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PROJECT : Ouarzazate Solar Power Station Project II

COUNTRY : MOROCCO

SUMMARY ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

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Environmental and Social Impact Assessment (ESIA)
Summary

Project Title	:	**Ouarzazate Solar Power Station II**
Country	:	**MOROCCO**
Project Number	:	**P-MA-FF0-002**

1. INTRODUCTION

This project is part of the Ouarzazate Solar Complex Programme (500 MW) scheduled to be implemented in phases. The first phase (Nour I) of 160 MW was approved by the Bank in May 2012. While implementing this phase, the Moroccan Agency for Renewable Energies (MASEN) started preparing phase II of the Ouarzazate Solar Complex with a capacity of 300 MW (Noor II and Noor III), for which this second financing is provided by the African Development Bank jointly with other donors. The technical, financial, environmental and social studies of the complex have been conducted. The project is the first of a series of 5 solar complexes in Morocco which will have a combined capacity of 2000 MW by 2020.

This document is the executive summary of the environmental and social impact assessment for the Ouarzazate solar complex project in Morocco. The assessment was updated in 2014, and will be supplemented by a special environmental and social impact assessment to be conducted by the private investor. The special assessment will take into account the specificities of the power station and related facilities that will be needed.

The environmental and social impact assessment was conducted and reviewed in accordance with the policies and procedures of the African Development Bank and other donors, especially the French Development Agency, the European Investment Bank, the World Bank, and KfW Bankengruppe.

2. PROJECT DESCRIPTION AND RATIONALE

2.1. Project Description and Rationale

The second phase, which is the focus of this project, relates to the design, financing, construction, operation and maintenance of 2 (two) new power stations called Noor II and Noor III, based on the same technology (CSP) used in Noor I. The total capacity of these power stations is approximately 350 MW. They will be constructed through PPPs for private generation of electricity. The Noor II power station (approximately 200 MW) will use the parabolic trough technology, while the Noor III power station (approximately 150 MW) will use a solar tower. Each power station will be provided with a thermal storage mechanism to improve the injection of its output into the energy mix, especially during peak periods at about 6 p.m. in winter and 7 p.m. in summer. The Noor II power station will have a thermal storage capacity of 2,800 MWh corresponding to 5 hours of production when operating at full capacity. The Noor III power station will have a thermal energy storage capacity of 2,730 MWh, or 7 hours of production when operating at full capacity, thus raising the project's total thermal energy storage capacity to 5530 MWh. The Noor II and III power stations will use a dry cooling system, while Noor I will use a wet cooling system; this should generate annual water consumption savings of approximately 3.6 million m^3, which is quite high for an arid region like Ouarzazate. One or two consortiums of private partners will be recruited

through open international competitive bidding to develop the Noor II and III power stations through PPPs. Two specific project companies will then be created to build and operate each power station for a period of 25 years.

The site is located about 10 km from Ouarzazate town on National Highway No. 10 (NH10), which leads to Errachidia town. The two power stations planned for phase II have right-of-ways of 680 ha for Noor I and 750 ha for Noor III respectively (450 ha for the current Noor I power station). Consequently, a total surface area of approximately 3,000 ha, obtained through an initial procurement of 2,500 ha (for Noor I, Noor II and Noor III) and a second procurement of 3 additional plots of 500 ha (to meet any additional needs) has been chosen on the Tamzaghten Izerki site belonging to Ait Oukrour Toundout ethnic community, located in Ghessat rural council area. MASEN procured the first 2500 ha in 2010. Subsequently, three new plots adjacent to the initial site, with a surface area of 543 ha, were procured for future expansion of the complex and implementation of a research and development platform on solar energy, and to secure the landed property in the area. The Ait Oukrour Toundout municipality and its supervisory council approved the sale of the three new plots to MASEN on 25 August 2011 and 22 September 2011 respectively. The project will not cause any displacement of the population or loss of economic activities.

The final design of the Noor Ouarzazate complex projects, as well as the precise identification of their environmental and social impacts will be done by the developers of the said projects, selected through international competitive bidding. The developer of the first phase in 2012 prepared a detailed Phase I environmental and social assessment and a specific Environmental and Social Management Plan for Phase I in compliance with MASEN commitments to the donors during Phase 1 financing.

The current environmental and social assessment, updated in June 2014, will be supplemented by specific environmental and social impact assessments for Noor II and Noor III. The assessments will take into account the specificities of each power station and will be based on the specific proposal of the developer to whom the project is awarded. They will also comply with the requirements of Moroccan authorities and international financial institutions.

The cost of Phase 2 of the project is estimated at EUR 1,759.51 million. Noor I was awarded in September 2012. The bidding process for Noor II and Noor III was launched in 2013.

The electricity generated by the solar complex will be evacuated through the Ouarzazate 225/60 KV post located near the complex and other scheduled posts before the complex is commissioned in 2015.

The Ghessat site was selected for the following reasons:

- With a Direct Normal Irradiation (DNI) of about 2,635 kWh/m²/year, the Ouarzazate site is one of the localities with the highest sunshine in the world.
- The energy generated by the power station could be evacuated through the Ouarzazate 225/60 KV post located near the complex (4 km).

- The topography, 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 only very few user conflicts because the site is currently used for grazing but has 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 area, and no major co-visibility problems are expected.

This project will help to:

- reduce the Kingdom's energy dependency (Morocco is currently 95% dependent on oil for its energy needs);
- develop a national resource: Morocco receives much sunshine; the project will help to harness and develop this resource at 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 volume of greenhouse gas emissions that will be avoided through operation of Noor II and Noor III solar power stations is estimated to be equivalent of 533,000 tonnes of CO_2 per year or 13 million tonnes of CO_2 over the 25-year period during which the power stations will be operated. Since the greenhouse gas emissions that will be avoided through the first Noor I power station is 240,000 tonnes of CO_2 per year (6 million tonnes of CO_2 over 25 years), the Noor II and III power stations will raise the volume of greenhouse gas emissions avoided, thanks to the Ouarzazate complex, to 762,000 tonnes of CO_2 per year and 19 million tonnes of CO_2 over the 25-year period. Morocco's solar plan, with a total capacity of 2000 MW, is part of a project to reduce greenhouse gas emissions by up to 3.8 million tonnes of CO_2 per year by 2020.

2.2. Equipment and Related Utilities

The value of CSP systems increases if a thermal storage mechanism is attached to them, because such mechanisms are used to adapt electricity production and raise it to match peak demand, that is, in the late afternoon. The concept is simple: use energy to heat up a product (e.g. eutectic salts) during the day and then recover energy from the heat to continue operating the generators after sunset.

The heat will be stored in eutectic salts, which are a mixture of 60% sodium nitrate ($NaNO_3$) and 40% potassium nitrate (KNO_3). Between 84,000 and 140,000 tonnes of eutectic salts will be needed for the Ouarzazate complex.

Synthetic Oil:

If the adopted option is power stations with parabolic trough mirrors, then the heat-conveying fluid used will be synthetic oil. Between 15,000 and 17,000 tonnes of

eutectic salts will be needed for the Ouarzazate complex. Synthetic oil can be heated to high temperatures (400°C) and solidifies at about 12°C. It is highly viscose at room temperature and reduces the effect of infiltration. Leakages during filling of the circuits and in the operational duct conductors can cause short-term soil pollution.

Fossil Fuel Needs

Energy supply using fossil fuel is crucial in order to:

- maintain the eutectic salts at high temperature so that they remain liquid (solidification at 110°C), and
- maintain the temperature of the oil above its minimal operational temperature (8°C for synthetic oil) and feed the pumps at night so that oil keeps circulating in the circuits.

Back-up fuel needs for the Ouarzazate complex have been estimated at 19T/day of gasoil for a capacity of 500 MW. Gasoil with a sulphur content of 50 ppm is recommended.

Water Needs and Supply

Water consumption for the Ouarzazate Noor complex is estimated at 2.5 to 3 million m^3 for one wet-cooling project (Noor I) and two dry-cooling projects (Noor II and III).

The water supply source for the solar complex will be the Mansour Eddabhi dam (located 12 km from the project). No borehole or groundwater supply will be developed. During the construction phase, the current water needs (for Noor I) will be met using direct supply from the reservoir of the Mansour Eddahbi dam, initially transported by tank trucks for storage in a provisional pond, and subsequently through a provisional pipeline. The technical water supply arrangements for the construction of Noor II and III will be determined by the companies that win the contracts to build these power stations.

Water storage reservoirs (with a total capacity of 300,000 M^3) are currently being constructed on the site to ensure the safety of the cooling systems.

Related Infrastructure

MASEN has also decided to develop the infrastructure needed for smooth deployment of the Ouarzazate Noor solar complex, thereby providing better visibility to the power station developers and ensuring greater synergy and optimization of their construction costs and time. This mainly concerns related infrastructure such as road, water supply and electricity infrastructure.

Environmental and social assessments for the associated infrastructure has been completed, approved and published (access road to the site access road to the village of Tasselmante, raw water reservoir, raw water pipeline, Transmission line 225 KV, sub-station 225/60Kv of errachidia, etc..). Other specific studies for the phase 2 (T-line 225 Kv Tzarte, etc..) are being finalized. These studies are conducted in compliance with the regulations in force and the requirements of international financial institutions prior to the launching of the related works.

Other Infrastructure and Civil Engineering

The site will contain various facilities and buildings which could each be different in nature depending on the technologies used:

- provisional buildings or structures used as accommodation for construction workers (workers' camp);
- permanent buildings constructed for administrative and technical uses;
- civil engineering structures to serve as engine blocks (turbines);
- civil engineering structures to receive engine blocks;
- stabilization and protective structures;
- storm water drainage and evacuation structures;
- roads within the site;
- establishment of telecommunication networks;
- etc.

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) defining 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) defining the conditions for organizing and conducting a public survey on projects subject to environmental impact assessments. Since no decree has been issued to determine the cost of the public survey, it is not yet conducted systematically;
- 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 that generate electricity from renewable sources.

The other main relevant laws applicable under the Noor project are the following:

- Law No. 11-03 of June 2003 governing environmental protection and development;
- Decree No. 2-97-787 of 6 Chaoual (4 February 1998) relating to water quality standards and its related orders;

- Law No. 28-00 of 7 December 2006 relating to waste management and disposal and its implementing decrees;
- Dahir No. 1-60-063 of 30 Hijja 1379 (25 June 1960) relating to the development of rural settlements;
- Global National Charter on the Environment and Sustainable Development;
- National laws governing biodiversity protection: The wildlife species protected by law under the annual order of the Ministry of Water Resources and Forestry include the following bird species: all diurnal and nocturnal birds of prey, all species of bustard, all species of shelduck, pratincoles, grebes, curlews, comorants, red-nosed pochards and white-eyed pochards. All wading birds (little egrets, avocets, storks, stilts, herons, ox-peckers, flamingoes, cranes, ibis, and spoonbills) are permanently protected (Order of the Ministry of Agriculture No. 582-62 of 3/11/1962).

3.2 International Conventions

Morocco has signed and/or ratified many international conventions on biodiversity that impose certain commitments on the country, particularly:

- the Convention on Biological Diversity (Rio Convention);
- the International Convention for the Protection of Birds;
- the Barcelona Convention: Signed after the United Nations Conference on the Human Environment (Stockholm, 1972) attended by all Mediterranean countries; and
- the Stockholm Convention on Persistent Organic Pollutants (POPs).

3.3 INSTITUTIONAL FRAMEWORK

The main institution responsible for environmental protection is the Ministry of Energy, Mines, Water Resources and the Environment (MEMEE), which includes the Secretariat of State for Water and the Environment (SEEE). The latter entity has oversight of water basin authorities, which are responsible for mobilizing, managing and protecting the water resources of each major basin.
Apart from the Ministry of Energy, Mines, Water Resources and Environment, the other public agencies whose actions are relevant to the Noor project are:

- the Water basin authorities;
- the High Commission for Water Resources, Forestry and Desertification Control (HCELFLCD);
- the Ministry of Agriculture, Rural Development and Maritime Fisheries (MADRPM);
- the Ministry of Equipment and Transport;
- the Ministry of Interior;
- the Ministry of Health;
- the National Electricity and Water Authority (ONEE); and

- the Moroccan Agency for Solar Energy

3.4 DONOR POLICIES AND PROCEDURES

The AfDB policies and procedures applied to this project are the AfDB Environmental Policy, 2004; the Involuntary Resettlement Policy, 2003; the Gender Policy, 2001; and the Policy and Guidelines on Cooperation with Civil Society Organizations, 2001. The new Integrated Environmental and Social Safeguards System of the AfDB, approved in December 2013, has not been applied in this project because the Bank validated the project preparation phase before 1 July 2014.

World Bank policies and guidelines: Environmental assessment (OP/BP/GP 4.01) and Involuntary Resettlement of Persons (OP/BP 4.12) have been applied under environmental and social assessment.

4. DESCRIPTION OF THE PROJECT ENVIRONMENT

The characteristics of the study sector as well as its compatibilities 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 of 1,100 m to 1,450 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), highly 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 alluvions 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 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	Irregular hydrological regime. The hydrographical network draining neighbouring and outlying areas show no sensitivity to the project.

	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 Mm^3/year.	Part of the *chaabas* network could be preserved in order to facilitate water flow. The second phase of the project does not involve wet cooling. Consequently, there is no major risk to the water resources of the area.
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; Risk of vibrations caused by neighbouring seismic activity; The site is located in a zone with high erosion risk.	Precautions to be taken to stabilize the project site in order to avoid any landslides on its edges. These risks are low and do not place any 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 to the North-West of the site); • The Iguernane Reserve (15 km to the 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 considered to be of low heritage value. The areas with high heritage value are located on the eastern and western reaches of the project site.
Birdlife	In the field, 10 probably nesting bird species have been identified in the study area. All these species are fairly widespread in this type of region,	The technologies of the tower (Noor III) and the receptors pose risks to the

	except the mourning wheateater, which is relatively rare and localized in Morocco. The site of the complex is not located along the migration corridor of birds that flock together in large numbers. Indeed, the corridors for large flocks are rather found in the valleys near the site including the Izerki valley (to the East) and the Wargouine valley (to the West).	birdlife of the region (high heat flux from the receptors and risk of blindness for the birds).
Landscape	The site is marked 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, zouias, 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 the 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 road traffic noise. 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 have 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.

4.1. Socio-economic Profile of the Project Area

Ghessate municipality, which is receiving the complex on its territory, is experiencing a population decline aggravated by various episodes of drought. It has a population of 8,300 inhabitants with a density of 8.8 inhabitants/km² (2009). The other rural council areas in Ouarzazate Province have an average of 25.5 inhabitants/km². The population of this council area is scattered among the 38 douars belonging to the Igrnan (mountain) and Ait Ougrrour (plateau and plain) ethnic groups. Migration is characteristic of the project area. Local migration to other municipalities of the province is predominant. International migration also affects the Ghassate municipality, albeit moderately.

Ghessate municipality has a rural population involved in economic activities in the livestock, agriculture, handicraft and trade sectors. Extensive rearing of sheep and goats, as well as cattle-fattening are most frequent. The usable farm area is 1797 ha with 1058 farmers and approximately 13.594 farm plots. The major identified farming systems are irrigation farming and extensive farming for forage crops. The project area is characterized by two agricultural systems, namely mountain agriculture and oasis agriculture.

Ghessate municipality 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, zouias, etc.) are visible on the outlying and neighbouring areas of the site.

Ghessate municipality 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 municipality. In certain localities such as Tasselmante, drinking water has a high level of salinity. The electrification rate is 99 % (2009).

The municipality has a road network of 260 km. Other roads have been constructed by the local communities organized in associations. The main road cuts across the project area, leading to the douars of Tasselmante, Essour, Oum Romane, Agouddim Izerki and Iznaguene. Other secondary non-motorable roads lead off this main road, as short-cuts leading to other douars which are 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 inaccessible.

The drainage system in the entire Ghessate rural council area is autonomous. 70% of the population use latrines and cesspools, while the rest opt for disposal into the natural environment. There is currently no waste collection and/or treatment system in place. Ghessate municipality has a municipal health centre and a dispensary. Deployed human resources are limited to one physician at the municipal health centre, representing one physician for every 8,300 inhabitants (approximately 400 consultations per month).

The industrial fabric of the Ouarzazate province is insufficient to sustain local development. Its production capacity is limited, with 4% of the region’s artisanal production.

The gender issue needs to be underscored in the project area. Universal education and gender parity have almost been attained in primary schools. There are more girls than boys in secondary schools. There is an improvement in the adult literacy rate, particularly among women. Maternal and infant mortality rates are very high in the region. Based on a labour force of 150,000 persons, the region has participation rate of 30.9% and a female participation rate of 17%. Unemployment is particularly high among the youths (the majority of the unemployed are less than 35 years old).

A detailed socio-economic impact assessment launched by MASEN was conducted by a specialized consultancy firm in September 2011. The assessment will adopt a participatory approach to provide a detailed socio-economic profile of the project area and identify opportunities as well as economic development and social impacts before and after construction and commissioning of the solar power station. The assessment presents project support actions that could boost local development. The assessment also examines the actions that other stakeholders (except MASEN) could initiate for the wellbeing of the project area. An action plan and a management framework for support actions involving the stakeholders concerned was also developed to accompany the assessment.

The main results of the consultation are that the community has a positive perception of this investment in the area. This perception is founded on hopes of employment, economic activity, renown for the town, and even "recognition before the authorities" for the inhabitants of Ghessate municipality. Furthermore, great expectations have been expressed in the following areas: (i) local employment which is far from the main project concern, with two approaches: some stakeholders express outlandish and sometimes unrealistic expectations; and others have more reasonable expectations and are waiting to see how to realize them concretely. (ii) participation in youth training to increase their employability and technical skills; (iii) local development support, through local purchase of services for the industry and spill-over effects on the local economy; and (iv) the need for regular communication between project representatives and local stakeholders has been expressed on the whole.

The project raises few concerns among the locals interviewed. Some of the concerns expressed are: the risk that the project may not satisfy high expectations for development, especially regarding employment, equipment and infrastructure; risks related to the massive influx of workers, for example a hike in rents or local inflation; and risks related to loss of economic activity following closure of the construction site if there is no replacement activity.

5. ALTERNATIVE SOLUTIONS

Two concentrating solar power (CSP) technologies were adopted for phase 2 of the Ouarzazate project: parabolic trough technology (Noor II) and tower solar power stations (Noor III).

- **parabolic troughs:** The structure uses concave mirrors to focus sunlight on a tube filled with a fluid. The liquid traps the thermal energy and transports it to the "factory block" where a turbine converts it into vapour and subsequently electricity.

- **Solar towers:** A tower bearing a solar collector and surrounded by a field equipped with hundreds of heliostatic mirrors (movable mirrors) that all move in response to changes in the sun's position. Just like for parabolic trough mirrors, a liquid transports the energy to the power station.

Photovoltaic (PV) technology was discarded for phase 2 but will be used for phase 3 of the project (Nour 4). Technical studies are in the preliminary stage. This phase is not covered by the current Bank financing.

Table 1: The Main Differences between PV and CSP

Photovoltaic Solar Power (PV)	**Concentrated Solar Power (CSP)**
	
Photovoltaic technology directly taps into the energy of photons and their capacity to provoke a difference of potential in certain mediums to generate electricity. Solar energy is directly converted into electricity by semi-conducting materials like silicium covered with a light metallic coating.	The sun's rays are focused on a combustion chamber in which a heat-conveying fluid circulates. 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 (preferable 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.	For 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 therefore best for high-power facilities.
The PV needs only very limited 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.

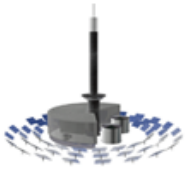
Table 2: Comparison of the Main Advantages and Disadvantages of PV and CSP

	Photovoltaic Solar Power (PV)	Concentrated Solar Power (CSP) (CSP)
ADVANTAGES	• No need for a heat conversion system which is perforce 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 required 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 (gas, for example); • 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 to 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; • Used PV panels are toxic; • Recycling is complex with high energy consumption; • Since the maintenance needs are highly limited, 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 are still very less developed in terms of MW (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 wet cooling).

6. POTENTIAL IMPACT AND MITIGATION MEASURES

6.1. Summary of the impacts of the two technologies proposed for phase 2

Table 3: Comparative Summary of the Impacts of the Two Technologies Proposed for Phase 2

<table>
<tr><th colspan="2"></th><th colspan="2">Solar Tower
.</th><th colspan="2">Parabolic Trough Collectors
.</th></tr>
<tr><td colspan="2"></td><td colspan="2">  </td><td colspan="2">  </td></tr>
<tr><td colspan="2">Cooling</td><td>Humid</td><td>Dry</td><td>Wet</td><td>Dry</td></tr>
<tr><td rowspan="3">Geology and soils</td><td>Waterproofing</td><td colspan="2">Turbine 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)
Fixings for panels (1,000 m^2 for fixing of pilings)
Representing a total of approximately 35 000 m^2</td><td colspan="2">Turbine 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)
Fixing of trackers (about 400,000 m^2)
Representing a maximum total of 434,000 m^2)</td></tr>
<tr><td>Compacting</td><td colspan="4">Moderate impact of works
Much displacement (much staff for works and operation)</td></tr>
<tr><td>Erosion</td><td colspan="4">Very low impact (no clearing will be necessary)</td></tr>
</table>

	Pollution	Eutectic salts (thermal storage). Fossil fuels (booster power supply for the power station).		Synthetic oil (heat-conveying fluid). Eutectic salts (thermal storage). Fossil fuels (booster power supply for the power station).	
Ground water		No supply needs, absence of groundwater on site (lower water table not very vulnerable)			
Surface water		Average surface area for waterproofing (technical and administrative buildings – approximately 35,000 m^2). Very high water consumption (watering of roads, toilets, frequent washing of dish mirrors and in particular humid cooling – 6 Mm3/year). Establishment of an evaporation tank; no disposal of water into the natural environment. Very localized risk of rain water contamination due to the use of fossil fuels (case of gasoil).	Average surface area for waterproofing (technical and administrative buildings – approximately 35,000 m^2). Moderate water consumption (only for watering of roads, toilets, and frequent cleaning of dish mirrors) Establishment of an evaporation tank; no disposal of water into the natural environment Very localized 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, toilets, frequent washing of dish mirrors and in particular humid cooling – 6 Mm3/year). Establishment of an evaporation tank; no disposal of water into the natural environment. Very localized 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, toilets, and frequent cleaning of dish mirrors). Establishment of an evaporation tank; no disposal of water into the natural environment. Very localized 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, discharge from the use of fossil fuels			
Risks		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		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 prohibited of grazing in 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 prohibited 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 like heat-conveying fluid (leakage in the pipes) which 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.
Biological Environment		Negative impact on birdlife due to the high heat flux near the tower receptor (the glare from the heliostatic mirrors could momentarily blind birds) No impact on pilots whose flight routes do not pass over the solar complex site.		Risk of disturbance to wildlife during construction
Landscape		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 (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 transfer of technology.		
	Land tenure		The project will require no destruction of habitat, or displacement of communities or economic activities. Only the access road to the douar of Tasselmante will be modified by the project. The 60KV line may be displaced.	The site is currently used only for grazing, an activity which can be easily transferred to neighbouring sites, and little touristic interest (quad road).

	Agro-pastoral activities	No impact on the usable farm 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 publicity on the pedagogic role of the project.			
	Noise and vibrations	Construction phase: Major impact in terms of substantial needs for equipment, labour, on-site assembly and construction. Operational phase: major impact stemming from rotation of the turbine and the condensers.			
	Human health	Very low risk from the discharge of slight amounts of water vapour and exhaust fumes; Risk related to the presence of legionellosis.	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 legionellosis.	Very low risk from the discharge of slight amounts of water vapour and exhaust fumes
Site rehabilitation at the end of operations		Solar collectors are fully recyclable; Dismantling of operation buildings is complex; Maintenance of a waterproof surface if all the concrete slabs are not removed.			

In conclusion, it is evident that the solution that has the greatest impact has major effects on soil sealing, surface water, the natural environment and fire risk, mainly related to the water consumption procedure involved in case of wet cooling procedure and the use of polluting substances.

The installation of the solar complex will have no impact on erosion. However, settlements are to predict and accidental pollution may occur. During the operational phase, the impact of a solar power plant on the soil and the sub-soil is minimal. The risk of soil contamination exists only in the case of the use of synthetic oil as a heat transfer fluid.

Some measures are proposed to avoid / minimize compaction, landslide, soil and water pollution and natural resources, such as:
- The development of the site will consider the technical and hydrological constraints of the site;
- A buffer zone will be maintained at the site boundary, where landslides have been recorded;
- Defining MASEN's Integrated Project scope;
- Limitation of allowances, risks of accidental pollution and atmospheric emissions (at the start of the construction, a pre-landscaping will be carried out in order to materialize the main roads, identification of requirements to be met by contractors, etc. .).

The solar tower will have a major impact on the landscape because it will be visible even right from the town of Ouarzazate. Furthermore, it could have a negative impact on regional birds that are on a quest for food, because of the heat generated by dazzling reflection from the heliostats of the solar tower. There will be a major impact on local noise levels, especially during the construction phase. Soil compaction and site rehabilitation at the end of operations are moderate impacts of the project. Environmental and social impact assessments that focus on the specificities of each power station will be conducted in accordance with the requirements of international financial institutions and Moroccan regulations. They will include a specific environmental and social management plan (ESMP) for each power station.

Disturbance of birds can be mitigated by planning most of the works out of the nesting period (between March to May) work. After work, the fauna will most likely reinstall in all favorable sites, the site of the complex, and its margins. The site of the complex is not located on a bird migration corridor with high strength. The high effective corridors are within the coastal valleys of the site including Izerki (east) and Wargouine (west). All necessary measures for the preservation of birds will be implemented for the solar tower, where the risk of blindness birds is unlikely. Monitoring of birds, counts and markings are proposed. This aspect will be discussed in detail in the detailed environmental assessment which will be developed by the private developer.

6.2. Social Impact

6.2.1. Employment and Economic Activity

a) Impact

During the construction phase, the project will create new income-generating opportunities at two levels, namely: jobs created during the construction works (approximately 2,000 to 2,500 direct jobs) and the indirect jobs created (thousands).

These indirect jobs essentially stem from an increase in the activities of existing local enterprises that supply materials and equipment needed for the project and daily sustenance of workers, as well as the onsite creation of an enterprise to assemble the solar farm. Labour will essentially be recruited locally, and infrastructure will be constructed in Ouarzazate area for the accommodation and sustenance of workers.

As an illustration, for Phase 1 of the complex (Noor 1) 1409 people are recruited on site, including 587 people originally from Ouarzazate / Ghessate (42%) and 35 women with 25 Moroccan.

During the operational phase, the number of jobs created will depend on the technology adopted; photovoltaic technology requires virtually no maintenance, while CSP requires much regular maintenance (3/8). For instance, a PV power station on the site could recruit less than 50 full-time employees, while a CSP power station would need between 400 and 500 employees. Permanent workers will be lodged, and will certainly have a positive socio-economic impact on the region. Furthermore, during this period, local small and medium-sized enterprises will provide various services such as maintenance, security, industrial cleaning, etc. Recruitment, especially of unskilled labour, will essentially be done locally, and infrastructure will be constructed for the accommodation and sustenance of workers. Furthermore, local small and medium-sized enterprises will provide various services such as maintenance, security, industrial cleaning, etc. This will help develop industrial activities in the region. In addition, there will be new opportunities to reduce unemployment thanks to the greater supply of energy (creation of SMEs).

Energy capacity development will provide new guarantees and an incentive to investors who will no longer hesitate to relocate to peripheral areas that abound with cheap labour. The power station will ensure the development of the country's natural resources for the benefit of the entire population, and thus help to reduce poverty. Furthermore, the project will allow for continuation of rural and semi-urban electrification programmes and provide access to electricity for hitherto marginalized social classes, thereby getting several regions out of their isolation.

To a certain extent, it will reduce the isolation of various regions and rural communities, as well as enhance security by improving street lighting. The Moroccan industry is facing international competition, especially under the Partnership Agreement with the European Union and the Free Trade Agreement with the United States. It can be competitive, hold its own against external competition and save jobs only if there is an effective reduction in electricity costs. This project will facilitate the attainment of that objective by creating the conditions needed to preserve and create jobs in the country. Furthermore, the technologies proposed under the project will help to develop cutting-edge national expertise. The project is

also a new opportunity to train technicians in new technologies for renewable and non-polluting energies.

Since women participate in all types of economic and social activities, the creation of new jobs will also benefit the female population. Regular energy supply will enable women to develop new lucrative economic activities. Lastly, the socio-economic fallout from this project includes training and transfer of solar energy technology, which is crucial to the attainment of Morocco's ambitious targets in the domain of solar energy.

b) Compensatory Measures

Since the project's impact on employment and economic activities is positive, compensatory measures are unnecessary. Nonetheless, a socio-economic study has been conducted, and its recommendations will be implemented in order to capitalize on the positive effects that result from implementation of such a project.

6.2.2. Local Population

a) Impact

The project is located on a desert plateau used for pastoral activity by the local community. The entire study area has approximately 9 main douars. The nearest (Tasselmant) is located within the immediate vicinity of the project site (approximately 1 km north-east). The other two closest douars (Oum Romane and Essour) are located within the wider vicinity of the study area (approximately 3 km from the project area boundary).

Construction Phase: During construction, there will be increased road traffic to supply technical materials and construction machines. During the few months of intensive construction work, the traffic will also increase due to the movement of vehicles of technical teams needed for the construction site. This traffic could cause temporary inconvenience resulting in noise and dust emissions generated by vehicle movements. However, since the population density in the study area is low and there are no dwellings in the project area, any inconveniences will be limited.

Operational Phase: The main inconvenience during the operational phase relates to staff movements, noise from the facilities, and the visual impact of the site. These impacts will vary greatly from one form of technology to another, with photovoltaic technology generating less traffic and less noise than CSP technology. However, such inconveniences will be limited since nearby dwellings are few and rather located in the valleys; this reduces the visibility of the plateau on which the project is located.

b) Compensatory Measures

Conventional impact reduction measures for the construction phase will be implemented through an environmental and social management plan. Since the impact on the local community is generally low and limited over time, no specific measure is necessary. More concrete measures could be proposed depending on the project selected.

6.2.3. Land Tenure and Land Occupancy

As regards land tenure, the project site is located on community land of approximately 2,500 ha, which belonged to the Ait Oukrour Toundout ethnic group. The land purchase procedures were conducted by MASEN in accordance with the laws in force, and are described in the Land Procurement Plan prepared by MASEN in 2010. Since all the authorizations and prerequisites had been obtained, the land procurement was finalized on 18 October 2010 through a private sales agreement, with the possibility for an attorney or agent to act on behalf of the Ait Oukrour Toudout community as vendor and ONEE as purchaser. After the sale, a declaration of agency was made between ONEE and MASEN. The certificate of non-agricultural use for the land was obtained on 22 October 2010 from the competent territorial authorities tasked with the issuance such certificates. The boundary verification and survey operations on the land will be conducted by Ouarzazate ordinance survey service with a view to registering the land. Currently, three new plots adjacent to the initial site, with a surface area of 543 ha, have been procured for future expansion of the complex and the establishment of a solar energy research and development platform and for securing the landed property in the area. MASEN has prepared a second land procurement plan to establish the procedures that led to the purchase of these three new plots, which are a single entity belonging to the Ait Oukrour Toundout community. The lands to be procured have no agricultural use, business premises or industrial establishments, and their sale caused no displacement of pre-existing installations. They are semi-arid virgin lands located adjacent to the site of the complex, previously procured by MASEN in 2010. Just like the lands initially procured by MASEN, the lands in question are not intended to be settlement areas for the local community, although they are used for grazing to a limited extent. Hence, procurement of the three new plots did not generate any physical or economic displacement of the local community.

The Ait Oukrour Toundout community and its supervisory council approved the sale of the three new plots to MASEN on 14 January and 20 May 2010 respectively, in accordance with statutory terms of sale and for the price set by the review commission.

The project will require no destruction of habitat or displacement of communities or economic activities. Only the access road to Douar Tasselmante will be modified by the project. Currently, the site is only used for very limited grazing (basically folding of livestock) and is of limited touristic interest. Hence, the change in land use will have very limited impact.

a) Compensatory Measures

A new access road to Douar Tasselmante will be created. On 18 March 2010, the review board set the purchase price of the land at DH 25,000,000 (on the basis of DH 10,000 per hectare). The supervisory council of the community will decide on how proceeds from the land sale will be used for the benefit of the Ait Oukrour Toundout community.

6.2.4. Agro-Pastoral Activities

a) Impact

During the construction and operational phases, the site will no longer be accessible to herders. A fence will be constructed around the site. However, the project will have only a very limited impact on agro-pastoral activities. Indeed, the site is located some distance away

from irrigation farming areas and, as concerns stockbreeding, the project site area, though partly occupied by the complex (had having only a negligible supply of pasture), still has sufficient territory available for extensive stockbreeding. The project will have no impact on the municipality's UFA[1] (1 797 ha). A few sheep barns are located on the southern and western fringes (off-site). They are mobile. Hence, it will not be necessary to displace them for the purposes of the project. Provision could be made only for a change of itinerary.

b) **Countervailing Measures**

Given the very low impact on agro-pastoral activities, there is no provision for countervailing measures. However, during the operational phase, pastoral activity could be organized within the spaces between the solar collectors, since vegetation could grow again on such spaces.

6.2.5. Tourism

a) Impact

The project area has very few tourism activities (apart from a few unofficial motocross and quad bike circuits). Activities are rather concentrated in Ouarzazate. No historic site or monument of interest has been detected in the study area. Hence, the construction of a solar power station will have no negative effects on cultural and tourism activities in the sector. On the contrary, the establishment of the solar power station could have a positive impact on tourism. Indeed, the operation of a large-scale solar power station will certainly generate media publicity at national and international levels, shedding positive light on the Ouarzazate region and placing it at the cutting edge of innovation and progress.

The project could include a pedagogical component with the organization of visits for tourists or pupils and children in general. The idea will be to explain this technology and its functioning to such visitors and initiate them to the concept of sustainable development. Information panels could be posted during the construction and operational phases. A building that will host, for instance, a centre for renewable energies could be constructed on the site.

An environmental and social management framework plan (ESMP) was prepared as part of the environmental assessment. It sums up the mitigation and compensatory measures which will be instituted under the Ouarzazate solar complex project. To ensure that all these measures are implemented, the ESMP will be included in the bidding documents (as terms of reference for mandatory compliance) for private developers. Furthermore, the developer must supplement and have the final ESMP revalidated by the competent authorities during establishment of the project.

6.3. Mitigation Measures

The environmental and social management plan (ESMP) sums up the mitigation and compensatory measures that will be implemented for the Ouarzazate solar complex project, as well as the surveillance and environmental monitoring measures proposed for the CSP technologies used for parabolic trough collectors and the solar tower.
These measures concern:

[1] Usable Farm Area

- infrastructure to be constructed directly by MASEN or jointly with other national operators like ONEE; and

- the various power stations to be constructed and operated on the complex.

These measures relate to the design, development and operational phases.
On the whole, MASEN is still responsible for implementation of this ESMP and will adopt an organizational model that ensures the accomplishment of this mission.

As concerns the measures directly implemented by developers, ESMPs adapted to each technology were identified. The environmental and social impact assessment (including the ESMP) will be appended to the bidding documents so that developers can incorporate these measures in their proposals.

Furthermore, the developer will prepare a special environmental and social impact assessment (ESIA) that will comprise an ESMP adapted to the specificities of the power station; this ESMP will be validated by the competent authorities and donors.

Moreover, the constructor has to prepare an environmental and social management plan on construction and comply with the applicable requirements. The contractor also has to prepare:

- an emergency intervention plan;
- an access plan;
- a waste management plan;
- a medical assistance plan; and
- an investigation plan for accidents and risk assessment procedures governing the on-site activities of its workers and submit them to MASEN for approval.

Furthermore, the contractor will also prepare the hygiene, safety and environmental requirements for its sub-contractors. Additional procedures for specific activities such as working in confined spaces, critical lifts and the installation and assembly of mirrors will be developed prior to the commencement of construction activities.

MASEN and/or its sub-contractors will provide the human and material resources needed for ESMP implementation during the construction and operational phases. The environmental and social impact assessment will enable the structures tasked with conduct of the project to undertake a broad prospective assessment of the environmental and social impacts of future activities and prepare mitigation or compensatory measures based on clear, precise, concise and operational instructions. An environmental and social management plan (ESMP) will be prepared that covers key elements of management, sub-components, potential impact and mitigation measures, as well as the implementation of these measures and institutional responsibilities, monitoring and the budget for its implementation.

The table below presents the cost estimate of the environmental and social impact mitigation measures and implementation measures for the programme and the monitoring plan:

Activities	**Cost (in DH million)**
Cost of impact mitigation measures	33
Cost of implementation measures for the programme and monitoring plan	42
TOTAL	**75**

7. MANAGEMENT OF ENVIRONMENTAL RISKS

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

The project developer and constructor have to establish monitoring mechanisms and comply with health, safety and environmental (HSE) requirements, as well as Moroccan laws and the guidelines of international financial institutions during construction. An HSE construction site monitoring report will be prepared and submitted to MASEN on a monthly basis throughout the construction phase. During the operational phase, a monthly hygiene, safety and environmental assessment report has to be prepared and submitted to MASEN. These reports will be prepared after a close inspection of the entire site by at least one member of the HSE team that will be set up. These reports will include the list of incidents/accidents that occurred during the period, water consumption data, volume of waste generated and the treatment methods used, types and quantities of dangerous products, data on the traffic generated, plantations, any archaeological findings, as well as any useful data on the measures adopted to guarantee health, ensure safety and protect the environment.

8. MONITORING PROGRAMME

The project developer and constructor have to establish monitoring mechanisms and comply with health, safety and environmental (HSE) requirements, as well as with Moroccan laws and the guidelines of international financial institutions during construction. An HSE construction site monitoring report will be prepared and submitted to MASEN on a monthly basis throughout the construction phase. During the operational phase, a monthly hygiene, safety and environmental assessment report has to be prepared and submitted to MASEN. These reports will be prepared after a close inspection of the entire site by at least one member of the HSE team that will be set up. These reports will include the list of incidents/accidents that occurred during the period, water consumption data, volume of waste generated and the treatment methods used, types and quantities of dangerous products, data on the traffic generated, plantations, any archaeological findings, as well as any useful data on measures adopted to guarantee health, ensure safety and protect the environment.

Furthermore, an environmental and social monitoring report will be prepared and will contain elements related to:

- monitoring of accidental pollution;
- monthly monitoring of water consumption;

- monitoring of legionellosis 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 due to the installation of the complex; if they are, measures will be envisaged;
- Monitoring of birdlife and herpetofauna in the same areas.

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

A complaints mechanism will be established for the local community as soon as construction begins. Complaints received will be included in the periodic HSE reports and an action plan prepared to address them. The complaints mechanism will be established by MASEN early enough to pre-empt and address all the concerns of the local community, mitigate risks and create a positive effect for the project. The mechanism will be clear and simple enough to be understood by all stakeholders and implemented easily. A complaints management committee (CGD) and a formal complaints management procedure are the basic tools for implementing this mechanism. The role of the CGD will be to review the complaints, propose remedies and ensure the transparency of the mechanism. Its composition will be determined to ensure maximum efficiency and compliance with the regulations in force.

Organization of MASEN for Environmental Monitoring

MASEN is a company created in March 2010. It currently has close to 30 staff members, including a Sustainable Development Officer who will head the Environmental Management Unit (EMU). The main mission of EMU is to ensure that the measures recommended in the environmental impact study are fully applied during project implementation. If need be, EMU could be reinforced by recruiting an external enterprise specialized in the environment. The Manager EMU will design, coordinate and guide the implementation of MASEN's environmental policy (including training). Under the authority of his/her hierarchical superior, he/she will ensure the implementation of the ESMP and ESMPs to be prepared for related facilities. He/she will also be responsible for relations with all administrative services and donors for issues pertaining to the environment.

Furthermore, each private project developer will establish an environmental and social management system that combines hygiene and security during the construction and operational phases. The system will be presented in an HSE manual containing all the procedures that will be followed during the construction and operational phases to protect the local environment, as well as ensure the hygiene and security of workers and local communities. This manual will be submitted to MASEN for validation.

9. CONSULTATIONS AND PUBLIC INFORMATION

Public information and consultative meetings will be organized under the environmental and social impact assessments specific to each power station that will be conducted in line with the requirements of international financial institutions and Moroccan regulations. They will

be conducted in the presence of the community and community representatives, elected representatives from the municipalities concerned, representatives of the Ministries concerned and representatives of MASEN. Their objective will be to present each specific project, the results of the environmental and social impact assessment conducted, and collect questions from the community in order to provide appropriate answers.
A public information and consultation meeting on the Ouarzazate Solar Station was held on 3 November 2010 at Palace Berbère Hotel, Ouarzazate, and was attended by the Governor of Ouarzazate Region, the MASEN Board Chairperson and his aides, representatives of the group of Phenixa-Burgeap consultancy firms and of the work team, elected representatives from the municipalities of the region, representatives of the Ministries concerned (Energy and Mines, Environment, Agriculture and Forestry), ONEE, civil society associations, etc. The theme of the meeting focused on presentation and discussion of the results of the Environmental Impact Assessment (EIA) conducted by the PHENIXA-BURGEAP group of consultancy firms.

MASEN's land procurement process under the Ouarzazate solar complex development project stems from two successive procurements:

- an initial procurement of 2,500 hectares from the Ait Ougrour community;
- a second procurement of 543 hectares from the Ait Ougrour community.

The *nouabs* from the Ait Ougrour community, representing the community concerned by the purchase, were consulted during consultative meetings held on 14 January 2010 and 25 August 2011 respectively. They approved the sale of the land to MASEN in accordance with the procurement arrangements in force and the price set by the review committees.

A public consultation was held on 2 November 2012 during evaluation of the special environmental and social impact assessment conducted in December 2012 for Noor I project to inform all participants of the ESIA results for the first project.

During update of this study for Noor II and Noor III, a public consultation was held on 9 June 2014 at the headquarters of Ghassate rural council in Ouarzazate and was by the President of Ghassate Rural Council, the *naibs* of the community lands and representatives of the communities in the *douars* of Ghassate municipality, representatives of Ouarzazate province, representatives of MASEN, as well as the representative of the Phenixa-Burgeap group of consultancy firms.

The objective of this consultation was to inform the entire public of the results of the updated FESIA of the Ouarzazate Noor solar complex after the changes which affect the project, present the project status (including common and related infrastructures, such as roads, electricity, water and other infrastructure), answer the questions of various participants, and gather their views, questions, objections and proposals on these changes.

MASEN has established an information, consultation and collaborative process with stakeholders to detect and address any discontent, grievances, conflicts or complaints. A letter box has been placed within MASEN premises at the Ouarzazate site to collect community complaints. Furthermore, a social expert recruited by MASEN and based on the Ouarzazate site, who is directly attached to MASEN’s local development department and maintains direct contact with the community, is tasked with collecting and addressing complaints and grievances, managing conflicts and monitoring and assessing local development projects. The complaints recorded are included in periodic reports which also cover the actions taken to address them.

MASEN and/or its sub-contractors will provide the human and material resources needed for implementation of the ESMP during the construction and operational phases. The FESIA will enable the structures tasked with conduct of the project to undertake a broad prospective assessment of the environmental and social impacts of future activities and prepare the mitigation or compensatory measures based on clear, precise, concise and operational instructions. An environmental and social management plan (ESMP) will be prepared that includes key elements of management, sub-components, potential impact and mitigation measures, as well as the implementation of these measures and institutional responsibilities, monitoring and the budget for its implementation.

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.

The environmental and social impact assessment updated in July 2014 and all studies conducted for the Ouarzazate complex can downloaded from MASEN Website: http://www.masen.org.ma/index.php?Id=53&lang=fr&=/_ since 26th June, 2014.

10. ADDITIONAL INITIATIVES

Additional initiatives to ensure the economic and socio-cultural development of communities affected by the project will be proposed by the socio-economic study and the socio-economic action plan which is being finalized by MASEN.

The first initiative to promote employment was the creation of an employment committee within the province that will study the best way of promoting local employment. Another initiative, which is under study, would be to increase access to a village near the project site (Tasselmant). MASEN currently plans to implement the following actions: (i) take advantage of the infrastructure to improve on the lives of the people; (ii) promote employment and local sub-contracting; (iii) contribute to the Ouarzazate Neutral Carbon Convention in 2015; and (iv) create a touristic site devoted to solar issues within the complex.

MASEN will prepare a strategy for managing relations with stakeholders and a communication strategy for the project. The strategy will be used to maintain the acceptability of the project and ensure the cooperation of local stakeholders.

The proceeds from sale of the land belonging to the Ait Oukrour Toundout community will be used to finance development projects in the community. Following a process initiated by the technical services of the province from November 2009 to September 2011, the local population had the opportunity to express their needs in the form of projects. Several projects have been identified, mainly in the following three domains: (i) basic equipment projects; (ii) economic projects; and (iii) socio-educational projects. Some of these projects will be financed with proceeds from the land sale and others will be implemented by MASEN based on the conclusions of the socio-economic study. Indeed, all these projects will contribute positively to the local development programme for the project area.

The supervisory entity of the communities that sold the land for the Ouarzazate Noor solar complex project lands to MASEN, namely the Department of Rural Affairs (DAR, Ministry of Interior), is responsible for the implementation of development projects financed with the proceeds from the sale.

The sale was for the sum of DH 30.5 million distributed as follows:

- DH 25 million from the initial procurement of land with a surface area of 2,500 ha;
- DH 5.5 million for the second procurement of three additional plots with a surface area of 500 ha.

In order to better address local community expectations, the DAR organized sessions to review needs and prioritize development projects, ending up with a list of projects targeting various domains such as irrigation schemes, drinking water supply schemes, various types of infrastructure projects, etc. To date, DH 26 million has been committed and the remaining funds should be exhausted by 2015.

11. CONCLUSIONS

In 2011, a preliminary environmental and social assessment was conducted for the future Ouarzazate solar complex. This study helped to determine the environmental and social impacts of each technological option (photovoltaic power or concentrated solar power) and an ESMP was developed for each type of technology. The first phase (Noor 1) was subjected to a specific environmental assessment and specific ESMP prepared by the private developer (APO) upon validation of the final design. The final design has already been published on MASEN Website.

During the assessment of phase 2, this environmental and social assessment (2011) was updated in June 2014 to cover phase 2 (Noor 2 and Noor 3) and is presented in this summary. Similarly, impact assessments and specific environmental and social management plans will be prepared by the private developers upon award of the contracts. These studies will be submitted to the Bank and Moroccan authorities for validation, and will be published on MASEN website as was the case with Phase 1.

12. REFERENCES AND CONTACTS

The documents reviewed by the African Development Bank are:

- the Environmental and Social Impact Assessment for the Ouerzazate Solar Complex, BURGEAP, March 2011;
- Update of the Environmental and Social Impact Assessment for the Ouerzazate Solar Complex, BURGEAP, June 2014;
- Land Procurement Plan, MASEN, April 2011;
- Land Procurement Plan (1 (a)), MASEN, May 2013; and
- Summary of the Socio-Economic Study, September 2011.

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