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AFRICAN DEVELOPMENT BANK GROUP

PROJECT : OUARZAZATE SOLAR POWER STATION PROJECT

COUNTRY : MOROCCO

SUMMARY OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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Environmental and Social Impact Assessment (ESIA)
Summary

Project Name	:	**Ouarzazate Solar Power Station**
Country	:	**MOROCCO**
Project Number	:	**P-MA-DC0-003**

1. INTRODUCTION

This document is the executive summary of the Environmental and Social Impact Assessment for the Ouarzazate Solar Complex Project in Morocco. With a capacity of 500 MW and an estimated output of 1150 GWH/year (if thermo-solar technology is used), this project is the first of a series of 5 solar complexes that will have a combined capacity of 2,000 MW by 2020. A Preliminary Environmental Impact Assessment was carried out by MASEN and will be supplemented by a specific environmental and social impact assessment to be conducted by the private investor. This specific assessment will focus on the specificities of the power station and the related facilities that will be needed. The Environmental and Social Framework was conducted and reviewed in accordance with the policies and procedures of the African Development Bank and the operational policies of the World Bank. A detailed Environmental and Social Impact Assessment will be undertaken by the private developer in compliance with national regulations and the policies and procedures of donors.

2. PROJECT DESCRIPTION AND RATIONALE

2.1. PROJECT DESCRIPTION AND RATIONALE

A surface area of 2500 ha was selected on the Tamzaghten Izerki site, belonging to the Ait Oukrour Toundout ethnic community situated in the Ghessate rural council area. The site is located about 10 km away from Ouarzazate town along the national highway leading to Errachedia (cf. Figure 1). The electricity generated by the solar complex will be evacuated through the Ouarzazate 225/60 KV station located near the complex and other stations scheduled to be built before the complex is commissioned in 2015.

This project will make it possible to:

- Reduce the Kingdom's energy dependence (Morocco currently depends 95% on oil for its energy needs);
- Develop a national resource: Morocco receives very strong sunshine; the project will help to ensure that this resource is harnessed and developed at the national level and thus generate economic benefits for the population;
- Develop a competitive advantage in energy over the long term;

- Reduce greenhouse gas emissions: the Moroccan Solar Plan will help to reduce emission worth 3.7 million tonnes of CO_2. This first solar farm will generate savings of 1 million tonnes of CO_2 per year.

The Ghessate site was selected for the following reasons:

- With a DNI (Direct Normal Irradiation) of about 2 635 kWh/m²/year, the Ouarzazate site is one of the areas with the highest sunshine level in the world.
- A road constructed north of National Highway P32 leads directly to the site (4 km).
- The site is located near the Mansour Eddahbi dam (4 km), which has a storage capacity of 439 hm^3.
- The energy generated by the power station could be evacuated through the Ouarzazate 225/60 KV station located near the complex (4 km).
- The topography, the soil quality and the low seismic risk of the region are conducive to the establishment of the solar complex.
- The installation of a solar farm on the Tamzaghten Izerki site will cause very few land-use conflicts because the site is currently used as grazing land with very little pasture. There will be no displacement of communities or economic activities.
- The site is located far from the main settlement areas.
- It is located far from any protected natural or touristic areas, and no major co-visibility problems are expected.

The project's environmental and social assessment was conducted based on two major technological variants, namely: photovoltaic (PV) solar power and concentrated solar power (CSP). The first phase of the project (140 to 160 MW gross) will be implemented by a company or consortium selected through an international competitive bidding process initiated on 18 May 2011 with the issuance of bidding documents to pre-selected candidates. The private operator retained at the end of the bidding process will conduct a detailed environmental and social assessment of the technology to be deployed.

Project Investment Cost and Planning

The project investment amount (first tranche of 140 to 160 MW gross) is estimated at USD 930 million. The project will be implemented through bid invitation from developers. A project company will then be set up.

A bidding process for the first tranche of 125 MW was launched in 2011 (18 May 2011: bidding documents made available to candidates) and the facility is to be commissioned

in 2014. Other bidding processes will follow for the other tranches, and the 500 MW capacity will come on stream in early 2015.

3. POLITICAL, LEGAL AND ADMINISTRATIVE FRAMEWORK

3.1 LEGAL FRAMEWORK

The current legal framework governing environmental and social assessment in Morocco comprises (but is not limited to): Law No. 11-03 governing environmental protection and development; Law No 12-03 governing environmental impact assessments, promulgated by Dahir No. 1-03-06 of 10 Rabii I 1424 (12 May 2003), which defines the list of liable projects, the implementation procedure and the consistency of impact assessments; Decree No. 2-04-564 of 5 Di Kaada 1429 (4 November 2008), which defines the modalities for organising and conducting a public survey on projects subject to environmental impact assessments. Since no decree has been issued to set the cost of the public survey, it is not yet conducted systematically and the instrument published on 26 Safar 1431 (or 11 February 2010) and promulgated by Law No. 13-09 on renewable energies is aimed at instituting a legal framework that creates prospects for individuals or corporations from the public or private sectors to build and operate facilities for generating electricity from renewable sources.

3.2 INSTITUTIONAL FRAMEWORK

The main institution responsible for environmental protection is the Ministry of Energy, Mines, Water Resources and Environment (MEMEE), which includes the Secretariat of State for Water Resources and the Environment (SEEE). The latter entity has oversight of water basin authorities, which are responsible for mobilising, managing and protecting the water resources of each major basin. Through Decree No. 2-04-563 of 5 Di Kaada 1429 (4 November 2008), Law No. 12-03 governing environmental impact assessments recently defined the powers, operational modalities and composition of the national and regional environmental impact assessment committees. Each regional committee is chaired by the Wali of the project region or his representative.

3.3 DONOR POLICIES AND PROCEDURES

The ADB policies and procedures applied to this project are the ADB Environmental Policy, 2004; the Involuntary Resettlement Policy, 2003; the Gender Policy, 2001; and the Policy and Guidelines on Cooperation with Civil Society Organisations, 2001.

World Bank policies and guidelines: Environmental assessment (OP/BP/GP 4.01) and Involuntary Resettlement of Persons (OP/BP 4.12) were applied as part of the environmental and social assessment.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

The characteristics of the sector studied as well as its compatibilities with or sensitivities to a solar power station project are summed up as follows:

Environment	*Description*	*Sensitivity to the Project*
Topography	It is an area of flat plateaux gullied by erosion, with altitudes ranging from 1100 m to 1450 m. These plateaux rise tens of metres above the wadi valleys which run through them. River beds cut across these plateaux, creating local lush green valleys.	Site visibility challenges would depend on the technology chosen (CSP towers can rise to a height of 150m).
Climate	The area has an arid climate. The inter-annual mean temperature is about 20°C and the mean monthly temperature variation coefficient is 7%. It has two wet seasons from mid-September to late December and from January to late March, respectively. The inter-annual mean duration of sunshine is 288 hours.	Exceptional sunshine (one of the highest in the world), very conducive to such a project.
Geology	The gullied plateaux are cretaceous and eocene lands buried under a tertiary and quaternary detritical complex. In the wadi valleys, the dominant geological formations with outcroppings are recent alluvial deposits overlaid by loam soils. The plateau bearing the site has cretaceous and eocene lands buried under a tertiary and quaternary detritical complex.	Compatible geological characteristics, subject to the findings of the geotechnical study.
Groundwater	Below the valleys lie alluvial sheets with brackish water and low productivity. The plateau bearing the site is hydro-geologically sterile. Above the Oued Izerki valley, around the Douar Tasselmant, runs an alluvial sheet with brackish water and low productivity	The local hydro-geological conditions described show no sensitivity to the project, regardless of the technological variant selected.
Surface water	The outlying areas are drained by confluents of the Izerki wadi in the East, including *assif* N'Ougni, *assif* Tizerkit in the South, *assif* Issil Tfeig in the South-East and wadi Wargouine in the West. These streams have very irregular flow. Areas closer to the site are essentially drained on the East by Wadi Izerki. The project site is drained by a network of *chaabas* and dry river beds, including Issil Tfeig which flows South-East. Presence of Mansour Eddahbi dam which receives an average inflow of 384 mm3/year.	Irregular hydrological regime. The hydrographical network draining the neighbouring and outlying areas shows no sensitivity to the project. Part of the *chaabas* network could be preserved in order to facilitate water flow.
Air	The outlying areas could be exposed to air pollution caused by traffic along the RN10 and RP1511. The zone closer to the project site is an isolated rural area which is far from all polluting industrial activity; the local air quality can therefore be considered good.	Air quality compatible with the project regardless of the variant selected.
Natural risks	Risk of landslides on the edges of the gullied plateaux; Risk of flood; Risk of locust invasion;	Precautions have to be taken to stabilize the project site so as to avoid any landslides on its edges. These risks are low and do not put any

	Risk of vibrations caused by neighbouring seismic activity; The site is located in a zone with high erosion risk.	constraints on the project.
Protected areas	The Ouarzazate solar complex study area is not part of any protected natural zone; however, the following are located on its outlying zones: • The Mansour Ed Dahbi artificial lake, part of RAMSAR (site of the dam – located 6 km South of the site); • The Bouljir dorcas gazelle reserve (13 km North-West of the site); • The Iguernane Reserve (15 km North-West of the site); • The key site of Sbaa Chaab (20 km East of the site); • The Biosphere Reserve (solar complex in buffer zone B of the Biosphere Reserve).	None of the plant species found in the project site and its environs is considered rare or endangered. The solar complex project site is recognised to be of low heritage value. The areas with high heritage value are located on the eastern and western reaches of the project site.
Landscape	The site is characterised by the absence of physical obstacles (unencumbered space), the flatness of the land surface (very gentle slope of 1.1%) and its proximity to the road (RN10).	The site poses few challenges in terms of distant co-visibility.
Cultural and touristic heritage	No site of historical or cultural interest has been identified. However, some burial sites (marabouts, zaouias, etc.) are visible on the outlying and neighbouring areas of the site. Tourism is not particularly developed in the project area.	
Access roads and town planning	The study area, including the project site, is currently not covered by any town-planning document. This zone is located near areas covered by the SDAU of Grand Ouarzazate, the PDAR of Ghassate Centre which is under study and PDAR of Idalsane Centre which was extended in 2009.	
Noise and vibrations **Noise exposure**	The outlying southern and eastern extremes of the area, bordered respectively by RN10 and RP 1511, may experience noise from road traffic. In the short term, the site may be affected by activities in the military shooting range (located 2 km from the project site) and the Ouarzazate international airport (located 7 km as the crow flies). No source of remarkable noise or unusual sound levels has been detected.	The project site is uninhabited and far from any human settlements. Tasselmante, the closest *Douar* will, in principle, be protected against any noise pollution from the site.

Socio-economic Profile of the Project Area:

- The Ghassate council area, which will be hosting the complex on its territory, is characterized by a demographic decline due to different periods of dryness. The Ghassate council area has a population of 8300 inhabitants with a density of 8.8 inhabitants/km² (2009). The other rural councils in Ouarzazate Province have an average of 25.5 inhabitants/km². The population of this council area is distributed in 38 *Douars* belonging to the Igrnan (mountain) and Ait Ougrrour (plateau and plain) ethnic groups. Migration is characteristic of the project area. Local migration towards other council areas of the province is predominant. International migration also affects Ghassate, but only moderately.

- The Ghassate council area has a rural population which engages in economic activities in the stockbreeding, agriculture, handicraft and trade sectors. Extensive rearing of sheep and goats, and cattle-fattening are most frequent. The usable agricultural area is 1,797 ha with 1,058 farmers and about 13,594 farms. The main farming systems used are irrigation farming and extensive farming for forage crops. The project area is characterized by two agricultural systems, mountain agriculture and oasis agriculture.

- The Ghassate council area has a low tourism potential. With respect to heritage value, no site of historical or cultural interest has been identified. However, some burial sites (marabouts, zaouias, etc.) are visible on the outlying and neighbouring areas of the site.

- The Ghassate council area has a drinking water network managed by local associations, which supplies water to most households in the 36 *Douars*, representing 95% of the *Douars* in the area. In certain areas, such as Tasselmante, portable water has a significant degree of salinity. The electrification rate is 99% (2009).

- The council area has a road network of 260 km. Other roads have been constructed by the communities organised into associations. The main road cuts across the project area leading to Tasselmante, Essour, Oum Romane, Agouddim Izerki and Iznaguene *Douars*. Other secondary non-motorable roads lead off this main road, as short-cuts, to other *Douars* accessible through the paved road. The approved means of transport are limited to a few big taxis and informal transport. The mountainous areas are completely landlocked.

- The drainage system in the entire Ghassate council is autonomous; 70% of the population uses latrines and cesspools, while the rest opt for disposal in nature. There is currently no waste collection and/or treatment system in place. The Ghassate council area has a municipal health centre and a dispensary. The mobilised human resources are limited to one

physician at the municipal health centre, representing one physician for every 8,300 inhabitants (about 400 consultations per month).

- The industry fabric of the Ouarzazate province is inadequate to support local development. The productive capacity is limited with only 4% of artisanal productive capacities in the region.
- The gender aspect should be highlighted in the project zone of influence. Universal education has almost been achieved with respect to primary education as well as the parity between girls and boys. The number of girls surpasses that of boys in secondary education. There has been an improvement in the levels of literacy amongst adults, in particular women. The rates of maternal mortality and infant mortality are very high in the project area. Out of an active population of 150,000 people, the productivity rate is 30.9% and the female productivity rate is 17%. Employment is particularly high among the youth (the majority of the unemployed being under 35 years of age).

A detailed socio-economic impact study launched by MASEN is being conducted by a specialised consultancy firm. It will be finalised in the last quarter of 2011. This study, which is based on a participatory approach, will provide a detailed socio-economic profile of the project area and identify opportunities as well as economic development and social impact before and after the construction and commissioning of the solar power station. Furthermore, it will help to determine possible actions that could accompany the project in order to boost local development. The study will assess actions that other actors (aside from MASEN) could initiate for the benefit of the project zone of influence. The study would also help to identify a plan of action and a management framework for the supporting actions by involving all concerned actors.

5. ALTERNATIVE SOLUTIONS

Photovoltaic solar power and concentrated solar power are two fundamentally different types of technology. Table 1 presents their main differences while Table 2 lists their advantages and disadvantages.

Table 1
Main differences between PV and CSP

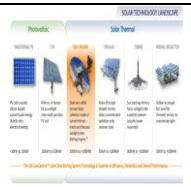
Photovoltaic Solar Power (PV)	**Concentrated Solar Power (CSP)**
	

Photovoltaic technology taps directly into the energy from photons and their capacity to provoke a difference of potential in certain media to generate electricity. Solar energy is directly converted into electricity by semi-conducting materials (e.g. silicium) covered with a light metallic coating.	The sun's rays are concentrated onto a combustion chamber in which circulates a heat-conveying fluid. The heat collected produces vapour which is then converted into electricity by a turbo-generator unit.
Does not only capture direct sunlight but also diffuses it (preferably for temperate regions)	Captures only direct sunlight (which is abundant in sun-rich areas such as the deserts of the Mediterranean solar belt)
Since photovoltaic panels are already manufactured in high-capacity factories, the installation costs are practically proportional to their size.	In concentrated solar power, only the solar field's cost is proportionate to its size, since the machine room, as in conventional power stations, benefits from great economies of scale. The CSP is best for high-power facilities.
The PV needs only very little operational staff.	Needs a large operational staff like any thermal power station. Also in this respect, the CSP should be reserved for high-power facilities.

Table 2
Comparison of the Main Advantages and Disadvantages of PV and CSP

	Photovoltaic Solar Power (PV)	Concentrated Solar Power (CSP)
ADVANTAGES	• No need for a heat conversion system which perforce is complex and consequently generates technological risks and a heavy financial cost; • No need for operating fluid(s); • Short installation period for solar farms; • Very limited maintenance needs; • Minimal water consumption for operational needs; • Panel production costs are falling rapidly because of current mass production, especially over the last 2 years; • Tested technology: several GWs currently in operation in the world; • The panels generate electricity even when there is a cloudy sky.	• Possibility of storing the recovered thermal energy directly in eutectic salts, making it possible to generate electricity day and night; • Prospects for local manufacture of the necessary equipment: traditional technologies with simple construction process are already partially available in Morocco; • Huge labour needs during the construction and operational phases; • Development of the local economy through indirect employment (housing, restaurants, etc.); • Possibility of associating energy sources other than the sun to operate the turbines (e.g. gas); • Recycling of simple installations after dismantling.
DISADVANTAGES	• Storage only possible in batteries and very limited possibilities (with energy losses over time; • Performance generally declines in inverse proportion with a rise in temperature (however, technological progress is underway); • Mode of power generation is more energy-consuming than for CSP: The carbon balance is not very good; • Toxicity of used PV panels; • Recycling is complex with high energy consumption; • Since maintenance needs are very small, PV power stations create very few jobs during the operational phase.	• High cost of needed investments (due to the turbo-generator and all the other related facilities), but which can be recouped with large-scale power stations. • Construction is complex and requires several technologies and various components; • Technical risk: certain technologies are still in the R&D stage and hardly developed at MW scale (the largest CSP station currently operational has a unit output of 90 MW); • Electricity generated only when there is a clear cloudless sky; • Need to cool the heat conversion system and this consumes an enormous volume of water; • Need for fossil fuels to maintain the heat-conveying fluid at the right temperature; • Depending on the CSP technology used, there could be risk of fire or explosion due to the presence of gas, high-pressure vapour, and high-temperature synthetic oils; risk of soil pollution (use of synthetic oils), discharge of enormous quantities of water (in case of humid cooling).

6. POTENTIAL IMPACT AND MITIGATIVE MEASURES

		Photovoltaic power without trackers	**Photovoltaic power with trackers**	**Solar tower** ***"Tower"***		**Cylindro-parabolic reflectors** ***"Trough"***	
							
Cooling		/	/	**Humid**	**Dry**	**Humid**	**Dry**
Geology and soils	**Waterproofing**	Slab for the technical premises (transformers, inverters) (about 6,000 m^2); Panel installation area (from 1000 m^2 to 6,000 m^2); Administrative building and parking area (200 to 300 m^2 for about 25 persons); **Representing a total of 12,300 m^2.**	**Slab for the technical premises (transformers, inverters) (about 6,000 m^2);** **Administrative building and parking area (200 to 300 m^2 for about 25 persons);** **Anchorage of trackers (about 400,000 m^2);** **Representing a total of 406,000 m^2.**	Turbo-generator building (12,000 m^2); Tower slabs (4 towers of 50 to 100 m^2, representing about 400 m^2); Thermal energy storage tanks (20,000 m^2 for 500 MW for 4h); Administrative building and parking (about 2,000 m^2 for 500 persons) Anchorage of panels (1,000 m^2 for anchorage of pilings) **Representing a total of about 35 000 m^2**		**Turbo-generator building (12,000 m^2);** **Thermal energy storage tanks (20,000 m^2 for 500 MW for 4h);** **Administrative building and parking (about 2,000 m^2 for 500 persons);** **Anchorage of trackers (about 400,000 m^2);** **Representing a maximum total of 434,000 m^2).**	
	Compacting	Low impact of works Little displacement (few staff)		Moderate impact of works Much displacement (large number of staff for works and operation)			
	Erosion	Very low impact (no clearing will be necessary)					

	Pollution	Very low impact (except there is accidental pollution during the construction phase)		Eutectic salts (thermal storage) Fossil fuels (booster power supply of the power station)		**Synthetic oil (heat-conveying fluid)** **Eutectic salts (thermal storage)** **Fossil fuels (booster power supply of the power station)**	
Groundwater		No supply needs, absence of groundwater on site (lower water table not very vulnerable)					
Surface water		Little surface to waterproof; Low water consumption; Installation of an evaporation tank – No discharge of water; No risk of rainwater contamination (no dangerous products stored on site).	Large surface area to waterproof (especially because of the concrete anchorage of trackers - 40 ha); Low water consumption (only for watering of roads, toilet use, and infrequent cleaning of panels); Installation of an evaporation tank – No discharge of water; No risk of rainwater contamination (no dangerous products stored on site).	**Moderate surface area to be waterproofed;** **High water consumption;** **Establishment of an evaporation tank; no disposal of water in nature;** **Very localised risk of rain water contamination due to the use of fossil fuels (case of gasoil).**	Average surface area for waterproofing (technical and administrative buildings – about 35,000 m^2); Moderate water consumption; Establishment of an evaporation tank; no disposal of water into nature; Very localised risk of rain water contamination due to the use of fossil fuels (case of gasoil).	**Very large surface area to be waterproofed (43 ha);** **Very high water consumption (watering of roads, toilet use, frequent washing of parabolic reflectors and in particular humid cooling – 6 mm3/year);** **Installation of an evaporation tank; no disposal of water in nature;** **Very localised risk of rain water contamination due to the use of synthetic oil and fossil fuels (case of gasoil);**	Very large surface area to be waterproofed (43 ha); Moderate water consumption (only for watering of roads, toilet use, and frequent cleaning of parabolic reflectors); Installation of an evaporation tank; No disposal of water into nature; Very localised risk of rain water contamination due to the use of synthetic oil and fossil fuels (case of gasoil).
Air		Exhaust fumes and dust from vehicles		Exhaust fumes and dust from vehicles, discharge from the use of fossil fuels			
Climate		One million tonnes of CO_2 saved per year					

Risks	No effect except on fire risk (presence of electrical equipment)		Major source of risk related to the presence of fossil fuels (gas or gasoil)	**Major source of risk related to the presence of fossil fuels;** **Fire risk increased by the presence of high-temperature oil (400°C).**
Natural environment	Low impact during the works phase (little excavation and less excavated earth in the mid-slope units); Risk of disturbance of animal life during the works; Positive impact related to prohibition of grazing in the space between the panels; Zero risk of pollution of *wadis* with high heritage value; Impact related to the destruction of vegetation.		Moderate impact during works (excavation, risk of deposit of excavated earth on the slopes, in the mid-slop units); Risk of disturbance of the animal life during the works and operational phases (large staff); Positive impact related to prohibition of grazing along the interstitial spaces (lower impact than for PV); Very low risk of pollution with little possibility of affecting *wadis* with high heritage value located below the site.	Moderate impact during works (excavation, risk of deposit of excavated earth on the slopes, in the mid-slop units). **Risk of disturbance of animal life during the works.** Positive impact related to prohibition of grazing along the interstitial spaces (lower positive impact than for PV because the water-proofed surface area is larger). **Pollution risk due to the presence of oils such as heat-conveying fluid (leakage in the pipes) that can indirectly affect *wadis* with high heritage value below the site and of the Mansour Ed Dahbi artificial lake. However, the heat-conveying fluid is biodegradable.**
Landscape	By limiting the project to the flat areas of the site (towards the centre), the visual impact will be zero.	Being limited to the flat areas of the site (towards the centre), the panels will be perceived from RP1511 which leads to Ghassate and from the access roads leading to the *Douars* situated East of the site.	**Project very visible even from the town of Ouarzazate (the antennas at the entrance of the site from RN10 can be seen from the town)**	Visual impact from RP1511 and access to the *Douars* of the East
Socio-economic context / **Jobs and economic activity**	Many jobs during the construction phase, about 25 to 50 full-time jobs during the operational phase. Many indirect jobs. Access to electricity, reduced isolation, training and technology transfer.		Many jobs during the construction phase (2,000 to 2,500) and 400 to 500 full-time jobs during the operational phase. Many indirect jobs. Access to electricity, reduced isolation, training and technology transfer.	

	Real estate	The project will require no destruction of habitat, or displacement of communities or economic activities. Only the access road to Tasselmante *Douar* will be modified by the project. The 60 KV line will be eventually displaced. The site is currently used for grazing only - an activity that can be easily transferred to neighbouring sites, and of little touristic interest (quad bike road).				
	Agro-pastoral activities	No impact on the usable agricultural area. Only a change in the itinerary of herders is expected.				
	Tourism	No impact on the local cultural heritage Positive impact on tourism and media fallout from the project Pedagogic role of the project				
	Noise and vibra-tions	Low noise during the construction phase due to road traffic and anchorage of panels; Negligible noise level during the operational phase.	Construction phase: Major impact related to substantial equipment and labour needs, on-site assembly and construction. Operational phase: major impact stemming from rotation of the turbine and condensers.			
	Human health	No impact (apart from temporary noise during the construction phase).	Very low risk from the discharge of slight amounts of water vapour and exhaust fumes; Risk related to the presence of legionella.	Very low risk from the discharge of slight amounts of water vapour and exhaust fumes	Very low risk from the discharge of slight amounts of water vapour and exhaust fumes; Risk related to the presence of legionella.	Very low risk because of the discharge of very low quantities of water vapour and combustion fumes.
Site rehabilitation at the end of operations		Easy to dismantle the facilities; Provide for recycling of panels; relatively complicated, depending on the type of panel.	Solar collectors are fully recyclable; Dismantling of operation buildings is complex; Maintenance of a waterproof surface if all the concrete slabs are not removed.			

Social Impact

The project will have a positive impact on the project area and the local communities. During the construction phase, the project will create jobs and new income-generating opportunities at two levels. It will generate 2,000 - 2,500 direct jobs and 10,000 indirect jobs. These indirect jobs mainly relate to an increase in the activities of existing local enterprises for the supply of materials and equipment needed for the activities and daily maintenance of workers, and the creation of an enterprise on site for the assembly of the solar farm. During the operational phase, a PV power station on the site will employ less than 50 full-time workers while a CSP power station would need 400 to 500 workers. Furthermore, local small- and medium-sized enterprises can participate in rendering various services, for instance maintenance, guard service, industrial cleaning, etc.

The project will have other positive social impacts:

- The project will facilitate the electrification of rural and semi-urban areas, and provide electricity to hitherto marginalised social groups thereby reducing the isolation of various regions and enhancing security by improving street lighting.
- The project will promote the industrial fabric by initiating a willing interaction between contractors/ MASEN and competent local authorities. Local and regional enterprises would be presented with opportunities to respond to the demands of the contractors.

- The project will help to make national industries more competitive vis-à-vis their foreign counterparts by keeping down electricity costs. The technologies proposed under the project will help to develop national expertise through training of technicians in new technologies for renewable and non-polluting energies. Such expertise could be shared in the sub-region and in other regions of Africa.

- Women will benefit from the creation of new jobs. The provision of regular energy supply will make it possible for women to develop new lucrative economic activities.

In contrast, the project is likely to have a negative impact at the social level:

- An increase in road traffic is expected during the construction phase. Such traffic could cause temporary inconvenience because of the noise and dust emissions resulting from vehicle movements.

- During the construction and operational phases, herders and their animals will no longer be able to pass through the site. A fence will be built around the site. However, the project will have only a very limited impact on agro-pastoral activities since the site is located far from irrigation farming areas. As a compensatory measure, pastoral activity can be organised in the spaces located between the solar collectors.

- The project will require no destruction of habitat, or displacement of communities or economic activities. The project site is located on land which has no specific economic use or any specific residential use for the local population. Only the access road to the Tasselmante *Douar* will be modified by the project. The site has very little pastoral activity (essentially penning in of livestock). The change of soil use will therefore have very limited impact. As a compensatory measure, a new access road to Tasselmante *Douar* will be created. The project site is situated on community land covering about 3,500 ha which belonged to the Ait Oukrour Toundout ethnic group. The land purchase procedures have already been carried out by MASEN. The Ait Oukrour Toundout community and its supervisory council gave their approval on 14 January and 20 May 2010, respectively, on transfer of the land to MASEN in accordance with statutory terms of sale and for the price set by the review commission. Purchase of the land was finalised on 18 October 2010 through a negotiated contract. The price for the land was paid by MASEN on 18 November 2010. The amount was deposited in a special account on behalf of the Ait Oukrour Toundout collectivity at the Ministry of the Interior, and this amount is managed by the Directorate for Rural Affairs. The community supervisory council will decide on how proceeds from the land sale will be used for the benefit of the Ait Oukrour Toundout community. Some of the funds will be used to for socio-economic activities in the project area, in consultation with the local population and other stakeholders. The acquisition of the land was conducted in a voluntary context with the voluntary consent of the local population. MASEN initiated an information and consultation process with stakeholders to identity and address any complaints.

A framework Environmental and Social Management Plan (ESMP) was prepared as part of the preliminary environmental assessment. It sums up the mitigative and compensatory measures to be instituted under the Ouarzazate Solar Complex Project. In a bid to ensure that all these measures are taken into account, the ESMP will be included in the bidding documents (in the form of terms of reference which must be mandatorily respected) for private developers. Furthermore, the developer must supplement and have the final ESMP revalidated by the competent authorities during project establishment.

Two different ESMPs were defined: one for photovoltaic technologies (with and without trackers) and the other for concentrated solar technologies (solar tower and cylindro-parabolic reflectors).

6. MANAGEMENT OF ENVIRONMENTAL RISKS

During the construction, public and staff safety risks would stem from onsite and offsite accidents (direct contact with construction equipment and road accidents). An accident risk may also arise from the transportation of hydrocarbon products. The main dangers identified for the operational phase arise from fire risk, compounded by the presence of high temperature oils/fluids (400°C). Risk management is an integral part of the ESMP.

7. MONITORING PROGRAMME

Environmental monitoring will be contingent on the type of technology deployed: concentrated solar power or photovoltaic power.

Environmental monitoring for the concentrated solar power station

- Monitoring of accidental pollution;
- Monthly monitoring of water consumption;
- Monitoring of legionella in the cooling systems;
- Monitoring of atmospheric emissions resulting from the use of fuels;
- Monitoring of animal and plant life;
- Monitoring of the vegetation status in the environs of the complex, to ensure that such areas are not degraded by overgrazing resulting from installation of the complex; if they are, measures must be envisaged;
- Monitoring of wild birds and herpetofauna in the same areas.

Environmental monitoring for the photovoltaic solar power station

- Monthly monitoring of water consumption;
- Monitoring of waste resulting from the destruction of panels;
- Monitoring of animal and plant life;
- Monitoring of the vegetation status in the environs of the complex, to ensure that such areas are not degraded by overgrazing resulting from installation of the complex; if they are, measures must be envisaged;
- Monitoring of wild birds and herpetofauna in the same areas.

Environmental monitoring reports will be produced annually and forwarded to the authorities concerned and donors.

The project developer must set up an environmental and social management system that combines hygiene and security during both the construction and operational phases. The system will be explained in an HSE manual containing all the procedures that will be put in place during construction and operation on the site to protect the local environment as well as the hygiene and safety of workers and local communities. This manual will be submitted to MASEN for validation.

A complaints mechanism for the local populations will be set up as soon as the works start. The complaints received will be included in the periodic HSE reports and an action plan prepared to address them.

***Supervision Plan*:** In light of the numerous environmental and social impacts of the project, a comprehensive supervision plan has been developed. With respect to the ADB, there will be joint missions with operations experts (an environmentalist/ a socio economist) and environmental and social compliance experts (a safeguards expert). The following table details the supervision plan:

The Supervision Plan

Date	Activity	Mission composition
1st trimester 2012	Supervision	• Engineer/ Task Manager • Environmentalist/Socio Economist • Safeguards Expert
3rd trimester 2012	Supervision	• Engineer/ Task Manager • Economist/ Financial Analyst • Environmentalist/Socio Economist • Safeguards Expert
2nd trimester 2013	Supervision	• Engineer/ Task Manager • Environmentalist/Socio Economist • Safeguards Expert
4th trimester 2013	Mid-term Review	• Engineer/ Task Manager • Disbursement Expert • Environmentalist/Socio Economist • Safeguards Expert
2nd trimester 2014	Supervision	• Engineer/ Task Manager • Environmentalist/Socio Economist • Safeguards Expert
4th trimester 2014	Supervision	• Engineer/ Task Manager • Economist/ Financial Analyst • Environmentalist/Socio Economist • Safeguards Expert
2nd trimester 2015	Supervision	• Engineer/ Task Manager • Environmentalist/Socio Economist • Safeguards Expert

4th trimester 2015	Supervision	• Engineer/ Task Manager • Economist/ Financial Analyst
2nd trimester 2016	Completion	• Engineer/ Task Manager • Economist/ Financial Analyst • Environmentalist/Socio Economist • Safeguards Expert

9. PUBLIC CONSULTATIONS AND PUBLICATION OF INFORMATION

A participatory approach was followed, including the identification of stakeholders, individual discussions, collaboration with the local authorities, etc. Consultations, thematic meetings, workshops, interviews, and focus groups were organised and others have been planned to finalise the socio-economic study. Different stakeholders were consulted, including economic and social actors, local administrative authorities and elected officials, traditional leaders from the neighbouring communities, and the social fabric (for example, associations representing women and civil society). The consultations provided an opportunity to inform the local population about the impact of the project and hear the concerns of certain groups. Strong concerns were raised (preoccupation with local employment; the importance of the youth participating in training opportunities; support for local development in terms of services for industry and other local activities; and the need for regular communication between representatives of the project and local actors. For example, the local communities expressed concern about receiving foreign workers. Associations talked of possible nuisance resulting from the construction (road traffic). All concerns were taken into account and preventive or mitigation measures will be proposed. There exists a positive perception about the project by the local population with respect to employment, economic activity, and the reputation of the town.

The first local consultation for the socio-economic study took place between 20 and 24 December 2010. It was followed by a follow up workshop on 15 March 2011 and a third workshop in September 2011. The public hearing process for the ESIA occurred from 12 September to 2 October 2011. The environmental acceptability of the project is planned for November 2011.

The summary environmental and social assessment will be posted on the website of the African Development Bank for 120 days after submission of the project to the ADB Board of Directors.

10. ADDITIONAL INITIATIVES

Additional initiatives aimed at economic development and the socio-cultural enhancement of communities affected by the project will be proposed by the socio-economic study and the socio-economic action plan which are being finalised by MASEN.

The first initiative to promote employment was the creation of an employment committee within the province to study the best way of encouraging local employment. Another initiative (study on-going) would be to increase access to a village near the project site (Tasselmant). MASEN is actually planning to undertake the following actions: (i) improve infrastructures so as to better the lives of the populations; (ii) prioritize employment and

subcontracting at the local level; (iii) contribute to the "Ouezazate Carbon Neutral by 2015" initiative; and (iv) create a tourist site within the solar complex.

MASEN will develop a strategy for the management of relationships with stakeholders and communication in support of the project. The strategy will serve to ensure the acceptability of the project and encourage cooperation between local stakeholders.

The amount gained from the sale of the land of the Ait Oukrour Toundout collectivity will serve to finance development projects for the same collectivity. Following a process which was started by the technical service agencies of the province from November 2009 to September 2011, the local population was provide with an opportunity to express their needs in the form of projects. Numerous projects were identified, in three primary areas: (i) basic amenities projects; (ii) economic projects; and (iii) socio-educational projects. Some of the projects will be financed through the amount which was paid to acquire the land and some of the projects will be financed by MASEN based on the findings from the socio-economic study. In general, all of these projects will contribute positively to the local development program for the project zone of influence.

11. CONCLUSIONS

A preliminary environmental and social assessment was conducted for the future Ouarzazate Solar Complex. This study made it possible to identify the environmental and social impact per technological variant (photovoltaic power or concentrated solar power). Besides, an ESMP was developed for each technology.

With respect to a preliminary study based on the technological alternatives, this framework ESMP will be taken into consideration when preparing detailed environmental and social assessments to be conducted by the private developer once it is selected by MASEN.

A detailed socio-economic study based on a participatory approach is being prepared by MASEN, which will identify the Social Action Plan, to develop socio-economic activities that promote local communities.

12. REFERENCES AND CONTACTS

The documents reviewed by the African Development Bank include:

- The Environmental and Social Impact Assessment for the Ouarzazate Solar Complex, BURGEAP, March 2011
- The Land Procurement Plan, MASEN, April 2011

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