Summary of Environmental and Social Consideration in Detailed Planning Survey for Photovoltaic Power Plant Feasibility Study Project in Morocco

1. Full title of the project

Photovoltaic Power Plant Feasibility Study Project in Morocco

2. Type of the study: Feasibility study

3. Categorization and its reason

3.1Categorization: Category “B”

3.2 Reason

Photovoltaic (PV) power plant does not emit flue gas, effluent, noise and any other pollutant during operation of the plant. Also construction of the plant does not need large scale civil works since most of the equipment for PV power plant is made in factories. Therefore construction and operation of PV power plant does not cause any significant environmental impact. On the other hands, PV power plant needs a large land. The project site for the PV power plant is a pasture which is owned by a local community to raise cattle, sheep and goat. The project use less than 10% of the pasture and therefore the impact to livestock industry is limited. There are 8 households in the project site and these households need to be resettled. Therefore the project needs to pay attention to minimizing impacts of the resettlement of the households.

4. Agency or institution responsible for the implementation of the project

Moroccan Agency for Solar Energy (MASEN)

5. Outline of the project

5.1 Objectives

(1) Goal of the Proposed Plan

The expected goals which will be attained by the proposed project are the followings.

- Feasibility study of the PV power plant in Ain Beni Mathar is completed.
- Capacity for PV project administration by counterpart is strengthened.

(2) Goal which will be attained by utilizing the Proposed Plan

The following goals will be attained by utilizing the proposed project.

- Contribution to Moroccan Solar Plan
- Industrial development in Morocco

5.2 Justification

Government of Morocco (GOM) sets an ambitious goal on developing renewable energy in order to gradually decrease dependency on fossil fuel resources and to promote sustainable development in the energy sector. GOM plans to generate 2000MW each by wind and solar energy by the year 2020. GOM particularly emphasizes on promoting solar energy in context of domestic industrial development and job creation.

Regarding solar energy, five regions have already been identified under the “Moroccan Solar Plan” to achieve the total capacity of 2000MW. MASEN is expected to develop detailed plans and implement them in each region. For example, at the first site of the plan (Ouarzazate (500MW in total)):
Phase 1: an independent Power Producer (IPP) of Concentrated Solar Power (CSP) plant is already awarded
Phase 2: pre-qualification to select an IPP is on-going
Phase 3: the construction of PV power plant is under planning

Furthermore, at the second region of the plan Ain Beni Mathar site was identified for a planned total capacity of about 400MW by combining of solar technologies including PV technology. However, feasibility study hasn’t started and detailed plan is not yet completed in Ain Beni Mathar. On the other hand, in response to some interests by private enterprises in Japan, Government of Japan (GOJ) acknowledges the importance of cooperation in the area of PV technology. Therefore, GOJ and related organizations of GOM concluded a memorandum (MOC) to promote comprehensive cooperation in the field of solar energy at Japan-Arab economy forum in December 2010. Thereafter, comprehensive cooperation in the field of solar energy was mentioned at several high level conferences including one held between both foreign ministries in march 2012 and other held between His Majesty King Mohammed Ⅵ of Morocco, and Mr. Genba, then foreign minister of Japan, in May 2012.

Therefore, GOM officially requested JICA to provide technical cooperation in implementing F/S for a PV power plant at Ain Beni Mathar.

Through a series of discussions between MASEN and JICA, both side agreed to carry out the Photovoltaic Power Plant Feasibility Study Project in Morocco.

5.3 Location

The PV power plant is located in Ain Beni Mathar in Oriental region. The following map shows the location of the PV power plant in Morocco.

Fig.1 Location of the PV power plant

5.4 Proposed activities

The feasibility study includes the following activities.

(1) Confirmation of present conditions of electricity sector and background of development plan in morocco
(2) Confirmation of the basic information in the candidate site
(3) Technical feasibility study
(4) Economic & financial feasibility study
(5) Support for making EIA report and related procedures by Moroccan side
(6) Potential for local contents (equipment, services, investment, etc.)
(7) Examination and suggestion for necessary arrangement for the implementation and O&M of the project
(8) Suggestion of implementation schedule and procurement package of the project
(9) Examination on an effect of reducing greenhouse gas (GHG) emission, and

recommendation of the mechanism to find the best value of carbon credit

5.5 Scope of the Study

The feasibility study includes the following contents.

(1) Confirmation of present conditions of electricity sector and background of development plan in Morocco, and examination over validity of PV power plant development.

(a) Review over present conditions of electric power sector and renewable energy.

(b) Review over present conditions and plan of renewable energy development.

(c) Review over present conditions and plan of solar energy (PV and CSP) development. Also, confirmation of the latest PV power development in Morocco.

(d) Confirmation of regulation about grid interconnection for the power station by renewable energy.

(e) Confirmation of policy and cooperation by other donors in energy sector (renewable energy in particular)

(2) Confirmation of the following basic information in the candidate site.

(a) Applicable data for solar radiation, for the development of solar radiation data (GHI and DNI) in a typical year

(b) Climate condition (temperature, precipitation, lightning, wind, etc.)

(c) Geographical condition, geological feature and earthquake-resistant condition

(d) Land use situation and future plan

(e) Existing and future infrastructures around the Project

(f) Conditions of existing electric facilities (substation, transmission lines) and development plan

(3) Technical feasibility study

(a) Review the result of further studies conducted by MASEN for other alternative sites in Ain Beni Mathar

(b) Review the latest applicable technology including comparison of different PV and storage technologies (cost-benefit analysis, maturity, conversion efficiency, aging, temperature effect, etc.) and current PV market development

(c) Recommendation on the capacity of PV power plant

(d) Civil and foundation work (including temporary construction)

(e) Site layout for the PV power plant

(f) Examination on the suitable tilt angle for PV arrays

(g) Method for grid interconnection

(h) Analysis of an impact to power systems including voltage/frequency fluctuation, short circuit current, etc. and suggestion of mitigation measures for them

(i) Specifications of equipment and material to be procured

(j) Suggested specifications of major equipment such PV module and inverter which is suitable for Moroccan environment and National grid

(k) Proposed supervisory and control system

(l) Design conditions, and the outline design of PV power plant and interconnection facilities

(4) Economic & financial feasibility study

(a) Estimation of project cost (EPC and development cost, O&M cost) with and without storage system

(b) Examination on economic & financial feasibility based on the calculated LOCE (Levelized cost of electricity)

(c) Recommendation of schemes for the promotion of PV system

(d) Comparison between with and without introducing storage system

(e) Suggestion of annual financial plan (incl. budget for O&M)

(5) Support for making EIA report and related procedures by Moroccan side

(a) Confirmation of regulations, procedures of environmental and social consideration by Morocco side

(b) Preparing the draft scoping (including evaluation items, an investigation method and alternative plans)

(c) Support for making EIA report

(d) Review of the “Land Acquisition and Resettlement Plan (LARAP)” prepared by MASEN, and check the compliance with JICA’s guidelines for Environmental and Social Consideration

(e) Support for holding public consultations with local stakeholders about environmental and social consideration

(f) Support for preparing a monitoring system

(6) Potential for local contents (equipment, services, investment, etc.)

(a) Analysis of PV value chain in Morocco, and the percentage of achievable local contents

(b) Suggestion of the road map to strengthen the local contents

(7) Examination and suggestion for necessary arrangement for the implementation and O&M of the project

(a) Suggestion of project implementation system (organization, role, demarcation of responsibility)

(b) Confirmation of the engineering capacity of counterparts (MASEN etc.)

(c) Suggestion of O&M system

(8) Suggestion of implementation schedule and procurement package of the project

(9) Examination on an effect of reducing greenhouse gas (GHG) emission, and recommendation of the mechanism to find the best value of carbon credit

6. Description of the project site

The PV power plant is located in Ain Beni Mathar in Oriental region near Algerian border. Ain Beni Mathar is about 100 km south of Oujda, which is the capital of the Oriental region. The population of the town is 13,526 according to the 2004 population census. The project site is a pasture owned by a local community to raise cattle, sheep and goat. The project site is over 3000ha wide, gently sloping plateau and semi-arid area at average altitude of about 1025m. There are 8 households inside the project site. These households are scattered in the project site. There is a large underground water resource, which extends over an area of 6,500km^2 in Ain Beni Mathar. There is an irrigation scheme in the center of Ain Beni Mathar. A water well and water supply facility for livestock is located near the project site. There is no access to electricity on the project site.

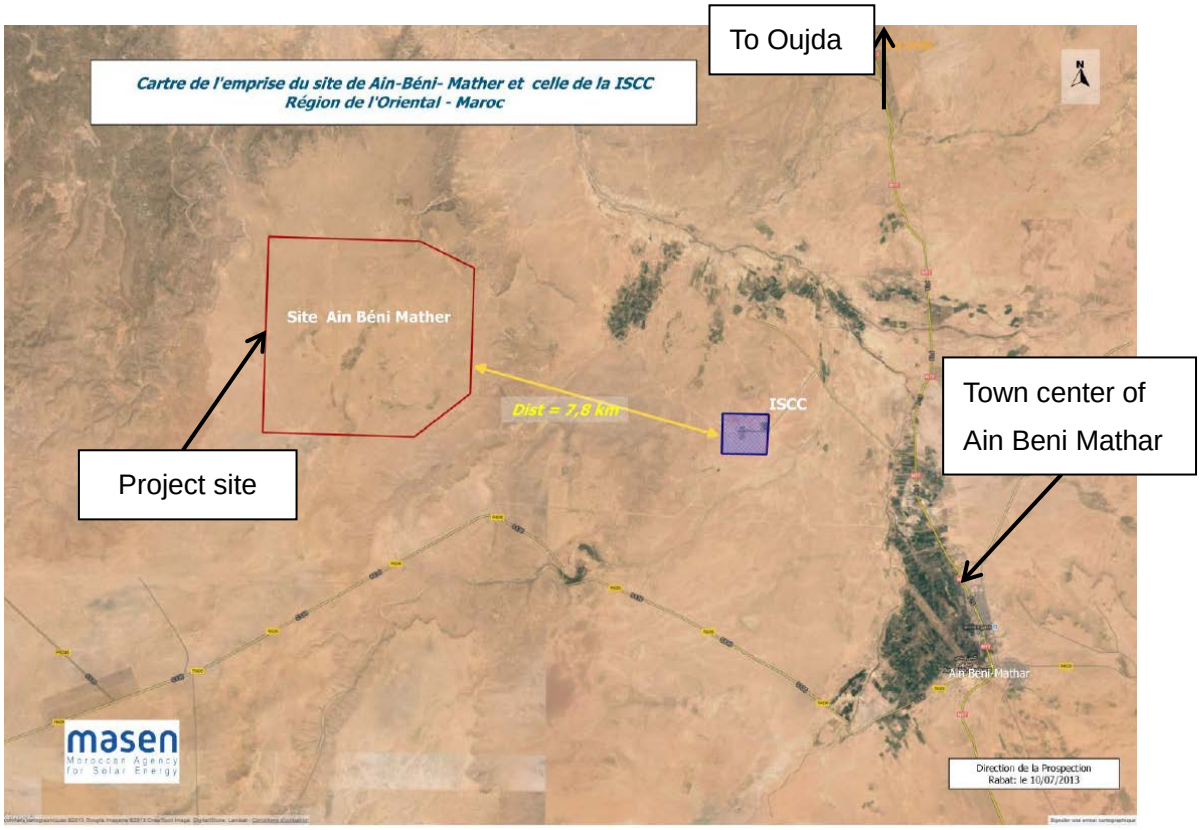

Figure 2 Project site

7. Legal framework of environmental and social considerations

(1) Constitution of Morocco, 1996

The Article 9 of the constitution guarantees all citizens freedom of settlement. The Article 15 of the constitution clearly states that the right of private property shall be guaranteed. The article also states that no expropriation shall be ordered except under such circumstances and provisions as prescribed by law. The Law No.7-81 relative à l'expropriation pour cause d'utilité publique et à l'occupation temporaire describes the circumstances and provisions of expropriation. Electric power supply is a public service and therefore MASEN has right to apply expropriation to develop solar power plants.

(2) Law No.11-03 Concerning the environmental protection and improvement of the environment and the relevant environmental protection laws

This law provides the general framework for the environmental protection in Morocco. Law No. 10-95 concerning water management and its implementing decrees set the regulations of waste water discharge. Law No. 13-03 concerning air pollution and its implementing decree set the regulations on air emissions caused by industrial, mining, commercial facilities, vehicles etc. Law No. 28-00 concerning waste disposal and management provides

the general framework of regulation of solid waste disposal and management. There are no regulations on soil contamination, noise and vibration.

(3) Dahir related to establishment of national parks etc.

This Dahir was issued in 1934 to designate national parks to protect areas with significant scientific, touristic and social values in Morocco. Dahir on forest conservation and exploitation was issued in 1917 to conserve and to exploit forests. Law No. 22-80 on cultural and historical heritage was enacted and the convention on world heritage was ratified. There is no designated and protected area under these Dahir and laws around the PV project site.

(4) Law No. 12-03 Concerning the environmental impact study and its implementation decrees

This law and its implementing degrees states the projects that need environment impact assessment study, contents of the study, requirement of local stakeholder consultation and procedures and institutional framework of reviewing the study. Large scale PV power plant and associated high voltage transmission line are required to carry out environmental impact assessment study under the law. Procedures of environmental impact assessment study are shown at the following figure 3.

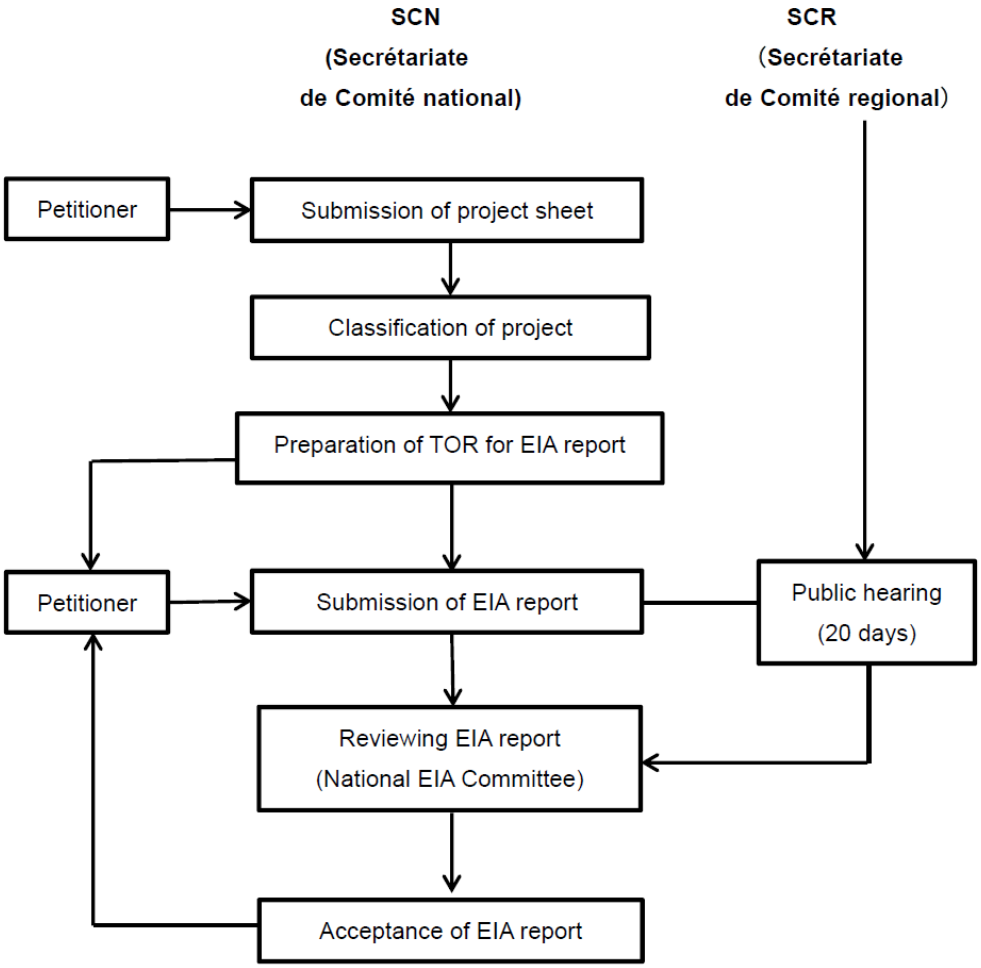

Figure 3 Procedure of environmental impact assessment

8. Provisional scoping

According to the on-going MASEN solar plant project in Ouarzazate, MASEN is responsible to develop solar power plant and ONEE (National Office of Electricity and drinking Water) is responsible to develop the associated transmission line to the solar power plant. MASEN considers ONEE will be in charge of building the associated transmission line to the PV power plant too. Therefore MASEN is not responsible to the environmental impact assessment of the associated transmission line. Accordingly, the environmental impact assessment in this study focuses only on the PV power plant. However initial environmental examination on the associated transmission line shall be carried out in this study to confirm if it does not cause any significant environmental impact.

Table 1 Provisional scoping

Impact		Rating		Description
		PV power plant	Associated transmission line	
Social Environment	Involuntary resettlement	B-	C	There are 8 households in the PV power plant site. They need to be resettled. The detailed survey of those households has not yet carried out. The associated transmission line route is not yet decided by ONEE.
	Local economy such as employment and livelihood, etc.	B+ D (O)	B+ D (O)	Opportunity of employment may increase and local procurement of goods and foods may be increased during construction of the PV power plant and the associated transmission line. During operation of the PV power plant and the associated transmission line, those facilities are operated without any operator.
	Land use and utilization of local resources	B－	B－	Less than 10% of a pasture owned by a local community is converted to the PV power plant site. Construction of transmission line may cause small impact to land use.
	Social institutions such as social infrastructure and local decision making institutions	D	C	There is no social institution in the PV power plant site. The associated transmission line route is not yet decided by ONEE.
	Existing social infrastructure and services	D	C	There is no social infrastructure in the PV power plant site. The associated transmission line route is not yet decided by ONEE.
	The poor, indigenous and ethnic people	C	C	There may be some households and activities of nomadic people in the PV power plant site. Negotiation on land use after construction of the PV power plant between the local community (land owner) and the nomadic people is not yet started. The associated transmission line route is not yet decided by ONEE.
	Misdistribution of benefit and damage	C	C	ditto

Impact		Rating		Description
		PV power plant	Associated transmission line	
	Cultural heritage	D	C	There is no cultural heritage in the PV power plant site. The associated transmission line route is not yet decided by ONEE.
	Local conflict of interest	C	C	There may be some households and activities of nomadic people in the PV power plant site. Negotiation on land use after construction of the PV power plant between the local community (land owner) and the nomadic people is not yet started. The associated transmission line route is not yet decided by ONEE.
	Water usage or water rights and communal rights	C	C	Ditto
	Sanitation	B- D (O)	B- D (O)	During construction of the PV power plant and the associated transmission line, human waste of workers is treated by temporary treatment facilities and may cause some negative sanitation impact near the facilities. After commissioning of the facilities, these facilities are operated without any operator.
	Hazards (risks), Infectious diseases such as HIV/AIDS	B- D (O)	B- D (O)	There is no large scale earth work during construction of the PV power plant and the associated transmission line. During construction of these facilities, workers may be migrated from other places with infectious diseases. After commissioning of these facilities, there is no migrant worker.
Natural Environment	Topography and geographical features	B- D (O)	B- D (O)	Some impact may be occurred during construction. After commissioning of these facilities, there is no significant earth work.
	Soil erosion	B-	B-	Land cover may be removed by construction of the PV power plant and the associated transmission line. Without appropriate mitigation measures, soil erosion may continue even after commissioning of these facilities.

Impact		Rating		Description
		PV power plant	Associated transmission line	
	Groundwater	D	C D (O)	Small amount of groundwater may be used during construction of the PV power plant. The associated transmission line route is not yet decided by ONEE. After commissioning of these facilities, there is no water consumption.
	Lakes and rivers	D	C D (O)	There is no lake and river around the PV power plant site. The associated transmission line route is not yet decided by ONEE. After commissioning of these facilities, there is no water consumption.
	Flora, fauna and biodiversity	D	C D (O)	The PV power plant site is a pasture. The associated transmission line route is not yet decided by ONEE. Operation of transmission line does not cause any impact to flora, fauna and biodiversity.
	National park	D	C	There is no national park around the PV power plant site. The associated transmission line route is not yet decided by ONEE.
	Other protected areas	D	C	Ditto
	Landscape	D	C	There is no view point around the PV power plant sire. The associated transmission line route is not yet decided by ONEE.
	Global warning	B- A+	B- D (O)	Construction of the PV power plant and the associated transmission line emit CO_2 by operation of machines and trucks. PV power is renewable energy and can replace fossil fuel consumption after commissioning. After commissioning of the transmission line, there is no emission.
Pollution	Air pollution	B- D (O)	B- D (O)	Construction of the PV power plant and the associated transmission line emit exhaust gas from machines and trucks. After commissioning of the PV power plant and the associated transmission line, there is no emission.
	Water pollution	B- D (O)	B- D (O)	Construction of the PV power plant and the associated transmission line emit effluent from offices and worker's houses. After commissioning of the PV power plant and the

Impact	Rating		Description
	PV power plant	Associated transmission line	
			associated transmission line, there is no effluent.
Soil contamination	D	D	Construction and operation of the PV power plant and the associated transmission line do not use any chemical to cause soil contamination.
Waste	B- (D (O)	B- D (O)	Some impact may be occurred during construction of the PV power plant and the associated transmission line. After commissioning of the PV power plant and the associated transmission line, there is no waste. Grid connected PV power plant usually does not need lead-acid batteries, which are required by stand-alone PV system such as solar home system. Therefore, there is no concern on pollution caused by used lead-acid batteries.
Noise and vibration	B- D (O)	B- D(O)	Some impact may be occurred during construction of the PV power plant and the associated transmission line. After commissioning of the PV power plant and the associated transmission line, there is no noise and vibration.
Ground subsidence	D	D	Small amount of groundwater may be used during construction of the PV power plant temporally. After commissioning of the PV power plant and the associated transmission line, there is no water consumption.
Offensive odor	D	D	Construction and operation of the PV power plant and the associated transmission line do not use any chemical to cause offensive odor.
Accidents	B- D (O)	B- D (O)	Construction of the PV power plant and the associated transmission line may cause accidents. After commissioning of these facilities, these facilities are operated without workers.

Rating:
A: Serious impact is expected
B: Some impact is expected

C: Extent of impact is unknown (Examination is needed. Impacts may become clear as study progresses)
D: No impact is expected. IEE/EIA is not necessary.
+: Positive impact, －: Negative impact
O: during operation of the facility

9. Alternatives to the project activities including “without project” option

Electricity demand in Morocco is growing (average annual growth of electricity consumption between 2002 and 2010 is 7%/year). This trend is expected to continue. Therefore zero option (without power plant development) will cause serious shortage of electricity supply and therefore zero option is not realistic option. Currently power supply in Morocco heavily depends on imported electricity and imported fossil fuels and GOM intends to reduce heavy dependence on imported energy in power sector. GOM set a goal to increase the ratio of capacity of renewable power generation (solar power, wind and hydro) up to 42% by 2020. Development of fossil fuel power plant such as coal and natural gas power plants increases dependency on imported energy and this is against the GOM policy. Development of wind power, concentrated solar power (CSP) and hydro power leave PV power not to be exploited in Morocco. There is abundant of solar energy in the area where water supply is not available for CSP and where direct solar radiation is not enough for CSP in Morocco. Without PV power plant, these abundant of solar energy may not be used for power generation. To maximize solar energy development and to achieve the goal of GOM in 2020, development of PV power plant is necessary and unavoidable. PV power plant also contributes to reduce GHG emission by replacing fossil fuel power generation. Therefore currently, development of PV power plant is the most desired choice for Morocco.

10. Result of the consultation with recipient government on environmental and social consideration including roles and responsibilities

MASEN agreed to abide by “JICA Guidelines for Environmental and Social Considerations” in order to ensure that appropriate considerations will be made for the environmental and social impacts of the Project.

11 Terms of reference for environmental and social consideration study

(1) Conducting the following baseline surveys on environmental and social consideration

- Laws and regulations on environmental and social consideration, such as environmental impact assessment, pollution control, resettlement, public participation, provision of information to public. Gap analysis between these legal frameworks and JICA Environmental and Social Consideration Guideline will be conducted.
- Federal and regional institutions which are in charge of environmental and social consideration.
- Designated national parks, other protected areas, habitats of wildlife and plants,

cultural heritages in and near the PV power plant site and the associated transmission line route.

- Social environment such as land use, rural communities, poor, ethnic minorities and indigenous peoples, economic and industrial activities in and near the PV power plant sites and the associated transmission line routes

(2) Scoping on possible environmental and social impacts, focusing on Resettlement, Living and Livelihood, Ethnic Minorities and Indigenous Peoples, Impacts during Construction

(3) Evaluating environmental and social impacts of the project

(4) Identifying mitigation measures to avoid and to minimize the negative impacts of the project

(5) Making monitoring plan for the project

(6) Making draft abbreviated resettlement action plan (RAP)

(7) The draft environmental and social consideration report and the draft abbreviated RAP to be consulted with local stakeholders. Comments submitted to the reports shall be taken into account in the final report.