced after every 25 years, or might work with reduced efficiency for longer duration and similarly the inverters. The outdated equipment, if not recycled properly, can pose serious environmental risks as it can contain substances toxic for the environment. Based on Solar Action Alliance, potentially the worst damage is done when the various components of solar energy systems have come to the end of their life and need to be disposed. Some of the components are potentially toxic, like the lead in lead acid batteries and some of the parts inside the solar panels. The pollution problem, like that of many manmade items can be reduced by smart recycling and this can also help to extend the usable life of the solar energy components and therefore reduce the average environmental cost of the original manufacturing.

The main component of the solar panels is silicon. Silicon dust has little adverse effect on lungs and does not appear to produce significant organic disease or toxic effects when exposures are kept beneath identified limits. Crystalline silica may affect the immune system, leading to mycobacterial infections or fungal, especially in workers with silicosis. Therefore, the supplier or project owner must ensure that there are recycling precautions considered after the useful lifecycle of this solar plant.

It is worth mentioning that there is also lead and small amounts of aluminum and silver in the electronics. The use of lead-based solder would lead to pollution problems if items are sent to landfill or incineration. It is important to mention that the same materials exists in other electronic goods such as computers and TVs so the development of ways to control them and address potential problems anyway, outside the solar industry as well (CAT, 2016).

Many chemicals found in e-waste are also found in solar PVs as well, including cadmium, brominated flame retardants, lead, and chromium. The manufacturing of solar cells involves several toxic, flammable and explosive chemicals. Many of those components suppose a health hazard to workers involved in manufacturing of solar cells (Dubey et al, 2013), hence, it is important to have an appropriate recycling procedure in place to avoid these adverse environmental effects.

Decommissioning activities that may cause environmental impacts include facility removal, land re-vegetation and re-contouring. Typical activities during the solar energy facility decommissioning and site reclamation phase include facility removal, breaking up of concrete pads and foundations, removal of access roads that are not maintained for other uses, re- contouring the surface, and re-vegetation.

Potential impacts from these activities are presented below, by the type of affected resource (TEEIC, 2017).

Physical Environment

Impacts on Topography and Mitigation Measures

Activities during the decommissioning phase that would impact landscape and geologic resources include removal of access and on-site roads, buildings, and other structures; and heavy vehicle traffic. Surface disturbance, heavy equipment traffic, and changes to surface runoff patterns can cause soil erosion. Impacts of soil erosion include soil nutrient loss and reduced water quality in nearby surface water bodies. Upon completion of decommissioning, disturbed areas would be contoured and re-vegetated to minimize the potential for soil erosion.

Upon decommissioning, land use impacts resulting from construction and operation of the project would be largely reversed. No permanent land use impacts would occur during this phase. The following mitigation measures are suggested during the decommissioning of the project:

- Remove all aboveground structures from the project area.
- Reestablish the original grade and drainage pattern to the extent practicable.
- Restore the vegetation cover, composition, and diversity commensurate with the ecological setting.
- Review reclamation efforts and weed control periodically until the site is determined to have been successfully reclaimed (TEEIC, 2017).

Impact of/on	Extent of impact
Topography	=Low

Impacts on Acoustic Environment and Mitigation Measures

The noise source during the decommissioning phase will be similar to those during the construction phase, and would include equipment (bulldozers, rollers, and diesel engines) and vehicular traffic. Though this activity impact will be temporary but the mitigation measures mentioned in the construction phase must apply in this phase as well to prevent the adverse impacts.

Impact of/on	Extent of impact
Acoustic	=Low

Impacts on Air Quality and Mitigation Measures

Emissions in the decommissioning phase include vehicles emissions; diesel emissions from large construction equipment and generators; and fugitive dust from many sources such as land clearing, structure removal, backfilling, dumping, restoration of disturbed areas (grading, and planting), truck and equipment traffic. These emissions would not likely exceed air quality standards or impact climate change and are temporary. The mitigation measures mentioned in the construction phase should apply here to minimize the adverse impacts.

Impact of/on	Extent of impact
Air quality	=Medium

Impacts on Soils and Mitigation Measures (including Seismicity/Geo Hazards)

Activities during the decommissioning phase that would impact soils and geologic resources include removal of access and on-site roads, buildings, and other structures; and heavy vehicle traffic. Surface disturbance, heavy equipment traffic, and changes to surface runoff patterns can cause soil erosion. Impacts of soil erosion include soil nutrient loss and reduced water quality in nearby surface water bodies. Upon completion of decommissioning, disturbed areas would be contoured and re-vegetated to minimize the potential for soil erosion.

Impact of/on	Extent of impact
Soil	=Medium

Following Mitigation measures will reduce the impacts:

- Backfill any foundations and trenches, preferably with excess excavation material generated during the construction phase.
- Use topsoil removed during the beginning of the project or during decommissioning activities to reclaim disturbed areas.
- Reestablish the original grade and drainage pattern to the extent practicable.
- Stabilize all areas of disturbed soil using weed-free native shrubs, grasses, and forbs.

Impacts of Water Quality and Mitigation Measures Water

Water is likely to be obtained from nearby Kabul River. It would be used for dust control for road traffic, dismantling of buildings, and for consumptive use by the decommissioning workers. Water quality could be affected by activities that cause soil erosion, weathering of newly exposed soils leading to leaching and oxidation that could release chemicals into the water, discharges of waste or sanitary water, presence of dissolved salts from untreated groundwater used to control dust, and pesticide applications. Upon completion of decommissioning, disturbed areas should be contoured and re-vegetated to minimize the potential for soil erosion and water-quality-related impacts.

As mentioned earlier solar components includes chemical hazard items. Therefore, in order to prevent these chemicals getting into the water, soil, and air, suitable and safe disposal mechanisms need to be developed. There is fortunately an added incentive for producers to look into this, though: several of the materials in cells are rare or valuable so they need to be recovered. This should encourage the investigation of recycling and safe disposal (TEEIC,

2017).

Impact of/on	Extent of impact
Water quality	=Low

Hazardous Materials and Waste Management

Substantial amounts of construction and solid waste will be produced during the decommissioning phased of the facility. Much of the solid material (e.g., concrete and masonry, steel, reflecting mirrors, power cable, pipes and etc.) could be recycled and sold as scrap or used in road building projects; the remaining nonhazardous waste will be sent to permitted disposal area.

Industrial wastes (hydraulic fluids, lubricating oils, dielectric fluids, coolants, solvents, and cleaning agents) would be treated similarly to maintenance wastes during operation (put in containers, characterized and labeled, possibly stored briefly, and transported by a licensed hauler to an appropriate permitted off-site disposal facility). Special handling of high- performance photovoltaic

solar cells containing toxic metals would be required. Impacts could result if these wastes were not properly handled and were released to the environment.

Biological Environment

Impacts to biological environment from decommissioning work would be similar in nature to that of construction, but of a reduced magnitude. There will be temporary increase in noise and visual disturbance associated with the removal of the project facilities. Insignificant to no reduction in wildlife habitat would be expected, and mortality and injury rates of vegetation and wildlife would be much lower than that were during construction. Removal of the solar energy project components would eliminate impacts associated with wildlife interactions with solar energy facility structures and from habitat fragmentation. Subsequent to the site reclamation, the ecological resources at the project site could eventually return to pre-project conditions, depending on the end use selected for the project area. Some of the mitigation measures include:

- Reclaim all areas of disturbed soil using weed-free native shrubs, grasses, and forbs.
- Restore the vegetation cover, composition, and diversity to values commensurate with the ecological setting.
- Review reclamation efforts and weed control periodically until the site is determined to have been successfully reclaimed.

Impact of/on	Extent of impact
Biological Environment	=Low

Socioeconomic Environment

Direct impacts would include the creation of new jobs for workers during decommissioning activities, and the associated income and taxes paid. Indirect impacts would occur from associated economic development and would include things such as jobs at businesses that support the decommissioning workforce or that provide project materials, and associated income and taxes. Decommissioning activities would not be expected to affect property values. In the long term, the loss of jobs and revenue after decommissioning is completed could adversely impact the local and regional economies (TEEIC, 2017)

Impact of/on	Extent of impact
Socio-economic	=Medium

Human Health and Safety

Potential impacts to employees and public health and safety during the decommissioning of this project is similar to the construction phase of the project such as earthmoving, crushing, large equipment, and transportation of overweight and oversized materials. Furthermore, health and safety issues include working in potential weather extremes and possible contact with natural hazards, such as uneven terrain and dangerous plants, animals, or insects. The health and safety mitigation measures addressed in the construction phase should be followed strictly in the decommissioning process to prevent the potential safety risks.

Impact of/on	Extent of impact
Human health and safety	=Medium

COVID-19 Management

Planning phase

- Plan construction phases avoiding large group of workers and unnecessary overlap of crews. If the work plan was developed prior to COVID-19 outbreak, consider reviewing and adapting when necessary;
 - Basic Personal Protective Equipment (PPE) related to construction safety such as gloves and glasses should be provided to workers depending on the tasks they are assigned to. In addition, each worker should be provided with two or more reusable masks (not surgical/medical graded masks);
 - Additional hand washing stations including provision of clean water and soap, together with cleaning and disinfection products may be required for construction sites opened prior to the outbreak. For new construction site, plan and budget provision of these items;
 - Preferably, every worker should be provided with a basic set of tools needed for the tasks they are assigned to. Using of the same tool by multiple workers should be avoided. If tools are shared or stored for later use by another person, they need to be disinfected/cleaned;
 - Plan to engage workers coming from the close proximity of the facility been built (possibly from the same block) and avoid involving labor from farther away camps or villages;
 - Supervision should be strengthened including COVID-19 prevention principles, and supervisors oriented on their new responsibilities;
-
- If possible, prior to start construction work coordinate with Health partners to check the site and ensure appropriate measures are adopted;

Prepare your workforce

- An orientation on COVID-19 should be provided to all workers, including description of the disease, symptoms, transmissibility, severity and WHO's key prevention messages to be followed on site, public spaces as well as in their homes;
- Prevention messages should be printed and clearly displayed on site. Consider providing an additional printed copy of the key prevention messages for all workers to disseminate in their families (and communities);
- Workers should be clearly informed on protocols to follow in case they or their family members get sick;
- Workers should be requested to maintain physical distance of 2 meters (6') from others as much as possible and to adhere to the other suggested practices for infection prevention and control, in particular:
 1. Wash your hands regularly with clean water and soap for at least 20 seconds, or clean them with a hand sanitizer;
 2. Avoid touching your eyes, nose and mouth with unwashed hands;
 3. When coughing or sneezing, cover your mouth with tissue and throw it into closed bin immediately. If you do not have a tissue, cough or sneeze into your flexed elbow;
 4. Do not spit.
- Working gloves are sometimes worn to protect against injuries during some activities, but they do not offer any protection against transmission of COVID-19 and should be considered as unwashed hands in terms of minimizing touching one's face;
- Workers should not greet each other with handshakes or embraces at any point during the day;
- If workers are operating in an area where sick or suspected infected people are currently or recently transited (in the previous 3 days), they should wear mask and disposable gloves at all times;
- If masks are not available, workers should be encouraged to prepare handmade ones using household items or clothes materials;

- Advice workers to wash their clothes frequently (daily if possible).

Access to site

- Only essential visitors (workers, supervisors, and managers) should be allowed on site;
- Programme/monitoring visits should be reduced to the minimum and should be planned when workers are not on site (i.e. lunch or prayer time);
- Fence off the construction site to ensure no one can enter or approach the workers without authorization;
- Entry and exit gates should be clearly marked and guarded;
- Body temperature should be measured for all persons entering the site;
- Allow enough space for people to queuing in a safe manner at the entrance of the site while they wash their hands and get screened;
- A trained staff should be designated to guard the access, checking temperature of workers and visitors and enquiring about overall health condition and vulnerability;
- Ensure there are sufficient hand washing stations at the entrance and that they have water and soap, as well as clearly display signs requesting persons entering to wash their hands;
- Anyone falling in one of the following categories should not be allowed on site:
 1. Has a family member suspected COVID-19 patient living in the same household or selfisolating, or if s/he has got in close contact with a confirmed COVID-19 patient in the previous
 2. two weeks. S/he should not report on site and self-quarantining at home for two weeks;
 3. Is showing one or more symptoms related to COVID-19 (high temperature, new persistent
 4. cough, shortness of breath). S/he should not report on site, stay home and self-isolate or seek
 5. medical care in case of severe symptoms;
 6. Is a vulnerable person (by virtue of age, clinical/health condition or pregnant)?
- All persons should wash or clean their hands before entering and leaving the site;
- Workers should be encouraged to reach the site using individual modes of transportation and avoid public transport when possible.

During construction

- To the most possible extent, workers should maintain physical distance of 2 meters (6') from others at all times. Performing activities that must be conducted in close proximity should be avoided when possible. If these activities must take place, workers should wear masks;
- If possible, construction crews should be segregated and tasks allocated so they do not overlap. It is suggested to establish crew shifts to be also applied for break, lunch and pray time;
- If a worker develops COVID-19 symptoms on site, the following actions should be followed:

Avoid touching anything;

- Cough and sneeze into a tissue and put it in a closed bin, or in their flexed elbow in case they
 - don't have tissues;
- Return home and self-isolate, or seek medical care in case of severe symptoms;
- All surfaces and tools s/he may have recently touched should be cleaned and disinfected.
- In spaces where queuing may happen (including latrines and hand washing stations), consider marking
- safe distance of 2 meters (6') on ground or railings;
- Meetings on site should be avoided at all times. Instruction to workers should be given in open spaces and maintaining physical distance;
- If construction activities happen in an enclosed space, the site should be ventilated as much as possible, for example leaving doors and windows open during the working day;
- Due to potential sudden access restrictions, all materials and equipment should be carefully and safely stored before leaving the site at the end of every day;
- When receiving and unloading goods and construction materials, workers should keep distance from the drivers at all times. When possible, drivers should remain in their vehicles. If drivers must unload

- the goods for safety reasons, they should do so without the help of the workers and they should wash
- or clean their hands before and after. Any contact between deliverers and receivers should be avoided
- (including delivery papers and pens for signature, etc.). It is recommending that everyone needing to sign
- paperwork have their own pen or wash their hands after.

Hand washing, hygiene and cleaning

- Provide adequate hand-washing station with water and soap or an alcohol-based hand sanitizer (min.60% alcohol).
- Ensure water and soap are topped up regularly;
- Clean the hand washing facilities regularly during the day, establishing a clear cleaning plan;
- Tools, reusable PPE and frequently touched surfaces should be cleaned and disinfected frequently (atleast daily);
- If possible, appropriate latrine facilities should be made available inside the compound and be kept
- cleaned. In any case, workers should be encouraged to wash their hands before and after using the latrines;
- Dedicated eating, break and prayer areas should be identified on site and access should be staggered
- to reduce risk of congestion. Workers should keep physical distance while eating, praying and having a break;
- Provide safe drinking water dispensers and one-time cups, or encourage workers to carry an individual cup;
- All solid waste (excluding construction materials) should be put immediately in closed bins or closed.
- bags and not left for someone else to clear up;
- Separate and collect all solid waste that could serve as transmission vector. To avoid contact with
- waste bags, use double plastic bags (for instance when removing a filled waste bag, cover tightly and
- wrap with a second plastic bag). Store the waste for at least 72 hours before disposing;
- Store leftovers construction materials for at least 72 hours before disposing.

Upon completion

- The facility should be carefully cleaned and disinfected prior to the handover;
- All waste, construction materials, tools and equipment should be removed from the site and disposed safely

Analysis of Alternatives

The feasibility study of this solar plant suggests the installation of crystalline modules. Crystalline silica (silicon dioxide) is a potent respiratory hazard. However, the likelihood of crystalline silica generation during normal processing is very remote. Silicon crystalline irritates the skin and eyes on contact. Inhalation will cause irritation to the lungs and mucus membrane. Crystalline silica may affect the immune system, leading to micro-bacterial infections or fungal, especially in workers with silicosis (CAT, 2016).

The manufacturing process of monocrystalline panels is likely to have more waste, as they are made from slices of silicon ingots-leaving off cuts, and etc. Though, this waste can be used to create multi-crystalline or polycrystalline PV modules, constructed of 'mashed up' silicon. Thin film silicon reduces the volume of material needed by spraying a thin layer of silicon on to a surface, so has the potential to reduce impacts and waste (CAT, 2016).

Based on the Silicon Valley Toxics Coalition report some potentially damaging chemicals are used in the manufacture of PV cells. There are several different sorts of PV technology and each of them use different processes to manufacture, but some of the common harmful chemicals involved in crystalline PV cell manufacturing are:

- Crystalline silicon is made using Silane gas, the production of which results in waste silicon tetrachloride which is toxic which has the potential to cause harm.
- Sulphur Hexafluoride is used to clean the reactor used in silicon production. If it escaped it would be a very potent greenhouse gas. It can also react with silicon to create a range of other compounds.
- A range of other chemicals used for cleaning the silicon and cells (CAT, 2016).

Both polycrystalline and monocrystalline solar cells are very similar in performance. Though the monocrystalline cells have highest efficiency and are costly then the polycrystalline. The main factors in terms of system performance during the lifetime of the solar panel is the absence of flaws in the manufacturing and operation processes. Thin film is completely different technology, which is less efficient and therefore needs more space. The better performance during the low light conditions when there is partial shading of the system or in extreme heat is one of its advantage.

The purpose of the analysis of alternatives as part of the IEE process is to select the best among all possible project options at most benefits and least costs in terms of financial, social, and environment, and. The suggested recommendations and alternatives were evaluated and analyzed which are organized as below:

The No Action Alternative

The "No Action" Alternative in this instance is defined as a decision not to undertake the proposed construction of the NCB 047 project. The "No Action" Alternative would result in the continued deterioration of the solar project structures in the project command area; thereby severely impeding the economic recovery of the Project Area and the country as a whole. All benefits would be foregone. The relatively minor, less than significant environmental impacts (such as noise and short-term air quality impacts due to maintenance activities) and inconveniences (such as traffic diversions) would be avoided in the short run. In the long run. In light of these considerations, the "No Action" Alternative is deemed to be neither prudent nor in the best interest of Afghanistan or those with an interest in, and attempting to assist restoration of, Afghanistan's wellbeing.

Site Alternative

Site alternatives generally include alternative routes, re-alignments, by-passes and similar actions. In this instance, due to the topographical conditions of the region and project nature no need to the site alternatives and cannot be considered as there is no alternate route for NCB-047 project.

Design Alternatives

In the project area multiple design option were studied to minimize the potential environmental impacts and reduce project costs. The design team considered the existing design with no changes.

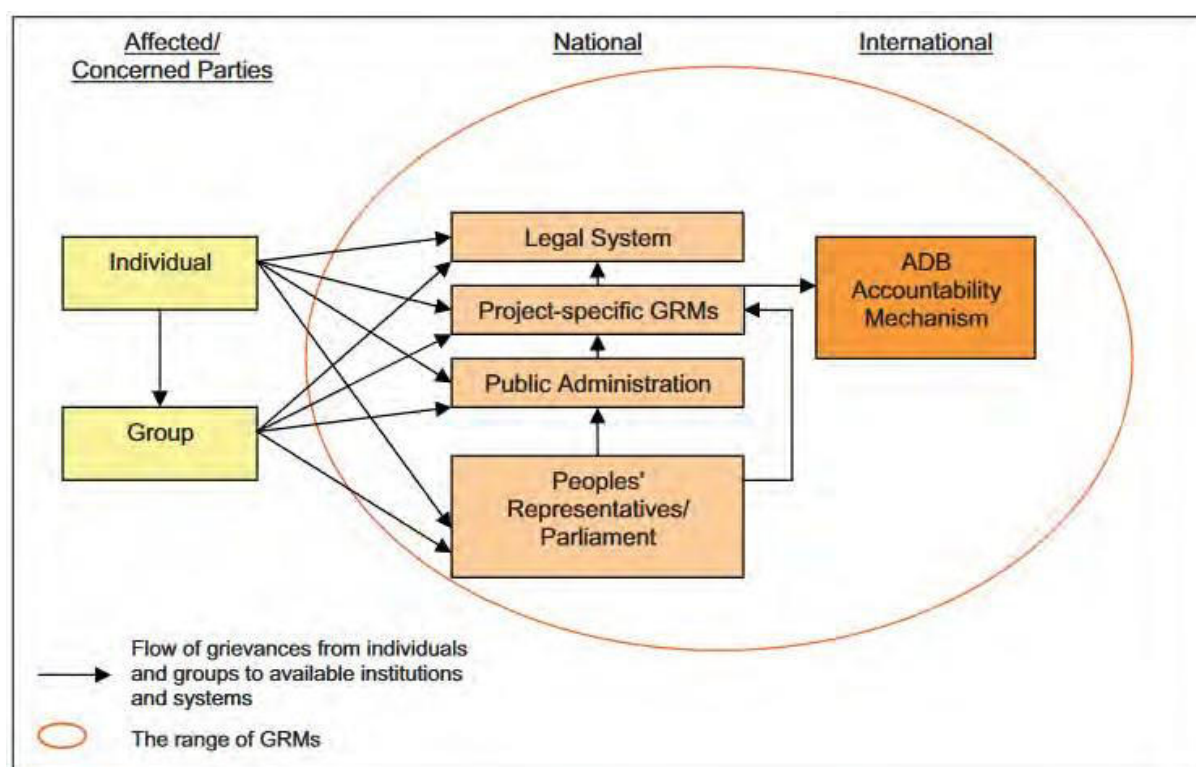
The design standards proposed for the NCB 047 on project are those generally adopted in Afghanistan, which refer to the ADB Standards

Grievance Redress Mechanism

Overall, the project is located in an area, where community close to project vicinity. However, if the project faces any grievance then the following methods will be implemented for better redress.

A mechanism to receive and facilitate resolution of concerns, complaints, and grievances about the project's environmental performance will be established. It will address Aggrieved Person (AP) concerns and complaints promptly, using an understandable and transient process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people at no costs and without retribution. Systems and institutions for grievance redress available to affected persons is shown in below figure.

Figure 8: Systems and Institutions for Grievance Redress Available to Affected Persons (ADB, 2010).



In the construction process, people affected by the project may suffer from accidental negative impacts or feel treated unjustly. This might happen for various reasons: the contractor does not adhere to sound construction principles, health hazards were incidentally produced, working conditions is found unacceptable, unexpected downstream impacts / environmental pollution were incidentally produced, damages to individual property is not paid for or misunderstandings have arisen and so forth.

In the case of individual grievances or disagreement with procedures of consultation, notification or valuation, people is encouraged to lodge their complaints with the responsible grievance redress mechanism within the Implementing Agency (DABS-PMO). In case of accidental environmental pollution, the local/national environmental authority will have to be directly informed and legal procedures will undertake.

The rationale behind is that people can get their problems solved and grievances redressed in a timely and effective manner without directly addressing the court. During consultation procedure, the

AP shall be notified orally or in a written form about their rights and the procedure of complaints introduction. The grievance mechanism has to be locally implemented at the level of village institutions and municipality. Distribution of leaflets as well as putting up information boards is an effective way of distributing information including contact addresses and telephone numbers to be contacted.

A professional attitude to accept complaints in a friendly manner and offering all possible help is a crucial qualification for the staff charged with grievance collection. Lodging complaints and grievance resolution must be cost-free for APs. In a first step, complaints resolution will be attempted at the community level in a negotiation procedure with an informal mediator and community authorities. If the grievance persists, a grievance form can be submitted to the responsible committee under the responsibility of the authorized body / DABS. The committee then decides whether to settle or go to court. The decision has to be taken within 15 days. In case of failure of the grievance redress system, the APs can submit their case to the appropriate court of law.

Members of the grievance committee will be the contractor, DABS-PMO, local administration, the environmental authority in charge, a lawyer and NGO representatives in case applicable. The contractor is obliged to carry out the work in accordance with the contractual requirements that include:

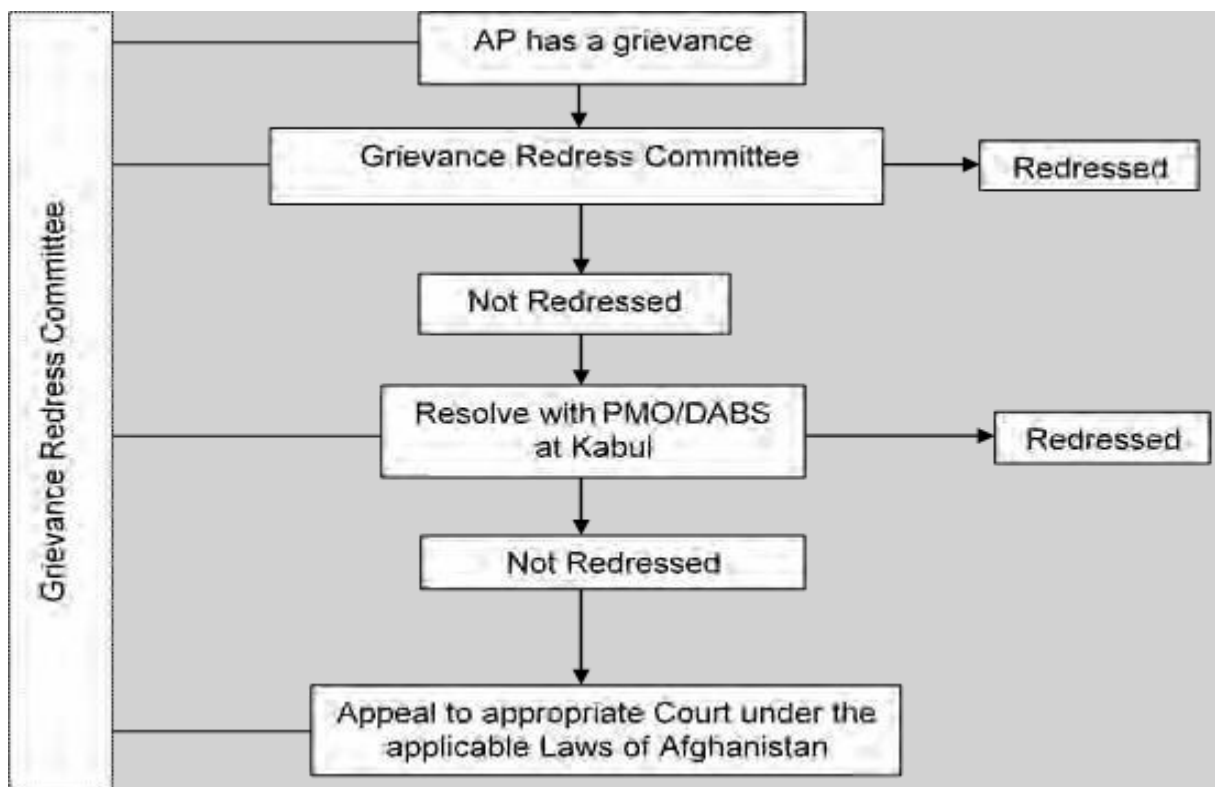
- a provisional sum for grievance redress
- a person of staff responsible for grievance procedure (including first contact, periodical site visiting of mitigation measure to be implemented by the contractor, record keeping of filed complaints and follow up, periodic reporting)
- a telephone line, e-mail address and contact name on project information boards
- Communication of contacts and grievance procedure to all affected Villages. There must be a complaint register at the site to record and register all complaints and its remedial actions. The complaint register will include a narrative on the actual process undertaken to mitigate these grievances. The contractor, together with the Implementing Agency (IA), will be responsible to include a social and gender specialist to:
 - coordinate the grievance redress procedure
 - arbitrate grievances with the contractor, AP, and local administration /Community leader
 - liaison with DABS
 - liaison with court
 - documentation of all grievances and resolution procedures.

Community leaders will act as informal mediators in case of complaints. However, APs have the option to choose a different representative or directly liaison with the IA staff designated for grievance redress. All grievances and their resolution process shall be documented. The AP is encouraged to proceed in the following way:

- contact the contractor's designated grievance staff /committee representative during periodical site visits in person or via the designated telephone number or via the community leader or NGO staff
- lodge the complaint and provide information on the case

- agree with the construction contractor on specific mitigation measures
- agree with the contractor on a time limit for the grievance settlement
- grievances have to be settled within the weeks, or as otherwise specified in the scheduled agreement
- sign if the mitigation measure has been implemented as agreed
- seek redress from DABS if not satisfied with the above-mentioned procedure
- involve appropriate local authorities to liaison with DABS and contractor
- involve NGOs or the construction supervision consultant to liaison with DABS and the contractor
- seek redress from ADB if not satisfied with a response by DABS
- Seek redress from the court if all other ways have failed.

Figure 9: Grievances Redress Chart.



The grievance mechanism is designed to avoid lengthy court procedures but does not limit the citizen's right to submit the case straight to the court of law just in the first stage of the grievance process. The Asian Development Bank (ADB) is not directly a part of the Grievance procedure but shall receive reports on which complaints were received and how they have been followed up/mitigated.

The grievance mechanism shall be implemented by the PMO in cooperation with the contractor. The PMO shall ensure the availability of GRM staff and make information about GRM (telephone number, contact persons etc. publicly available and free of charge.

In order to make the project affected communities accessible and to help ensure better and faster resolution of the project related grievances. This mechanism provides a channel to all those who believe they have been affected by the ADB financed project. Three channels for public complaints and communication are recommended to be available: complaints drop box, grievance telephone number and formal grievances through mail or letter. Among the three channels, the telephone could be the most effective channel to contact the project manager and discuss complaints as it is readily accessible to almost all segments of the affected people and is a two-way communication. The project team should share the grievance mechanism and contact channels details with affected people through brochure and notice boards near the project side. All complaints on construction trouble, damages to public property in any case must be addressed properly.

The project manager or environment responsible/specialist person after receiving the complaint must record the details of the complaint and identify the source of the problem and inform senior management. After the receipt of complaint they need to find out if the complaint is caused from the operation of the project. In case the problem is caused by the project, the team will fix the problem in case possible or stop the operation. Then, the environment specialist will facilitate to arrange a meeting with the complainer for better understanding and update them the progress of mitigation measures from time to time until the issue has been resolved. If the issue is beyond the authority of the project manager, it will be referred to the senior management for appropriate solution. Then, the project manager will respond to the complainer.

There must be a record book at the site to record and register all complains and its remedial actions. The record book will include a narrative on the actual process undertaken to mitigate these grievances.

Public Consultation and Information Disclosure

The subproject area is located in bare government land where no community is located close to it. The nearest community is 8 km away from the subproject area. Consultation meetings were held with concerned government authorities and NVDA project. The objectives of the meetings were to share the project relevant information with communities and understand their concerns. The information shared included project activities and their expected impacts on the physical, biological and socio-economic conditions. In coordination with Social Safeguard Officer, the concerns of the affected groups linked to the project were documented and understood.

Table 5: The below given table represent the community consultation details.

Solar Panel installation - Community Consultation and Information Disclosure Participants Meeting Attendance Sheet				
Meeting Location		NVDA		Date Different data and times
Agenda		Awareness about Solar Panel installation subproject.		
No	Name	Position	Organization	Key Concerns
1	Zarafullah	Director	NVDA	When is the project going to start? We welcome the project any time it's going to be started. Will the project help the poor people?
2	Hazart Gul	Director	NVDA	
3	Gul Ahmad	Head of Operation and auditing	NVDA	
4	Eng. Dawoot	Site Engineer	NVDA	
5	Eng. Ehsan	Site Engineer	NVDA	
6	Eng. Ameen	PIO Engineer		
7	Eng. Bahar	PIO Engineer	NVDA(CPM O)	
8	Eng. Shir Afghan	PIO Engineer	NVDA(CPM O)	

Environmental Management Plan (EMP)

This section covers the set of management and mitigation measures to be taken during project implementation to avoid, mitigate, reduce, or compensate for adverse environmental impacts (ADB, 2009) and Afghanistan law and regulation. EMP addresses environmental risks and impacts are related to all the project cycle stages including construction, operations, decommissioning, and closure.

The objectives of the EMP is to provide the delivery method to address the negative environmental impacts of this project during its implementation. During the project implementation, Project Implementation Unit will be responsible to monitor and control the project progress from environmental perspective. All project personnel must adhere to general environmental protection methods and particular mitigation measures. The project manager and environmental specialist must ensure that all the measures reflected in the EMP are properly implemented and the environmental specialist of the Engineer should monitor the implementation of the process

Environmental Management Plan (EMP)						
No.	Project Phases	Report Referenced Sections	Impacts	Mitigation Measures	Responsibility	Timing
1	Design and Construction Phase	8.1.1 and 8.1	Panels fixed structure foundation weakening, and soil erosion	<ul style="list-style-type: none"> ☑ The recommendations of geotechnical examination must be followed strictly, and the design need to consider all the calculation related to soil type, its strength and other geotechnical aspects. ☑ Areas having unstable soil will be avoided for foundation of solar panels. In unavoidable conditions, soil compaction and stable foundation construction is required. 	Designer, Environmental Specialist (ES), consultant	Before construction (BC), and during detailed designing of the project
		8.1; 8.1.1.3; 8.1.1.4	Soil and water contamination and health risks	<ul style="list-style-type: none"> ☑ Suitable waste water management or DEWAT systems consideration. ☑ PCB free equipment. ☑ Leaked oil collection arrangement (such as a channel and a drain pit below the transformers and other oil containers) consideration. 	Designer, Environmental Specialist (ES), consultant	BC

		8.1.1.5; 8.1.3.1	Safety hazards and public health concerns	☑ All safety measures consideration. Standard clearance distance of 3.7 meters from the live wires and equipment should be considered for the buildings trees, and etc.	Designer, Environmental Specialist (ES), consultant	BC
		8.1.1.1	Noise	☑ All the equipment, noise level should meet the noise standards limits of OSHA which is below 90 dBA.	Designer, Environmental Specialist (ES), consultant	BC

2	Site office Establishment and Operation	8.2.1 and 8.2.1.4	Soil Erosion / Contamination	<input checked="" type="checkbox"/> Land clearing, leveling and grading will be minimized and carried out in manner to minimize soil erosion. <input checked="" type="checkbox"/> Vehicle traffic on unpaved roads should be avoided <input checked="" type="checkbox"/> Operation of vehicles close to the river stream should be minimized. <input checked="" type="checkbox"/> The availability of approved waste management and disposal plan. <input checked="" type="checkbox"/> Proper sewage system. <input checked="" type="checkbox"/> The recyclable and non-recyclable wastes should be handled separately and transported to the relevant plants. <input checked="" type="checkbox"/> The hazardous waste will be kept separate and handled according to the nature of the waste.	Contractor	During Construction (DC)
		8..2.1.3	Air Quality Deterioration	<input checked="" type="checkbox"/> Use dust abatement techniques on unpaved, un-vegetated surfaces; speed limits of vehicles.	Contractor	BC; DC

				<input checked="" type="checkbox"/> Schedule construction activities during periods of low winds. <input checked="" type="checkbox"/> Generators and vehicles should be kept in good working condition and properly maintained. <input checked="" type="checkbox"/> Spray water on soil, where required and Remove dirt and mud from trucks' wheels before leaving the project site. <input checked="" type="checkbox"/> No open burning.		
		8.2.1.5	Surface water contamination	<input checked="" type="checkbox"/> For the domestic sewage, appropriate treatment and disposal system consideration. <input checked="" type="checkbox"/> Waste oils proper collection and control. <input checked="" type="checkbox"/> The inert recyclable waste from the site (such as card board, drums, broken/used parts, etc.) will be sold to recycling contractors. <input checked="" type="checkbox"/> The hazardous waste should be kept separate and handled according to the nature of the waste. <input checked="" type="checkbox"/> Domestic solid waste from the construction camp will be disposed	Contractor	BC;DC

				in a manner that does not cause soil contamination.		
		8.4.2	Damage of Vegetation	<input checked="" type="checkbox"/> Removal of natural vegetation should be avoided. <input checked="" type="checkbox"/> The workers must be provided with LPG for cooking and heating.	Contractor	DC
		8.2.1.2	Noise	<input checked="" type="checkbox"/> Generators and vehicles must be equipped with exhaust mufflers and silencers to minimize noise generation.	Contractor	DC
3	Construction Phase	8.2.1.3 and 8.2.1.5	Water Contamination	<input checked="" type="checkbox"/> Apply erosion controls measures. <input checked="" type="checkbox"/> Regularly monitor access roads, and other project areas for indications of erosion. <input checked="" type="checkbox"/> Use dust suppression techniques. <input checked="" type="checkbox"/> Apply protective covering on disturbed soils as quickly as possible. <input checked="" type="checkbox"/> Clean and maintain catch basins, drainage	Contractor	DC

				<p>ditches, and culverts regularly.</p> <p><input checked="" type="checkbox"/> Refuel in a designated fueling area.</p> <p><input checked="" type="checkbox"/> Use drip pans during refueling to contain accidental releases and under fuel pump and valve mechanisms of any bulk fueling vehicles parked at the project site.</p> <p><input checked="" type="checkbox"/> Limit herbicide/pesticide</p> <p><input checked="" type="checkbox"/> Vehicles and equipment containing lubricants must not be repaired in the field.</p>		
		8.2 and 8.2.1.3	Air Quality Deterioration	<p><input checked="" type="checkbox"/> Use dust abatement techniques on unpaved, un-vegetated surfaces.</p> <p><input checked="" type="checkbox"/> Post and enforce speed limits to reduce airborne fugitive dust.</p> <p><input checked="" type="checkbox"/> Limit access to the construction site and staging areas to authorized vehicles only.</p> <p><input checked="" type="checkbox"/> Schedule construction activities during periods of low winds.</p> <p><input checked="" type="checkbox"/> Cover construction materials and stockpiled soils.</p>	Contractor	BC;DC

				<input checked="" type="checkbox"/> Train workers to handle construction materials and debris during construction. <input checked="" type="checkbox"/> Keep soil moist while loading into dump trucks. <input checked="" type="checkbox"/> Minimize drop heights when loaders dump soil into trucks. <input checked="" type="checkbox"/> Cover dump trucks before traveling on public roads. <input checked="" type="checkbox"/> Keep vehicles in good working condition and cleaned, in order to minimize the exhaust emissions. <input checked="" type="checkbox"/> Spray water on soil, where required <input checked="" type="checkbox"/> Remove dirt and mud from vehicles wheels before leaving the project site. <input checked="" type="checkbox"/> The sand and soil carrying vehicles bodies should be covered by a cloth sheet.		
		8.2 and 8.2.1.2	Noise	<input checked="" type="checkbox"/> Limit noisy activities (including blasting) to the least noise- sensitive times of day (weekdays only between 8 a.m. and 6 p.m.).	Contractor	DC

				<input checked="" type="checkbox"/> Schedule different noisy activities (e.g., blasting and earthmoving) to occur at the same time. <input checked="" type="checkbox"/> Notify nearby residents in advance when blasting or other noisy activities are required. <input checked="" type="checkbox"/> Post warning signs in high-noise areas and implement a hearing protection program for work areas where noise exceeds 90 dBA. <input checked="" type="checkbox"/> Vehicles should have exhaust mufflers and silencers to minimize noise generation. <input checked="" type="checkbox"/> Vehicle speeds will be kept low, and horns will not be used while passing through or near the communities.		
4	Miscellaneous	11	Complains /grievances	<input checked="" type="checkbox"/> Project complaints will be mitigated through the Grievance Redress Mechanism	Contractor. As specified in the grievance redress mechanism	

		8.3.3 ; 8.2.3	Socioeconomic condition improvement through local Work Force	<input checked="" type="checkbox"/> Capacity building training to be provided for locally hired workers. <input checked="" type="checkbox"/> Local skill and semi-skilled labor be	Contractor	DC
			employment	employed from the community near the project site for better socio economic impacts and to address public grievances		
		8.3	Safety hazards	<input checked="" type="checkbox"/> O&M staff will be provided essential Personal Protective Equipment (PPE). <input checked="" type="checkbox"/> O&M staff will be provided safety training. <input checked="" type="checkbox"/> Fire extinguishers must be available at the site in all major places. <input checked="" type="checkbox"/> The Emergency Response Plan (ERP) should be developed and available at the solar plant. <input checked="" type="checkbox"/> Appropriate safety precautions signs must be installed at the key locations. <input checked="" type="checkbox"/> Equipment grounding and isolation procedure follow-up	Occupational Safety Supervisor (OSS)	During Operation & Maintenance (O&M)

		8.2	Soil and water contamination; toxic lubricants	<input checked="" type="checkbox"/> Consideration of septic tanks or Decentralized Wastewater Treatment System (DEWATS) system. <input checked="" type="checkbox"/> Waste oils and chemicals should be disposed in	Designer, Environmental Specialist (ES), consultant	During Operation & Maintenance (O&M)
				government and NEPA Regulations.		

1.1 Environmental Monitoring Plan

No.	Project Stages	Impacts	Parameters to be Monitored	Responsibility
1	Design Considerations	Panels fixed structure weakening, and soil erosion	<ul style="list-style-type: none"> ▪ The geotechnical examination results ▪ Foundation strength of solar panels ▪ Field Density Test (FDT) for foundation compaction 	Designer, Environmental Specialist (ES), consultant
		Flood protection and its proper direction	<ul style="list-style-type: none"> ▪ Flood volume at different season ▪ Flood runoffs sizes 	Designer, Environmental Specialist (ES), consultant
		Soil and water contamination and health risks	<ul style="list-style-type: none"> ▪ Availability of Suitable waste water management or DEWAT systems ▪ PCB contained equipment must not be allowed. ▪ Spilled lubricants and oil collection arrangement 	Designer, Environmental Specialist (ES), consultant
		Safety hazards and public health concerns	<ul style="list-style-type: none"> ▪ Standard clearance distance from the live wires and equipment from the buildings trees, and etc. ▪ Equipment and wire insulation arrangement. 	Designer, Environmental Specialist (ES), consultant
		Noise emissions	<ul style="list-style-type: none"> ▪ Noise level 	Designer, Environmental Specialist (ES), consultant

2	Site office Establishment and Operation	Soil Erosion / Contamination	<ul style="list-style-type: none"> ▪ Soil erosion level. ▪ Vehicle movement. ▪ Availability and implementation of approved waste disposal plan. ▪ Availability of sewage and waste a treatment system for domestic waste. Waste recycling. ▪ The recyclable and non-recyclable wastes handling procedure follow-up. ▪ The hazardous waste handling. ▪ Temporary structures, land leveling and re-contoured to the original condition or better. ▪ Debris and any other material removal from the site. 	Contractor
		Air Quality Deterioration	<ul style="list-style-type: none"> ▪ Condition and maintenance cycle of generator and vehicles. ▪ Water spraying of dust ▪ Removal of dirt and mud from trucks wheels before leaving the project site. 	Contractor
		Surface Water Contamination	<ul style="list-style-type: none"> ▪ Waste water treatment and disposal system availability. ▪ Waste oil and lubricant handling. ▪ Recycling waste handling. ▪ The hazardous waste treatment. ▪ Domestic solid waste arrangement. 	Contractor
		Damage of Vegetation	<ul style="list-style-type: none"> ▪ Handling of vegetation. ▪ The site office location. ▪ Fuel for cooking and heating. 	Contractor
		Noise	<ul style="list-style-type: none"> ▪ Generators and vehicles exhaust mufflers and silencers availability. ▪ Working time 	Contractor
3	Construction and Materials Transportation	Soil Erosion and Water Contamination	<ul style="list-style-type: none"> ▪ Repair of Vehicles and equipment containing lubricants. ▪ Arrangement for the protection of soil and water contamination by lubricants. 	Contractor

		Air Quality Deterioration	<ul style="list-style-type: none"> ▪ Working condition of the project vehicle and the exhaust emissions. ▪ Removal of dirt and mud from vehicles wheels. ▪ The vehicles speed on unpaved roads. ▪ The sand and soil carrying vehicles spill protection measures. 	Contractor
		Noise	<ul style="list-style-type: none"> ▪ Vehicles exhaust mufflers and silencers availability. ▪ Vehicle speed near the communities. ▪ Night time (5PM to 6AM) work. ▪ Noise barriers installation around the noisy equipment 	Contractor
4	Miscellaneous	Complains	<ul style="list-style-type: none"> ▪ Complaints handling and procedures ▪ Community access to complaints raising channels 	Contractor
		Socioeconomic condition improvement through local Work Force employment	<ul style="list-style-type: none"> ▪ Capacity building training for locally hired workers. ▪ Local skill and semi-skilled labor employment. 	Contractor
		Land acquisition disputes	<ul style="list-style-type: none"> ▪ Formal land clearance for the purpose of the solar project with all relevant parties. 	ADB
5	Operation and Maintenance Activities	Safety hazards	<ul style="list-style-type: none"> ▪ Personal Protective Equipment (PPE) availability. ▪ O&M staff training. ▪ Fire extinguishers availability. ▪ The Emergency Response Plan (ERP) availability. 	Designer, Environmental Specialist (ES), consultant
			<ul style="list-style-type: none"> ▪ Safety precautions signs installation. ▪ Equipment grounding ▪ Equipment isolation procedure 	

		Noise	<ul style="list-style-type: none"> Measures for noise reduction. Replacement of the noisy equipment Noise barrier installation. 	Designer, Environmental Specialist (ES),
		Soil and water Contamination; toxic lubricants	<ul style="list-style-type: none"> Availability of solid waste collection and disposal arrangements. The panels dust washing water drainage system and the suspended particles separation. Septic tank or Decentralized Wastewater Treatment System (DEWATS) system availability and operation The waste water flow to river Waste oils and chemicals disposal Material Safety Data Sheet (MSDS) availability. Recycling process of Non-toxic and toxic waste Channels and drainage availability for leaked oil of transformers and etc. Risk analysis through accredited laboratory whenever a transformer is scrapped, maintained, displaced, sold or when an oil change takes place, in case PCB contained transformer has used. The application of United Nations Environment Programme guidelines for PCB disposal and handling. Handling of oil/chemical spillage in accordance with the MSDS of the spilled oil/chemical. Soil erosion and mudflow signs. 	Contractor
		Solar panel light reflection	<ul style="list-style-type: none"> Panels light reflection on road traffic and tree planting. 	Designer, Environmental Specialist (ES), consultant

6	Plant Decommissioning/	Industrial waste and hazardous materials	<ul style="list-style-type: none"> ▪ Recycling arrangements for equipment taken out of service (panels after 20-25 years). ▪ Output power efficiency <80% ▪ Industrial waste handling in accordance to the government and NEPA regulations. 	Designer, Environmental Specialist (ES), consultant
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1.2 Estimated EMP Costs Summary:

Table 6: Preliminary cost estimate of the implementation of the EMP is given in Table below.

PROJECT STAGE	DETAILS	ESTIMATED COST (USD)
EMP IMPEMETATION TEAM	Salaries for 1-2 staff required for EMP implementation	15,000
AIR, NOISE, WATER TEST COST	Test costs for checking teh quality of air, noise and water before, during and post project implementation	10,000
TRAINING OF STAFF	Training on data collection, data entry, data analysis and reporting	5,000
MONITORING AND REGULAR DATA COLLECTION	Regular data collection to gauge the quality of various environmental parameters	10,000
HEALTH AND SAFETY	Office operation cost such as stationary, intenet, furniture, etc	5,000
TOTAL \$		450,00

Conclusion and Recommendations

The sun offers an incredible renewable source for sustainable, environment friendly and clean electricity generation without global warming emissions. The potential negative impacts associated with solar energy occur during construction and decommissioning stages. Furthermore, the habitat loss, land and water use, and the use of harmful materials in manufacturing process are some of the other adverse environmental concerns associated with solar energy production.

The NCB-047 solar panel installation project has minimum environmental concerns during the construction and operation phases as the project site area is not located at the vicinity of the sensitive ecosystem, for instance national forests, wildlife sanctuaries, etc. and no endangered species are affected by the project. The ecological survey of the site confirmed the nonappearance of scarce and ecologically significant fauna and flora. Therefore, there are no serious biological concerns with the implementation of this project. Evidence of agricultural and residential land-use have not been visible at the site. There are two types of naturally grown plants available at the site which are not unique and are common in the area. Therefore, the project does not pose any serious environmental concerns.

Furthermore, the construction will not create environmental disturbances from construction equipment such as noise and dust, with little impacts on the natural environment and the communities. The project site has low ecological sensitivity. On the other hand, the amount of solar energy produced will result in annual reduction of CO² in a year emissions associated with positive environmental and social benefits for society as a whole.

The Solar Plant must have Emergency Response Plan (ERP), Waste oils and chemicals disposal Material Safety Data Sheet (MSDS), solid waste collection and disposal arrangements. In addition, the panels dust washing water drainage system with suspended particles separation arrangement needs to be installed. Furthermore, septic tank or Decentralized Wastewater Treatment System (DEWATS) system availability is also recommended. The waste water and contaminated water must not be allowed to the nearby Kabul River.

The key environmental concern associated with solar plants is the recycling of the panels and other parts taken out of service during the decommissioning stage. Most of the solar panel brands have 25 year warranty and most likely will need to be replaced every 25 years, like the inverters. The equipment taken out of service, if not recycled properly can pose environmental risks as it can contain some toxic elements and other environment unfriendly substances. Therefore, the supplier or project implementer must ensure that there are recycling precautions in place when the useful lifecycle of the solar plant comes to end.

Recommendations

- For increasing the project socioeconomic positive impacts, it is recommended that the first priority shall be given to the recruitment of local people to work in the project.
- To make sure that the proposed mitigation measures are implemented and negative impacts are avoided, the IEE must be part of the bidding documents.
- An unexpected discovery of cultural resources during any phase of the project shall result in a work stoppage in the vicinity of the find until the resources can be evaluated by a professional archaeologist. And educate workers and the public on the consequences of unauthorized collection of artifacts.

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2 Annexes

Figure 10: Subproject Site Photos



