Environmental Impact Assessment
of the development plan of the site of
THE OUARZAZATE SOLAR COMPOUND

Non technical Summary

February 2012
Non technical summary

1- Legal and Institutional context

Moroccan legislation

- Environmental legislation
  - Law 12-03 on impact Studies and its implementation decrees
  - Law 11-03 concerning environmental protection and enhancement
  - Law 10-95 on water and its implementation texts
  - Law 42-09 completing Law 10-95 on water and its implementation texts
  - Law 28-00 on waste management and disposal and its implementation texts
  - Law 13-03 on fighting against air pollution and its implementation texts.
  - Law on premises considered insanitary, inconvenient or dangerous
  - Law 12-90 about urban planning and its implementation text
  - Law 22-80 on cultural and historical heritage as amended and supplemented in 2006 by Law 19-05
  - Law 78-00 on the Municipal Charter as amended and supplemented in 2002 by Law 01-03 and 2009 by Law 17-08.
  - «Dahir» (Royal decree) n° 1-06-102 of 18 joumada 1st 1427 (8 june 2006) promulgating the Law number 19-05, amending and supplementing the Law number 22-80 concerning the conservation of historic monuments and sites, and inscription of art objects and antiques.

Specific legislation related to power lines

- Order of the Minister of Civil Engineering No. 127-63 of March 15, 1963 regarding the technical conditions to be met by distributions of electric power;
- Decree of the Minister of Public Works of November 9, 1954 establishing and regulating the marking of distribution lines of electric power in the interest of air navigation.

- The project is also subject to other provisions
  Labor code, circular letter of the Ministry of Health, etc.

International conventions
Morocco has signed several conventions regarding the conservation of species and natural areas in connection with construction projects of Very High Voltage lines.

- The Rio Convention on Biological Diversity;
- The Bern convention
- The Bonn convention
- International Convention for Bird Protection;
- The Barcelona Conention; the African Convention on the Conservation of Nature and Natural Resources

Or :
- The Stockholm Convention on Persistent Organic Pollutants (POPs)

Institutional framework of environmental management
Many entities have responsibilities within the environmental framework. One can mention among others the Moroccan Ministry of Energy, Mining, Water and the Environment, The Moroccan Environment Department, and the Watershed Management Agencies (ABHs).
**Moroccan Institutional framework in terms of energy management**

- **The National Electricity Office (ONE):** The production and distribution of electricity are mainly controlled by the ONE. The Office, considered as the leader of electricity industry in Morocco, has been created in 1963 and proceed in the three key sectors of energy (production, transport and distribution).
- **The Department of Energy and Mining** within the MEMEE is in charge of the development and implementation of government policy in energy, mines and geology, as the control of other industries dependent of his authority. Its role is the supervision of firms and public that come within its competence, in particular the ONE.
- **The Moroccan Agency for Solar Energy (MASEN)** created in 2009. The mission of this agency is to look after the implementation of electric solar projects.
- **The Agency for Development of Renewable Energy and Energy Efficiency** created in 2009 and its mission is to contribute in the implementation of the politic of the government regarding the renewable Energies and energy efficiency.

**Environmental procedures of donors**

The project is also subject to environmental and social procedures of the donor represented by the World Bank. The Work Bank has ten guidelines specifying the principles of protection of social and environmental aspects to prevent or mitigate any fatal effects on the environment or vulnerable human groups that may result from a project or an activity financed by the Bank.

The main guidelines applicable to this project are:

- OP 4.01 : bringing the politics regarding the studies of impact
- OP 4.12: concerning the procedural framework for consultation and community involvement
- OP 4.04 : regarding devices and necessary measures to reduce and / or avoid damage to natural habitats

### 2 National framework in the energy industry

Morocco, a country not producing energy ressources untill now, relies on the outside world for substantially all its energy supply. This reliance amounts to about 95% currently. Therefore, the diversification of the energy mix is a priority area of intervention to reduce this reliance including through the development of local energy resources.

To meet the many challenges and handle the future of energy in order to ensure Morocco’s sustainable development, a new energy strategy was developed on the basis of technological and economic options as part of a long-term clear vision.

It is reflected into concrete action plans and achievable in the short, medium and long term, along with organizational and regulatory measures aiming at providing the necessary visibility to the operators. The set strategic objectives aimed at ensuring the security of energy supply, availability and accessibility of energy at the best cost and to reduce energy dependence by diversifying energy sources, developing the national potential energy, promoting energy efficiency in all economic and social activities.

In this sense, Morocco has an important potential in terms of renewable energies:

- A large solar radiation (about 7,2 kWh/j/m² in the South, 280 to 340 days per year)
- A large wind ressource: a potential of 6000 MW
- A significant potential for mini hydraulic systems: more than 200 sites
- A tank of 9 millions hectares of forest
- A geothermal potential not yet explored.
Thanks to this potential, Morocco banks on renewable energy through the installation of several wind, solar and hydroelectric power national stations.

In the field of solar energy, Moroccan Solar Plan plans to build a solar-based electric production capacity of 2 GW between 2015 and 2019, corresponding to 38% of the total electric power currently installed in Morocco.

In order to restart this production, five sites of solar energetic compounds have been identified on the Moroccan territory with a production capacity of 4500 GWh corresponding to 18% of the current national production.

These five sites are:
- Ouarzazate (500 MW);
- Ain Beni Mathar (400 MW);
- Sebhate Tah (500 MW);
- Foum Al Ouad (500 MW);
- Boujdour (100 MW).

The first site selected was the energetic solar compound of Ouarzazate. Located at 10 KM in the north of Ouarzazate, near the rural community of Ghassate, in a place called “Tamazaghten Izerki” on the national road 10 linking Ouarzazate to Errachidia.

### 3 Project description

The Ouarzazate solar energy compound, with a capacity of 500 MW, is the first phase of the Moroccan solar plan to be realized by MASEN.

This first compound, which commissioning is planned for 2015, is organized around five power stations and will be realized on successive phases:

- The first phase corresponds to a construction of a solar thermal CSP of 125 to 160 MW, wet-cooled with a capacity of storage of the thermal energy of three hours.
- For the following phases, three solar stations are possible, including:
  - Two thermal solar stations with cylindrical parabolic sensors, 125 MW each, wet-cooled with a capacity of storage of the thermal energy of three hours.
  - A thermal station with a solar tower with a capacity of 50 MW.
  - A photovoltaic station with a capacity of 50 MW.

Different construction phases of the solar compound may be realized simultaneously.

These five solar stations above mentioned represent the optimal scenario on which MASEN is based to determine the principal common substructures within its responsibility:

- **Infrastructure of intrasite water : water tank**
- **Roads infrastructure as: The access road to the site, the road inside the site and the road deviation of the trail going through the site and serving the village of Tasselmante.**
- **Electrical infrastructures including: an 60/22 kV electrical post inside the compound, two new 22kV lines and the deviation of the 60 kV line in order to by-pass the site of the solar compound.**
- **Infrastructures linked to drainage**
- **Security infrastructure**
- **Other infrastructures : lightening, surveillance camera, site installation...**
4 Justification of the project

In order to ensure the best conditions for the construction and running of the energetic solar compound of Ouarzazate, MASEN opted for the elaboration of a DP (Development Plan) of this compound, which allows the different stations of the compound:

- To define common infrastructures
- To identify preparation works of the construction sites
- To explain the procedures of management during the construction and running stages.

The implementation of such POD will allow also to realize the common infrastructures of the compound within a reasonable deadline and will ensure a startup of the stage work in a reasonable time, and as a result an optimal running of the solar compound.

This environmental assessment focuses on common infrastructures defined under POD of the energetic solar compound project of Ouarzazate and which the control of work is MASEN responsibility. These infrastructures are above mentioned.

The installation of such common infrastructures will allow the startup of the stage work and ensure a good running of the sire. This implementation will lead to many positive effects, more particularly:

- The improvement and enlargement of access to the basic social services (education, health, salubrious habitat, roads...etc) thanks to the opening up of a certain number of inhabitants after the implementation of the deviation road.
- The development of economic activities that generate incomes in agriculture, trade, craft industry...thanks to jobs created through the plan of development.

This will be reflected in an improvement of local demographic indicators (poverty, unemployment, emigrations, education...and will allow fighting against poverty and exclusion.

It is worth noting that some of those common settlements, such as the deviation of the 60kV electric line and the road of deviation are part of the mitigation measures to be implemented and identified during Environmental Impact Assessment of development plan of the site of Ouarzazate solar compound site, realized for MASEN in 2011. In this assessment, it has been mentioned that those infrastructures will be the subject of an impact assessment.

5 Project realization deadline

The initial work should start in early 2012 and conducted during 2012.
6 Analysis of the initial state

The characteristics of the study area and the compatibilities or sensitivities in relation with the project are listed in the following tables.

<table>
<thead>
<tr>
<th>Very high stakes</th>
<th>High stakes</th>
<th>Moderate stakes</th>
<th>Low stakes</th>
</tr>
</thead>
</table>

6.1 Physical environment

Table 1: General synthesis of initial state

<table>
<thead>
<tr>
<th>Theme</th>
<th>Distant perimeter characteristics</th>
<th>Nearby perimeter characteristics</th>
<th>Stakes level</th>
<th>Compatibility with the project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topography/hydrography</td>
<td>This is an area of flat plateaus fragmented by erosion, with altitudes fluctuating within a range of values ranging from 1100m to 1450m. Their elevation above the oueds valleys that cut into them is in the order of tens of meters. These plateaus are cut by the beds of rivers drawing green valleys locally. The edges of these plates are fragile with frequent landslides.</td>
<td>The support plate of the solar energy compound is notched at both the Eastern and Western edges of the two rivers Izerki and Wargouine. The elevation above the wadi beds that are notched fluctuates between 50 and 60 m. This plate sloping to the south is an area of gullied slope. In the North-East and South-East sides of the project site, clayey boulders are tipped out on cliffs of ten meters. The road deviation runs alongside and almost in the same way the oued bed of Izerki. This road passes first below the plateau and then rises to the level of the compound site.</td>
<td>Low</td>
<td>Low</td>
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<tr>
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<tr>
<td>Geology</td>
<td>The fragmented plateaus correspond to Cretaceous and Eocene lands submerged under a tertiary and quaternary detrital compound. Along the valleys of rivers dominant geological formations in the outcrop correspond to recent alluvial deposits, topped with silt.</td>
<td>The compound site ground and its eastern boundary are composed of detrital material, basically conglomerates and sandstones, and comprising an intercalation of layers of sandy clay. All this cover is highlighted by a conductive substratum probably of a marly nature between 34 and 50 m deep. Basic and resistant detrital formations dominate the north and northwest of the site of the compound. Fine detrital formations and sandy clay are conductive and they occupy the east and south east of the site. All these detrital formations are globally consistent. They continue edgeway with little or no change in their facies.</td>
<td>Distant area: Low, Nearby area: Low</td>
<td>Compatible geological nature, subject to consideration of the results of the geotechnical study.</td>
</tr>
<tr>
<td>Climatology</td>
<td>- The climate of the area is arid. - The average inter-annual of temperatures is around 20°C and the coefficient of variation of monthly average temperatures is 7% - Two wet seasons spreading respectively from mid-September to the end of December and from January until the end of March. These two periods alternate with a dry climatic episode spreading from April until mid-September - Low-frequency, fast and violent rainfall - The number of thunderstorm days, hail and snow is very limited</td>
<td></td>
<td>Distant area: Low</td>
<td>The climatological characteristics are not incompatible with the project. Aggressiveness of the rainfall is a factor of erosion, however, this phenomenon is</td>
</tr>
<tr>
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<tr>
<td></td>
<td>• The prevailing winds blow from west to northwest with speeds of 2 to 4 m/s</td>
<td></td>
<td>Distinct area</td>
<td>Nearby area</td>
</tr>
</tbody>
</table>

considered in the basic studies needed for the design and dimensioning of different common facilities.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Surface water</td>
<td>The study site is drained by the confluence of the Oued Izerki to the east including assif N'Ougni, assif Tizerkit in the South, assif Issil Tfteig in the South East and Wargouine in the West. These streams have an irregular and dry rate of flow during almost all year. All these streams flow into the south of the compound site to feed the dam Mansour Ed Dahbi.</td>
<td>The project site is drained by a network of chaaba and streams, including Issil Tfteig. The latter flows south east. The east and west edges of the compound site are cut by the watercourses of Izerki and Wargouine. Those watercourses are very irregular. The site's main water reservoir is provided in the middle of the watershed chaaba B. The site of the electrical substation 60/22 kV is located in the middle but slightly to the east of the watershed of the same chaaba. From upstream to hydrological downstream, the route of power lines 22 kV through the basins of the following chaabas: A, B, C and H. For their connection to the post 60/22 kV, these lines will cross the subwatershed B3. No risk of flooding can be reported in Quarzazate solar compound site. The section of road deviation below the plateau is crossed by some chaabas or gullies.</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
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</tr>
<tr>
<td><strong>Groundwater</strong></td>
<td>Brackish alluvial groundwater of low productivity can be found below the valleys.</td>
<td>The site’s support plateau is hydrogeologically sterile, the same is true for the lands crossed by the route of the diversion road.</td>
<td>None</td>
<td>The local hydrogeological conditions described are not sensitive in relation to the project (common infrastructures subject of this assessment)</td>
</tr>
<tr>
<td><strong>Air - Quality</strong></td>
<td>Source of punctual atmospheric emission:&lt;br&gt;The study area contains a crushing unit, on the bed of Oued Izerki and upstream near Mansour Ed Dahbi dam.</td>
<td>The site of the solar compound is located approximately 7 km at bird’s eye view.</td>
<td>Low</td>
<td>Air quality compatible with the project regardless of the chosen alternative</td>
</tr>
<tr>
<td></td>
<td>Source of lineic atmospheric emission:&lt;br&gt;The distant perimeter could be exposed to traffic-related pollution of the roads:</td>
<td>No atmospheric emission source is recorded and in or nearby the solar compound support except National Road 10 which is the starting point of the access road to the site. Also, the immediate perimeter along the route of the diversion road, no source of lineic atmospheric emissions can be reported except National Road 10 that represents its starting point and the crushing unit located approximately 6 km at the South-East of this route.</td>
<td>Low</td>
<td>The site is uninhabited and located far from any habitat. The diversion road doesn’t pass near any habitat.</td>
</tr>
</tbody>
</table>
### Distant perimeter characteristics

- **Source of surface atmospheric emission**
  - The emissions of douars Izerki including Tasselmante, Oum Romane, Essour, Inzaouene and Agouddim, and those located to the east of solar compound like Tflite, Tafghouste, Tidgheste et Igherm Amellal.

### Nearby perimeter characteristics

- **Stakes level**
  - Compatibility with the project

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Air - Noise</strong></td>
<td>The study area does not contain noticeable noise source, or an unusual noise.</td>
<td></td>
<td>Low</td>
<td>Air quality compatible with the project regardless of the chosen alternative.</td>
</tr>
<tr>
<td></td>
<td>The southern and eastern ends of the study area, bordered respectively by the N10 and PR 1511, may be impacted by road traffic noise.</td>
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<td></td>
<td>Along the bed of oued Izerki, some trucks illegally supplying local alluvia generate noise and punctual passenger. Punctual noise is also recorded at the crushing unit located on the bed of oued Izerki.</td>
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<td></td>
<td>The site of the solar compound is located approximately 7 km at bird’s eye in the north- north- east of Ouarzazate International Airport. An average of 2 flights/day. At the current state, no plan for noise exposure nearby the airport is available.</td>
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<tr>
<td>Theme</td>
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<tr>
<td>Natural risks</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Risk of landslides at the edges of the fragmented plateaus</td>
<td></td>
<td></td>
<td>Moderate</td>
<td>Precautions to be taken for the stability of the project’s site to avoid landslides that could affect its surroundings, especially regarding the establishment of the substation 60/22 kV and the main water tank, on the eastern edge, and the 60 kV line on the western and southern edges. The diversion road also crosses highly vulnerable areas.</td>
</tr>
<tr>
<td>Risk of vibrations from the seismic activity in the vicinity</td>
<td></td>
<td></td>
<td>Low</td>
<td>These risks are low and do not generate constraints for the project</td>
</tr>
<tr>
<td>Theme</td>
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<td>Compatibility with the project</td>
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</tr>
<tr>
<td>Natural risks</td>
<td>No risk of flooding is recorded at Ouarzazate solar compound. However, a detailed topographic and hydrological study is required to evaluate the risk of floodability of the diversion road that follows oued Izerki on its right bank. Sections of its Southern approach the shores of Izerki at distances of 650 m. Moreover, a study of drainage and sewerage of stormwater inside the Ouarzazate solar site is in progress on behalf of MASEN.</td>
<td></td>
<td>Low</td>
<td>This risk is low and does not generate constraints for the infrastructures. All the suggested measures in the study of drainage and cleaning up of rainwater inside the compound solar Ouarzazate in progress should be considered. A study of particular floodability should be conducted along the diversion road. Special measures shall be implemented to protect this route mainly in relation to Oued Izerki.</td>
</tr>
<tr>
<td></td>
<td>The site is located at an area with high erosion risk</td>
<td></td>
<td>High</td>
<td>Measures should be implemented in order to consider the high risk of erosion.</td>
</tr>
</tbody>
</table>
### 6.2 Biological environment

**Table 2: General synthesis of initial state – Natural environment**

<table>
<thead>
<tr>
<th>Theme</th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The study area of the Ouarzazate solar compound project is not included in any protected natural area, but in its distant perimeter, we can find:</td>
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<tr>
<td></td>
<td>• Lake of the Mansour Ed Dahbi dam, part of a RAMSAR site (site of the dam - 6 km south of the site)</td>
<td></td>
<td>Moderate</td>
<td>None</td>
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<tr>
<td></td>
<td>• The reserve of gazelles dorcas at Bouljir (13 km north - west of the site)</td>
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<td></td>
<td>• The reserve of Iguernane (15 km north - west of the site)</td>
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<td></td>
<td>• The Sbaa Shaab site (11 km east of the site)</td>
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<tr>
<td>Protected areas</td>
<td>The construction of Ouarzazate solar compound and its different linear infrastructures is planned in zone B.</td>
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</tr>
<tr>
<td>Fauna et Flora</td>
<td>At the compound site and its closer vicinity that is including all the studied infrastructures, we mention:</td>
<td></td>
<td>Low</td>
<td>Low</td>
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<tr>
<td></td>
<td>• Units with maximum legacy interest: dry oueds and slope environment</td>
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<tr>
<td></td>
<td>• Units with high legacy interest: alluvial regs, halophilic oueds, oasis and cultures</td>
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<tr>
<td></td>
<td>• Units with reduced legacy interest all regs, halophilic steppe, gullies on clay and gypsum bed of the Oued Izerki;</td>
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<tr>
<td></td>
<td>• Unit with a very low legacy interest: the douar.</td>
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<tr>
<td></td>
<td>Units with a maximum legacy occupy reduced areas in the zone of study.</td>
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<tr>
<td></td>
<td>The units with a reduced legacy interest</td>
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<tr>
<td></td>
<td>Most of the linear infrastructures are on reg units, with a low legacy value. Only short sections are planned in a units with a legacy value relatively high (slope environment, dry oueds, halophilic oueds)</td>
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<tr>
<td></td>
<td>The main water tank and the power spost 60/22kV are planned on an unit with a reduced legacy.</td>
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<td></td>
<td>None of the flora species found at the project site and its perimeter is considered threatened or rare.</td>
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<td>The heritage values from a flora and fauna points of view have been identified.</td>
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<td></td>
<td>The project site of the solar compound is recognized as being of low patrimonial value.</td>
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<td></td>
<td>Areas of high heritage value are located in the east and west edges of the project site.</td>
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<td></td>
<td>Measures will be implemented to protect them.</td>
</tr>
</tbody>
</table>
occupy most surfaces in the zone of study (about 81%), and more in the solar compound area.

Real estate
The solar compound site acquired by MASEN is a collective land belonging to the ethnic group of Southern Ait Ougrour. The diversion road is an infrastructure outside the site and follows the route of an existing track passable on a collective land. The roundabout and access from the national road RN9 are also outside the compound ground.

No private land to be expropriated. The real estate has no particular stake.

None

No incompatibilities common infrastructures of the compound is observed in relation to land
All the entitled persons from Ait Ougrour Toundount were compensated according to procedures in effect.

Urban planning
No urban planning document currently covers the study area.

* The Urban Planning Master Plan S0DAU) of the Greater Ouarzazate
* Development plans of the Ghassate and Idalsane municipalities are the main urban planning documents nearby the study area.

The nearby perimeter of infrastructures is not covered by any urban planning document.

None

No incompatibilities common infrastructures of the compound is observed in relation to the urban planning documents
<table>
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</thead>
<tbody>
<tr>
<td>Population</td>
<td>The population of Ghassate village represent:</td>
<td>The 9 douars of the study area are located more than 3 kms from the site, except douar Tasselmante. No habitat nor a douar is to be displaced</td>
<td>Low</td>
<td>No incompatibilities common infrastructures of the compound is observed in relation to the demography</td>
</tr>
<tr>
<td></td>
<td>- 0.3% of the population of the region and 1.8% of the population of the province.</td>
<td></td>
<td>Low</td>
<td>The project is located in an area of low population density. No residence is directly present on the project site.</td>
</tr>
<tr>
<td></td>
<td>- A constant decrease (8300 inhabitants in 2009 versus 9843 in 1994.</td>
<td></td>
<td></td>
<td>All the entitled persons from Ait Ougrour Toumdount were compensated according to procedures in effect.</td>
</tr>
<tr>
<td></td>
<td>- A low density (8.8 inhabitants/km²).</td>
<td></td>
<td></td>
<td>The site development plan is an opportunity for improving demographic indicators (poverty, migration, employment, education,...)</td>
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<tr>
<td></td>
<td>- A poverty rate of 30% and a vulnerability rate of 64%</td>
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<tr>
<td>Economic activities</td>
<td>Entirely rural population, primarily active in the following areas: farming, agriculture, handicraft, and trade. The extensive farming and oasis agriculture are the main economic activities occupied by the majority of the population. The craft industry and trade remain very limited in the distant perimeter. The other developed activities in the region and the province, such as tourism and industry, are almost nonexistent.</td>
<td>The acquisition of the land of the solar compound site and its commissioning will lead to a deviation of the mobility of some local and transhumant herds. It is the same for the route of the detour route. However, it should be noted that the site of the compound is almost naked with a very low forage supply.</td>
<td>Low</td>
<td>No incompatibility</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Low</td>
<td>The plan of development of the compound is an excellent opportunity for the development of a number of initiatives socioeconomic that can substantially reduce rates of poverty and vulnerability. Herders can follow other circuits that can be defined in consultation with representatives of concerned ethnic groups.</td>
</tr>
<tr>
<td>Theme</td>
<td>Distant perimeter characteristics</td>
<td>Nearby perimeter characteristics</td>
<td>Stakes level</td>
<td>Compatibility with the project</td>
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<tr>
<td>Cultural and touristic heritage</td>
<td>No site of historical or cultural interest has been identified, except sepulchral sites (marabouts, zaouias, cemeteries etc..). Tourism is not developed in the project area.</td>
<td></td>
<td></td>
<td>The Ouarzazate solar compound’s site is not located near any site of heritage interest. No sensitivity towards sepulchral sites has been identified as regards to the project.</td>
</tr>
</tbody>
</table>
| Landscape                     | The support plateau of the project site, is surrounded by two valleys:  
  - The valley of oued Izerki to the East like a steep slope but passable, covered by a dispersed vegetation.  
  - The valley of oued Wargouine to the west like a non passable steep cliff, created by watercourse. | - The main water tank and post 60/22 kV are planned to the east of the the compound site, leading to the valley of Izerki  
- The tracings of 22 kV lines and intrasite serving follow a north south line in the center of the compound.  
From the National Road RN10, the route of the diversion road goes across a landscape of flat slightly hilly, steep gully in places to reach the support plateau of the site. From the RN10 to the end of this road, the dominating landscape in the east is the valley of Izerki and some gullies designed by its tributaries and confluences.  
The deviated route of line 60 kV line goes from the west side of the compound site. There, the dominant landscape of the support plate goes across the compound, to a system of steep cliffs overlooking a large valley of oued Wargouine. The southern section of that deviated line through an area deeply weathered and rugged. | Low          | There are few issues in terms of distant co-visibility  
Some precautions have to be taken to manage local stakes, whatever the chosen alternative |

The study area seems to be favorable of the installation of different common infrastructure of the solar energetic compound of Ouarzazate, subjct to the consideration of various existing constraints.
7 Identified major impacts and compensation measures

The project’s prospective impacts on the environment have been presented and can be positive or negative, temporary (during the construction stage) and permanent (on the shelf life of the projected works), direct or indirect.

The evaluation of the impacts is the result of the intersection between the initial state in place, the technical project and feedback. The study has identified several mitigation measures and compensation to minimize these impacts during all stages of the project (see the table below).

7.1 Positive impacts:
The main contributions of the construction project of different common infrastructures of the solar compound of Ouarzazate are:

- Job creation during the works stage. Indeed, the implemented works for the installation and/or the construction of various infrastructures municipalities studied involve the use of local labor, generally available and inexpensive. The companies responsible of works recruited locally for earthmoving, construction and installation of electrical poles or posts, etc. that require no special qualifications.
- Temporary employment could be created for civil engineering works, assembling and installing towers, processing and installing cables and to transport materials. The work to open of access roads will also be provided by the local workforce.
- On top of temporary employment directly created by works, there is also the creation of indirect jobs linked to the necessary logistics for staff coming from outside.
- Overall, demand for goods and services will increase and temporarily boost the local economy.
- Due to low local income and the proportion of people below the poverty line in some parts of the area of study, the distribution of salaries has a positive impact on the population.

During the operating phase, the development program of solar energy compound will definitely a number of positive impacts, interlinked and inducing each other. Thus the direct positive impacts related to infrastructure development of the site provided (intrasite and diversion roads, water supply, power, fences…) induce direct and/or indirect positive impacts on human environmental variables:

- Improving and expanding access to basic social services (education, health, salubrious habitat, roads…etc), thanks to the opening up of a number of people after the commissioning of the diversion road.
- The development of economic activities that generate incomes in agriculture, trade, craft industry... thanks to the created jobs by the plan of development.

This will lead to an improvement of local demographic indicators (poverty, unemployments, emigration, education, etc..) And will consequently fight against poverty and exclusion.

The implementation of the plan of development of the energetic solar compound of Ouarzazate in general and the construction of the diversion road in particular, reinforced by other planned programs by Ouarzazate DPE (Splitting of RN10) and by Ghassate village (development of tracks) will allow more provision of main services to the site and to satisfy the pressing requests of the population for a better access to the road network. This will contribute into the opening up of the douars close to the site thanks to the improvement of transport conditions of persons and goods.

Thus, several positive impacts, directs and indirects, are expected:

Positive impacts on social services:

- Supporting an implementation of development comunal plan (PCD) on water supply in Agouddim Izerki, Oum Romane, Essour and Iznaguene “douars” (hamlets).
- Contributing to solving some problems of basic educational infrastructure (bathrooms, power, maintenance...), in order to reduce alarming illiteracy rates in the douars of the study area, among women in particular.
- Improving the social security cover of the population by installing the infrastructures and appointing medical staff.

**Positive impacts on economic activities**

In economic sector, the opening up of the douars will allow:

- To include Ghassate village in touristic tours, through a scientific tourism that integrate a visit to the solar station and to emphasize the existing touristic potential.
- To encourage and formalise the main activity linked to the craft industry (carpet weaving), through the creation of women associations and the organisation of training sessions.

The dynamic and the job creation will contribute to the improvement of demographic indicators of the area including:

- Reversing the regressive trend (-2.4%) of the population in the village of Ghassate (chalking of the intensity of rural depopulation and stabilization of the workforce)
- The reduction of the unemployment rate (75% of the population of working age including over 93% of women), reinforcement of the fight against poverty and vulnerability of local population by encouraging initiatives as part of the INDH.

Through various partnership agreements, local associations can play a fundamental role to reinforce such impacts.

The realization of the diversion road of the track through the site will give a strong protection to the local population of douar Tasselmant, Oum Roman and Agouddim Izerki, against any accident that may occur inside the site.
### 7.2 Summary of negative impacts and combined measures

Table 4: Impacts of infrastructures on the environment and general mitigation actions during the design and works phase

<table>
<thead>
<tr>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enviro nment</td>
<td>Environment element</td>
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<td></td>
<td></td>
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<tr>
<td>Physical environment</td>
<td>Climate / Air</td>
<td>Degradation of air quality and the sound atmosphere by atmospheric emissions by vehicles. Dust emissions in phase of excavation work.</td>
<td>Minimization of atmospheric emissions and noise • Gear and truck yards should be well maintained and will meet the standards in terms of fume emissions (decree of 1988 on emission standards). They should be chosen to reduce smells, fumes and dust. • The use of covered trucks is preferred to transport materials • Immediate repair construction machinery and vehicles that produce excessive fumes or noise emissions. • A light watering of access roads will be needed to limit dust uprisings</td>
<td>Companies responsible of works under the control of MASEN, included in the cost of works.</td>
</tr>
<tr>
<td>Environment element</td>
<td>Potential impact</td>
<td>Mitigation/compensation measure And application of the measure</td>
<td>Responsibility of implementation and cost</td>
<td>Residual impact</td>
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</table>
| Soil and water resources | • Changes of topography and soil by excavation work  
• Movements of land, impact on stability and soil erosion (excavation and backfill)  
• Soil erosion  
• Soil sealing  
• Destruction of the natural vegetation (low and sporadic)  
• Perturbation of the system of surface water streaming specially during rainy period.  
• Exploitation of quarries of borrowing material | Soil stabilization, land management and control of borrow areas and disposal areas  
• The arrangement, type, section and length of anchorage ground, and the location of the different common infrastructure, will be chosen according to the results of the geotechnical study to be adapted to the constraints of the site.  
• Companies have to the restoration of the sites at the end of work  
• Materials of excavation as backfill materials should be used only if their geotechnical characteristics allow it, or storing surplus materials according to a plan earthmoving harmoniously with the landscape and facilitating plant regrowth  
• Excavation and backfill will be stable, drained and replanted when necessary and possible.  
• Soil stabilization will be performed immediately after the interventions on the environment  
• Companies will limit the areas of vegetation clearing to the strictly necessary  
• The borrow areas will be subject to necessary required authorizations (study of impact on the environment, autorization of exploitation)  
• Companies must implement appropriate management of surplus material. Places of deposit must be identified by the company and approved by Masen. These zones of deposits should be stable, protected from erosion and should not impede the flow of water. | MASEN (incorporation of the terms in the of work specifications)  
Companies responsible of work under the control of MASEN | Very low |
| Environment element | Potential impact | Mitigation/compensation measure  
And application of the measure | Responsibility of implementation  
and cost | Residual impact |
|---------------------|------------------|---------------------------------|------------------|----------------|
| Deterioration of the quality of soil and water by generating solid and liquid wastes in construction phase | • Construction areas will be clearly defined to contain the production areas of liquid and solid wastes  
• It is necessary to limit the volume of wastes and their management (waste production will be limited from the source)  
• Each company has the responsibility of collection, sorting and transporting to the recycling channels and/or treatment of wastes generated by the company.  
• Units of mobile wastewater treatment will be implemented for the site staff with external drain | Requirements included in the specifications of companies responsible for the work  
Implementation by companies under the control of MASEN. Included in the cost of work | Very low |
<table>
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<th>Target</th>
<th>Enviroment</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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</thead>
</table>
| Environment element | Contamination of soil and surface water by spillage of hazardous products (hydrocarbon, oils and lubricants...) | • Companies will develop tools to prevent pollution and management plans of accidental pollution (training and awareness of staff, equipment based life suitable absorbent material, equipment kit absorbing every machine to meet the point source discharges)  
• Storage areas will be provided for cleaning and maintenance of equipment on a tight platform with contaminated rainwater and oil separator will be set up  
• The holding tanks must be installed around the storage areas of fuel or lubricants | Requirements included in the specifications of companies responsible for the work  
Implementation by companies under the control of MASEN.  
Included in the cost of work | Very low |
<table>
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<tr>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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</thead>
</table>
| Disruption of local drainage network, hydrological system and soil erosion by structural construction and implementation of various earthworks. | - Implementation of water projects under various conventional techniques of rural engineering:  
  - Limitation of the concentration of runoff  
  - Organization of water conduit  
  - Protection of areas where floods and untimely deposits would cause significant damage  
-Companies will not disrupt the natural flow of water when carrying out work to limit erosion and runoff. | To take into consideration in the conception phase for the implementation and design of structures under the control of MASEN follow up of the performance of work under the control of MASEN | Very low |
<p>| Situation of the whole compound of solar Ouarzazate and the entire infrastructure in area of biosphere | The compound is planned to be built in B zoning of the biosphere reserve. Like zoning between areas A, B and C is being proposed, it is desirable to integrate immediately the site of the compound in Area C (corresponding to the development zone of Ouarzazate) in order not to be in conflict with the orientations of zoning B (only tourism-related activities) | MASEN Water and forests | Absence |</p>
<table>
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<tr>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure and application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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<tbody>
<tr>
<td>Fauna and flora</td>
<td>• Temporary disturbance of wildlife (fauna) and flora due to the intense activity at work</td>
<td>Staff will be aware of the existing fauna and avifauna (species recognition, lifestyle and interest). To limit the actions of the craft part of the grip of strict construction which must be well defined. After work, wildlife will reinstall most likely in all suitable sites, the site of the solar compound, and its margins</td>
<td>Implementation by companies under the control of MASEN. Included in the cost of work</td>
<td>Low</td>
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<td></td>
<td>• Accidental pollution by deposition or leakage of contaminants that will destroy the vegetation • Deposit of rubble on the slopes, in units of mid-slope, with lasting impact</td>
<td>• The risk of spoil will be canceled by a strict prohibition of these deposits in slope environments; cuttings should be recycled either on site or accumulated on site in mid-shelf reg • The measures taken against pollution of the environment in which units based fauna and flora are identical to those proposed for the protection of soil and water resources. • Ditches, chaabas, and streams must be kept clean and clear, to meet the drainage and biodiversity.</td>
<td>companies responsible of work Included in the cost of work</td>
<td>Very low</td>
</tr>
<tr>
<td>Target</td>
<td>Potential impact</td>
<td>Mitigation/compensation measure</td>
<td>Responsibility of implementation and cost</td>
<td>Residual impact</td>
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</tbody>
</table>
| Human environment | Habitat and population | Embarrassment of residents during the installation of the construction sites | Communication with residents  
- Masen inform the local population of the place of work and establish a system for handling complaints of local people from the start of work.  
- The practical details of this mechanism will be developed in concert with stakeholders (MASEN, companies, local authorities...)  
- Companies should not hinder communication with residents. Their collaboration is also required for the treatment and resolution of complaints about him.  
- Companies should preferably use local resources for construction since this population has the required skills. The companies will connect with ANAPEC to establish a recruitment process at the local level.  

Minimization of probable discomfort:  
- Each company must develop an optimal schedule of work execution, planning to start with the realization of the diversion road to allow people to borrow and release the current track through the site for its redevelopment and construction of other components of the plan of development  
- Firms will choose hours handling operations (loading and unloading of products and materials, etc..) Off peak hours  
- Companies will ensure smoother traffic  
- Companies should establish adequate warning signs and signs of decreasing traffic speed after obtaining permission from the commune. | MASEN (for communication and planning of executing the work)  
Implementation by companies under the control of MASEN. | Very low |
| Human environment | Habitat and population | • Disruption of traffic on access roads to the site which consist essentially of the RN10 road  
• Risk of road accidents | • Companies will choose the time for handling operations (loading and unloading of products and materials, etc.) off-peak hours.  
• Companies will ensure smoother traffic  
• Companies should set up enough signboards and signs of decreasing velocity after upon obtaining permission from the municipality. | Companies responsible for work under the control of MASEN | Very low |
<table>
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<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure and application of the measure</th>
<th>Responsibility of implementation and cost</th>
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<tr>
<td>Environment element</td>
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</tbody>
</table>
| Increase of noise level | Noise control  
Companies should keep vehicles in good condition of the site.  
Companies will use the equipment in good condition, arranging work schedules to minimize any discomfort and respect the legislation in force, equip workers with hearing protection when needed.  
Equipment and devices shall comply with noise limits corresponding to their technical specifications.  
Minimization of dust: see measures proposed in the section air in phase work. | Include in the specifications of the work. To be implemented by the companies in charge of the work under the control of MASEN.  
Inclure dans les cahier des charges des travaux. A mettre en œuvre par les entreprises chargées des travaux sous contrôle de MASEN. | Very low |
| Increase of dust and atmospheric emissions | | | | |
| Risk of fire | • The usual measures prevent and protect against fire will be implemented (no smoking, electrical clearances, installation of fire extinguishers etc).  
• Stripping of little vegetation around the sites of projects will be one of the first operations to be performed at the start of work. | Companies responsible of work  
Included in the cost of work | Very low |
<table>
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<tr>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
</tr>
</thead>
</table>
| Historically and culturally heritage | discomfort for the landscape | • The allowances of the sites will be limited as much as possible.  
• The areas corresponding to earthworks construction allowances, to limit work and movements of earth to the strictly necessary  
• Companies will avoid depositing waste outside designated areas for this purpose  
• Companies will restore the original right-of-sites | companies responsible of work  
Included in the cost of work | Very low |
| Archaeological finds | The company that discovers archaeological vestiges phase of work is obliged to immediately notify the competent local authority.  
Following this advice, the Ministry of Culture operates through its agents in order to achieve expertise and determine the final conditions which shall be subject the works the option decide a temporary cessation of works | companies responsible of work  
Included in the cost of work | None |
| Environment management | • Companies should ensure good environmental management in the construction specifications of the company performing the work  
Companies must submit in their offer:  
• A management plan for health, safety and environment for the construction phase  
• An environment responsible of the construction site  
• The procedures to be implemented to ensure the inclusion of mitigation measures and environmental management | To include in the specifications of the work. To be implemented by the companies in charge of the work under the control of MASEN | - |
Table 5: Electrical infrastructure impacts on the environment and specific measures during the design / work

<table>
<thead>
<tr>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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<tbody>
<tr>
<td>Enviro</td>
<td>Environment element</td>
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<table>
<thead>
<tr>
<th>Environment element</th>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
</tr>
</thead>
</table>
| Natural environment | Wildlife and flora | Mortality of avifauna in river of Mansour Eddahbi dam (site of Ramsar) by percussion or electrocution on power lines 22kV and 60kV. Mortality of avifauna (essentially as migratory, including diurnal raptors, very patrimonial group) mainly due to the orientation of the line sections 60 kV and 22 kV of the same. | The layout of the 60 kV line sections considered dangerous (diversion of the 60kV line) should be modified. The proposed alternative route is only 1 to 6 km (instead of 12.8 km initially anticipated) and the installation of the line is easier, due to less hilly landscape:  
- The southern part should be carried further north, near the boundaries of solar compound, so it is essentially on the board, avoiding the system gorges south of the plateau  
- The western part should be given 100 meters from the edge of the plateau (including the steephead valleys cutting into the plateau)  
The ground wire that protects conductor cables against atmospheric overvoltages should be marked out.  
For 22kV lines  
Poles with medium voltage with rigid insulators are considered dangerous and the overhead switches and some angle supports dual level isolateurs. Thus it is important to:  
- Modifiate the configurations of the insulator  
- Install a perch on top of the pylon  
- Sheath with insulating materials for armaments and replace the "bridges" by sheathed bridges  
- Replace Air Switches with Mechanical Command by new types of switches which are less restrictive for the avifauna | Consideration during the conception phase under the responsibility of MASEN | Very low |

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<table>
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<tr>
<th>Environment element</th>
<th>Potential impact</th>
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<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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</thead>
<tbody>
<tr>
<td>Soil and water resources</td>
<td>Erosion and soil landslide along the route deviated from the 60 kV line Contamination of ground and surface water.</td>
<td>• The installation of pylons will avoid unstable areas subject to geological hazards such as the edges of cliffs and hilly areas. 60 kV line will avoid areas of high gully particularly in western and southern borders of the site’s solar energy compound in Ouarzazate.</td>
<td>Consideration in conception by MASEN</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td>Contamination of soil and surface waters</td>
<td>• At the electrical station 60/22 kV: it will be necessary to opt for a dry transformer. In the case of an oil transformer, it will be placed on retentions (for example a tight cube placed under the transformer and connected to an offset pit in order to recover the oil in case of leakage).</td>
<td>Consideration in conception by MASEN</td>
<td>None</td>
</tr>
<tr>
<td>Landscape</td>
<td>Modification of the initial landscape</td>
<td>The different electric infrastructures should be integrated into the local landscape ⇒ a landscape charter is under realization</td>
<td>Consideration by study of the landscape charter-MASEN</td>
<td>Very low</td>
</tr>
</tbody>
</table>
Table 6: Impacts of electric infrastructures on the environment and specific actions in phase of exploitation

<table>
<thead>
<tr>
<th>Environment element</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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<tbody>
<tr>
<td><strong>Physical environment</strong></td>
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</tbody>
</table>
| Soil and surface waters | Accidental leakage of sulfur hexafluoride ($SF_6$) from the breaker of the post transformer 60/22kV | Implementation of prevention tools and development of an action plan in case of accidental pollution
The pression of $SF_6$ must be be continuously supervised to allow a very fast leak detection When a leak is detected, | MASEN | None |
| | Contamination of soil and surface waters by:
 Leakage of transformer oils of the post 60/22kV if the transformer is not dry
 Leakage of waste oil and other dangerous products that can be used for maintenance the electrical substation. | **Implementation of prevention // and development of an action plan is case of accidental pollution**

- Training will be provided to all compound site employees upon arrival and practical exercises will be conducted
- Absorbent material will be provided at intervals near the transformer and potential storage of oil or other dangerous products.
- In case of leak or spill, the contaminated products will be collected and disposed of by specialized in dangerous wastes
- The transformer of the electrical substation should be conform to the regulation of liquid component of dioxin.
- Risk reduction at source by the use of technology the safest and implementation of appropriate security measures on the one hand, and planning of emergency measures in case of accident taking into account technological risks are required and recommended. | MASEN | None |
| **Increase of noise level linked to**:
- Electrical substantion: the noise of transformer comes from two sources:
  - Fans installed on oil radiators
  - Movement of winding. They are transmitted in open air by the steel cuve.
- Air emissions, mainly those | **Minimization of noise of power station 60/22kV transform**
MASEN will ensure that the WHO guidelines on noise emissions are respected
**Minimization and control of air emissions:** see the category about “air”
**Minimization of radio interference.**
In case of disturbances, conduct tests to determine the exact cause disturbances. If the responsibility of power lines is involved, arrangements are made to correct and restore normal receiving. It is usually to remove a slight technical fault line and, sometimes, to fit the receiving device. These modifications are made at the expense of MASEN | MASEN | Local service broadcasting
Cost not determined | None |
<table>
<thead>
<tr>
<th>Target</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure And application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
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<td>Enviro element</td>
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<tr>
<td>Environment</td>
<td>Environment</td>
<td>associated with accidental releases of sulfur hexafluoride</td>
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<tr>
<td></td>
<td></td>
<td>- Radio interference essentially from power lines 60 and 22 kV</td>
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</tbody>
</table>
| Human environment | Health | Risk of technical accident | Inform residents on safety measures and prohibitions | MASEN Local authority, schools...
150000 dhs for information campaigns of concerned public. | |
| | | | - It is forbidden to approach or approaching objects handled (ladder, tools) within 5 m of electrical conductors, specifying the special security measures in place | | |
| | | | - Residents will be informed that in case of a damage to a work, you should never touch or approach a cable while it is in contact with the ground | | |
| | | | - Residents should be informed of procedures to alert the help desk or maintenance MASEN | | |
Table 7: Impacts of roads infrastructures on the environment and specific measures in phase of conception and work

<table>
<thead>
<tr>
<th>Target</th>
<th>Environment</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure and application of the measure</th>
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<tr>
<td>Target</td>
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<td>Mitigation/compensation measure</td>
<td>Responsibility of implementation and cost</td>
<td>Residual impact</td>
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<tr>
<td>Environment</td>
<td>Physical environment</td>
<td>Implementation of prevention tools and developing a plan of action in case of accidental pollution</td>
<td>To be implemented by the companies in charge of the work under the control of MASEN</td>
<td>Very low</td>
<td></td>
</tr>
<tr>
<td>Soil and water resources</td>
<td>Point source pollution of soil and surface water (including oued Izerki and chaabas on the compound site) by residues of concrete roe, oil spills or other products recognized dangerous, stored or manipulated along the diversion road.</td>
<td>Prevention measures:</td>
<td>Included in the cost of works.</td>
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<td></td>
<td></td>
<td>• Prohibition of parking off working hours for construction equipment and all vehicles associated with construction site activities in protection zones</td>
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<td>• Prohibition of storage of fuel within 100 meters of a watercourse. The contractor shall obtain approval for the locations that can be used for waste handling and storage of hazardous materials (mainly).</td>
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<td></td>
<td></td>
<td>• Previous review of gear at the beginning of construction activities to reduce the risk of technical failure</td>
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<td></td>
<td>The contracted company will develop an intervention plan in case of leakage or spillage of pollutants: it will be implemented if necessary as soon as possible.</td>
<td><strong>Management and recovery of pollution on construction sites</strong></td>
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<td></td>
<td><strong>Prevention tools and developing a plan of action in case of accidental pollution</strong></td>
<td>• The collection of waste products and areas of work as the progress of construction goes on</td>
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<td></td>
<td><strong>Prevention measures:</strong></td>
<td>• The elimination by routing to controlled landfill, collection, storage and disposal of oils and lubricants to potential buyers</td>
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<td></td>
<td>• Prohibition of parking off working hours for construction equipment and all vehicles associated with construction site activities in protection zones</td>
<td>• Provide a storage area for all these products, tight enough and has a drainage device connected to a holding tank</td>
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<tr>
<td></td>
<td>• Prohibition of storage of fuel within 100 meters of a watercourse. The contractor shall obtain approval for the locations that can be used for waste handling and storage of hazardous materials (mainly).</td>
<td>• Ensure a management of each specific product category according to the instructions of Environmental Protection</td>
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<tr>
<td></td>
<td>• Previous review of gear at the beginning of construction activities to reduce the risk of technical failure</td>
<td>• In case of pollution, contaminated area should be immediately covered with materials with very high absorption rate (sawdust). The area will then stripped and drained to a suitable discharge</td>
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<td></td>
<td>The contracted company will develop an intervention plan in case of leakage or spillage of pollutants: it will be implemented if necessary as soon as possible.</td>
<td>• Provide training prior to the class of workers handling products labeled dangerous and/or toxic at the construction site. This training should be particularly focused on the themes: environmental protection, occupational safety and first aid actions.</td>
<td></td>
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<tr>
<td>Environment</td>
<td>Element environment</td>
<td>Potential impact</td>
<td>Mitigation/compensation measure And application of the measure</td>
<td>Responsibility of implementation and cost</td>
<td>Residual impact</td>
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<tr>
<td>Biological environment</td>
<td>Wildlife and flora</td>
<td>• Disturbance and/or pollution of natural environment in which units the water hydrous environment</td>
<td>Whenever a road will cross a river, there must be a strong design of nozzles of water flow, to avoid disrupting the flow of water downstream (as well as to ensure the sustainability of the work)</td>
<td>MASEN</td>
<td>None</td>
</tr>
<tr>
<td>Human environment</td>
<td>Habitats et population</td>
<td>Users of the access track to douar Tasselmante and other douars Izerki will be forced to practice the diversion road (changing habits)</td>
<td>A briefing and consultation supported by an explanatory brochure of the site plan of development in aid of active associations in the area. The track will become a diversion road. These associations can become partners which facilitate the result in a better achievement of the site development plan.</td>
<td>MASEN Communes of Ghessat Local authorities</td>
<td>None</td>
</tr>
<tr>
<td>Target</td>
<td>Environmental</td>
<td>Element environment</td>
<td>Potential impact</td>
<td>Mitigation/compensation measure</td>
<td>Responsibility of implementation and cost</td>
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</tbody>
</table>
| Environment | Human environment | Human environment | Deviation of herd mobility regarding to the site of the compound solar and route of the diversion road | Risk reduction of road accidents and traffic flow on the RN10 For the access road to the site, MASEN will:  
- Redesign the location of the roundabout junction with the RN 10 and move it 800 meters further in the direction of Errachidia. At this point, the visibility is perfect and the risk of accidents will be minimized  
- Consult DPE about about the technical constraints to be respected including the duplication of the RN10 road during the study (study and production by the DPE)  
- Provide a plan and configuration of the roundabout in accordance with technical Moroccan road construction.  
- Provide signs of solar station, speed limit and speed bumps  
- The access road to the compound ends at the front door under the south east boundary of the site. It will be equipped with effective signposting to ensure its visibility from the RN 10 road.  
- The speed limit in this section of the RN10 road will be lowered to 80 km/h (except large trucks, where the speed limit should be 40 km/h).  
- At the exit of the site access road to the intersection, the speed of vehicular traffic will be limited to 30 km/h. For the diversion road, it is necessary:  
- To arrange a crossroads at the connection of this road to the RN10  
- To limit the speed in this section of the road RN10 80 km/h instead of 100 km/h. At the end of this road to the roundabout, limit the speed of movement of vehicles to 30 km/h. | MASEN | Very low |
| Land use | Socioeconomy | Socioeconomy | Modification of initial landscape | It will be necessary to notify people of douars area and especially the shepherds on the structure of the components of POD and encourage them to adapt the movements of their herds (in consultation with representatives of ethnic groups affected) | MASEN | None |
| Land use | Landscape | Landscape | Modification of initial landscape | The different road infrastructure will be integrated into the local landscape ‒ a landscape charter is in progress | MASEN | Very low |
### Table 8: Impacts of road infrastructures on the environment and specific measures in phase of exploitation

<table>
<thead>
<tr>
<th>Target</th>
<th>Environmental element</th>
<th>Potential impact</th>
<th>Mitigation/compensation measure and application of the measure</th>
<th>Responsibility of implementation and cost</th>
<th>Residual impact</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical environment</strong></td>
<td>Soil and surface water</td>
<td>Risk of environmental degradation of adjacent hydraulic structures if they do not function (scouring the sides of the road) Also risk of damage to the road structure.</td>
<td>It will be necessary to ensure regular maintenance of hydraulic structures to ensure their proper functioning during the rains. Required road maintenance work should be provided.</td>
<td>MASEN for intra sites roads and the commune for the diversion road</td>
<td>Very low</td>
</tr>
</tbody>
</table>
| **Human environment** | Health-security | Crossing the access road and diversion road with the N10 are sources of potential accident | The installation of speed reduction road signs at the intersections of crossroads on each route:  
- Provide signs of solar station, speed limit and speed bumps  
- The access road to the compound ends at the main gate of the south east border of the site. It will be equipped with efficient signage to ensure its visibility from the RN 10.  
- The speed limit in this section of the RN10 road will be lowered to 80 km/h (except large trucks, where the speed limit should be 40 km / h).  
- At the exit of the access road to the site to the intersection, the speed of vehicular traffic will be limited to 30 km / h.  
For the diversion road:  
- Arrange a crossroads at the connection of this road to the N10  
- Limit the speed in this section of the road RN10 80 km/h instead of 100 km/h. At the end of this road to the roundabout, limit the speed of movement of vehicles to 30 km/h | Direction of Infrastructure and Transport | Low |
8 Environment and Social Management Plan (PGES)

8.1 Introduction

This PGES was prepared on the basis of predictable impacts identified during the environmental assessment and mitigation measures and reduction defined in order to reduce and mitigate them. It aims to ensure respect of the implementation of these measures and requirements under the regulatory framework. More specifically, the PGES outlines ways and mechanisms to ensure respect for legal requirements and environmental and social and the smooth functioning of work, equipment and facilities. It also verifies the accuracy of forecasting and evaluations of certain impacts and efficiency of some mitigation measures and, where appropriate, compensation measures.

These measures mainly concern the common infrastructure to be implemented directly by MASEN.

These measures include the design, construction and operation phases.

**Suppression measures and mitigation impacts**

Every precaution will be taken to minimize the impact of the construction of various infrastructures municipalities studied on various environmental components. As such, many suppression and mitigation measures have been identified to maximize the integration of these infrastructures in the environment and minimize the short, medium and long term effects.

The majority of measures costs shall be established at the time of the final estimation of work.

However, several measures will not involve additional paid out since they represent requirements to be followed during construction.

**Compensation measures:**

The realization of this set of common infrastructure will not cause a loss of land areas since the field of solar compound support infrastructure is already acquired, the establishment of access rights is part of the owners.

MASEN remains generally responsible for the implementation of the PGES and must adopt an organization can to ensure that mission.

Monthly reports of site monitoring HSE will be prepared and submitted to MASEN throughout the construction phase.

During the exploitation, a monthly balance on health, safety and the environment will be achieved by MASEN. These reports will follow a detailed inspection of the entire site by at least one team member that HSE will be implemented.

These reports will include the list of incidents/accidents occurring during the period, The data on water consumption, volumes of waste and treatment methods used, types and quantities of dangerous substances, data generated traffic, plantations, any archaeological findings and all relevant information on the measures put in place to protect health, safety and environment.

A mechanism for complaints of local people will be in place from the beginning of work. Recorded complaints will be included in periodic reports HSE, and an action plan to address them will be implemented.

A complaints mechanism will be established by MASEN early enough to prevent and fix all concerns of the locals, reduce risk and create a positive effect on the project. The mechanism must be sufficiently clear and simple to be understood by all parties and easily implemented, but not simplistic to be credible.

The Management Committee of Grievances (CGD) and the formal complaints management are the basic tools for implementing the mechanism. CGD’s role will be to consider appeals, propose amendments and ensure transparency of the mechanism. Its composition will be set for maximum efficiency, while conforming to current regulations.
The complaints management process aims to provide:
- A convergence point for the grievances to a better management
- An impartial and transparent point, and a mediation mechanism to deal with complaints, respecting the confidentiality of sensitive information
- A system of credible arbitration, effective and research-oriented to solutions

8.2 Legal requirements
MASEN agrees to comply with Laws and regulations prescribed by national Laws, as well as international conventions to which Morocco is a member, including:
- Law 12-03 on EIE
- Law 11-03 concerning environmental protection and enhancement
- Law 10-95 on water
- Law 42-09 completing Law 10-95 on water
- Law 28-00 on waste management and disposal
- Law 13-03 on air quality
- Law 13-09 on renewable energies («Dahir» (Royal decree) 1-10-16 of February 11th, 2010)
- Global National Charter on Environment and Sustainable Development
- Law 78-00 on the Municipal Charter as amended and supplemented in 2002 by Law 01-03 and 2009 by Law 17-08.
- Law 29-05 on the protection of flora and fauna species and regulating their trade («Dahir» (Royal decree) 1-11-84 of July 21th, 2011)
- «Dahir» (Royal decree) 1-69-170 (July 25th, 1969) on defense and land restauration
- Law 12-90 on urbanism and its application text
- «Dahir» (Royal decree) 1-60-063 (June 25th, 1960) on development of rural settlements
- Law 22-80 on cultural and historical heritage as amended and supplemented in 2006 by Law 19-05 («Dahir» (Royal decree) 1-06-102 of June 8th, 2006).
- Decree 2-70-510 (8 October 1970) on preventive measures to be taken on site
- Law 7-81 on expropriation for public utility and temporary occupancy (May 6, 1982);
- Law 08-01 (June 2002) on the working of quarries;
- «Dahir» (Royal decree) on quarries
- Circular 87 (June 8, 1994) on quarries;
- Decrees of application of the previously mentionned Laws.

8.3 MASEN organization for environmental follow-up
MASEN is a company created in March 2010, and currently has over 30 employees. For the work and operation phases, MASEN identify an internally charged environment that will be responsible for the management unit of the environment (UGE). The UGE mission will be to ensure that the measures recommended in the study of environmental impact are well implemented in the project. The UGE may be expanded if need be, by recourse to an outside firm specializing in environmental. The charge of UGE will design, coordinate and run the implementation of MASEN environmental policy (including training). Under the authority of his immediate supervisor, he should ensure the implementation of the PGES. He is also responsible regular contact with all administrative services and donors on issues related to the environment.

8.4 Summary of impacts of various common infrastructure on the environment and corresponding mitigation and/or compensation measures
See tables above of paragraph 7.2
8.5 Monitoring and environmental follow-up program

Environmental monitoring is to ensure that the commitments and recommendations of an environmental nature included in this study are fully applied. Initially, this activity includes monitoring the integration mitigation measures and other environmental considerations into the plans and specifications and their implementation during the construction.

MASEN will validate documents of studies and application submitted by contractors, mitigation measures they have to incorporate.

In addition, before starting work, MASER will appoint a responsible for environmental monitoring (in-house or outsourced service). The person responsible for environmental monitoring will be present on site on a regular basis, will be easily available and will be mandated to ensure the concrete application of mitigation measures on site construction. Any incident or accident that may affect the environment will be immediately reported to MASEN and if necessary, to local authorities and MEMEE.

The person in charge of environmental monitoring may be an environmental engineer from MASEN or an engineer from a consulting firm commissioned by MASEN. This official may be assisted by specialists if need be. It should be noted that this person comes under the site management.

Upon arrival at the site of new contractors, subcontractors and / or suppliers, the requirements of environmental protection and environmental emergency will be presented in order to sensitize them.

At site meetings, "Environment" point will be put on the agenda to follow-up elements to fix and/or pay special attention.

In addition to ensuring the implementation of all mitigation measures, the head of environmental monitoring will to face the derogations, to propose corrective and guide decision making on the site in relation to environmental issues. The notification process in cases of non-compliance with environmental measures will be presented at the first site meeting, and the various environmental monitoring documents to be produced before work begins and during the latter.

Throughout the progress of work, MASEN will notify the ministries or agencies responsible for conducting the work and significant changes in the timetable. Departments or agencies may at any time come and see the implementation of mitigation measures.

The person in charge of environmental monitoring will also be responsible for producing monthly reports of environmental monitoring and a final report at the end of work.

MASEN also attaches high importance to its relations with residents affected by the project. Throughout the work, MASEN will inform the public of the progress of the site through its website and communications with local and regional authorities.

La construction, l’entretien et l’exploitation des routes et intersections communes en dehors des centrales solaires du compounde seront à la charge et sous responsabilité de MASEN. Construction, maintenance and operation of roads and intersections outside the solar power compound will be the responsibility and liability under MASEN.

Different developers will be responsible for construction, maintenance and roads and intersections exploitation within the area of solar power plants.

MASEN will develop a traffic management plan attached to the Site Management Plan and including a description of the relation between MASEN and road users, inspection plans, maintenance standards, the levels of intervention and management systems.

Developers of different solar power plants will be required to respect that this traffic management plan will also include a description of actions in case of non compliance with the plan, causing a deterioration of infrastructure or circulation problems.

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In summary, the activities related to environmental monitoring will:
- See the implementation of mitigation measures contained in the impact study and the plans and estimates
- Conduct inspections of work sites and report any non-conformities to the site manager
- Identify, in conjunction with the site foreman, alternative measures to resolve any unforeseen problems that might occur during construction
- Ensure that work is carried out in accordance with environmental requirements and Moroccan donors.

8.6 Content of the environmental monitoring program

8.6.1 Objectives and implementation

Environmental monitoring affects the operation phase and pursues two objectives in the project:
- Check the evaluation of certain impacts identified in the the impact study and if necessary, make adjustments to the assessment of impacts and propose mitigation measures to minimize unintended impacts on the environment of integration of the project.
- Verify the efficiency of some mitigation measures and perform, if necessary, some adjustments.

The environmental monitoring of the operation of the Ouarzazate solar compound will be under the responsibility of MASEN that should nominate an environmental officer in the operation phase.

Integrated within the operations team of the various elements of the compound solar of Ouarzazate or carried out by specialized firms in environment, the team responsible for conducting environmental monitoring should have a good knowledge of engineering problems of the environment (water, noise and air). The main functions of environmental monitoring will include:
- Make a list of measures proposed in the impact study and commitments of MASEN and developers under the project
- Establish a detailed schedule of activities that should be performed to meet the commitments and the implementation of the suggested measures
- Document undertaken actions (letters, written reports, photographs...)
- Prepare semi-annual reports of activities conducted as part of environmental monitoring
- Communicate the results of monitoring to the departments concerned of MASEN, the ministries involved in the management and protection of the environment, international donors and the local population

In addition, a semi-annual report of environmental monitoring will be prepared. However, should an incident or activity likely to cause significant impacts on the environment during exploitation, an immediate report will be produced in order to set up, and, as soon as possible, appropriate corrective measures.

The semi-annual report and any immediate reports to incidents will be sent to donors. The practical method of reporting will be specified later.

The semi-annual report during the construction phase will contain the following:
- Main phases of executing the work crossed (stormwater drainage, installation of elements of civil engineering, etc...);
- Environmental issues associated with these phases (soil, natural environment etc. ...)
- Measures implemented by the company
- Residual impacts and possible undertaken measures
- Elements of summary of possible complaints.
The semiannual report during the operation phase will include the following:

- Status of electricity production
- Status of water consumption
- Status of fluid consumption
- Potential Incidents observed
- Elements of summary of possible complaints.