



ADEME



Deliverable 3.1

Report on commitments towards wind and energy concentrated solar thermal energy integration in Algeria, Jordan, Tunisia and Turkey.

Prepared by: OME

06/02/09

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Introduction

In the framework of WP3 “**Commitments towards wind and energy concentrated solar thermal energy integration in the Southern and Eastern Mediterranean area**”, and in order to discuss on the commitments and orientations towards wind power and concentrated solar power national workshops in the REMAP participating countries, have been organized in Algeria (26 June 2008), Jordan (8 & 9 July 2008), Tunisia (19 May 2008) and (13 June 2008) Turkey. During these national workshops the different available technologies and financing tools have been presented by the project partners to the local stakeholders. Local stakeholders, from industries, public agencies and ministries gave inputs in order to agree on the priority to be given within REMAP, CSP versus wind and to determine the most interesting sites to build wind power plants and/or CSP plants.

These national workshops were very successful and were the occasion to create a dialogue between the project partners but also between the local stakeholders.

At the occasion of the 18th month meeting in Amman the choice of the plant projects have been finalized and a more detailed description of each project has been produced.

General conclusions

The general conclusions about these workshops is that within REMAP CSP is the priority for all the countries, but Algeria and Jordan do not neglect the wind power and plan to develop some wind power plants, in particularly in Jordan with three projects for a capacity of 220MW.

Tunisia

The REMAP project priority for Tunisia is CSP, in the area pre-selected by DLR. The different technologies, with different maturities, have to be analyzed by the partner (DLR, Labein, ESD, 3E...) with the support of STEG. At the same time, a financing scheme adapted to Tunisia will be elaborated in cooperation with ESD and partners from the WP4. The benefits of using solar energy and CSP technology will be identified and quantified after dialogues with all the actors.

Turkey

As part of the REMAP project, it has been decided to focus on CSP in Turkey. This is related to the wind sector already being very developed (lots of existing wind capacity and new wind applications are foreseen) and the best wind sites are already used up, so new sites would only be viable, if higher incentives for investors were to be put in place.

Algeria

CREDEG wants to have the projects where they face some power problems and to use preferably proven technologies. CDER wants to have commercial available CSP technologies to boost the CSP installation as soon as possible, R&D technologies should be in the vicinity of researchers (including international). NEAL wants a diversification of CSP technologies that could enlarge the experience in CSP in Algeria. After discussion, the conclusion was to have both wind and CSP project within REMAP.

Jordan

Due to the maturity of wind power, CSP has been selected as the priority within REMAP. In addition to the projects already identified to produce electricity, it has been highlighted that it could be interesting to take into account the water shortage challenge also. The solution can be combined solar-desalination plants.

Commitments towards CSP:

Solar potential is important in the Mediterranean Partners Countries but the exploitation of this resource depends on many conditions: technical, economical, financial...

Tunisia

Energy storage or hybridation with gas do not seem to be necessary in Tunisia as the demand load peak is during the afternoon. But the solution of thermal storage could be interesting in the tourist areas. For instance it can allow the construction of cooling water grid, using thermodynamic machines which convert heat in cold.

Moreover, the financial mechanisms applied in other countries could be exploited in Tunisia, but it seems risky. If Tunisia makes long term PPA with private investors, STEG will pay the electricity more than it can sell it in the country. Selling electricity to Italy seems also complicated due to the grid regulation issues: variability of the resource, integration to the grid. In addition the electricity load curve is very marked in Tunisia, sometimes during the night the demand is below 50% of the day peak. In this case the exploitation of solar energy is adapted, because the demand and the supply evolve in the same way.

Turkey

Four specific areas for CSP plants were suggested which DLR will further analyse regarding their respective solar resources and also with respect to potential constraints. For the 2 sites located in the touristic area the study will focus on CSP – Desalination demonstration plants using the linear Fresnel technology.

The development of CSP in Turkey will be supported by an under discussion FIT specific to solar power. On the subject of the land costs, they are very high in the Turkish tourist area (South West) but there is also an important need of electricity and drinking water in this area. As a result the general feedback was such that there was a preference among the local participants for bi- or tri-generation plants (including desalination), possibly also in collaboration with local universities (e.g. as R&D projects).

Algeria

The hybrid gas-CSP project of Hassi R'Mel will be a pilot project for the North Africa region. Feedbacks on this plant will be useful for all the next plants in this region. The hybridation with gas is a solution to avoid the issue of the storage of energy.

In order to develop private investment a more detailed decree on FIT is necessary. The owner of the demonstration project will be a national institution, NEAL could play this role. The project finance model is known in the country and could best be applied for the projects. The NEAL is constructing a hybrid CSP project, 5.1% solar. The NEAL project has a bilateral contract with Sonatrach because Sonatrach is an eligible industrial.

Jordan

As mentioned earlier, due to the maturity of wind power, CSP has been selected as the priority within REMAP. In addition to the projects already identified to produce electricity, it has been highlighted that it could be interesting to take into account the water shortage challenge also. The solution can be combined solar-desalination plants.

The NEPCO (National Electric Power Company) asks for capacities and choose the tender with the lowest price which corresponds to the technical requirements. About the electricity transportation, the connection between the power plant and the grid needs always an agreement with NEPCO. Only the electricity distribution is still public in Jordan; the distribution is divided by geographical area but the price level is the same everywhere.

General conclusions on CSP:

About CSP it is important to divide clearly 2 kinds of project. Firstly, commercial projects with proven technology in locations where the cost of the fuel is important. Secondly, pure R&D projects to develop a local knowledge on the CSP technologies. This separation is essential to avoid a loose of trust in this technology due to failed projects. The benefits of using solar energy and CSP technology will be identified and quantified after dialogues with all the actors (industries, public agencies, banks...)

Commitments towards Wind power:

Globally the wind technology is well known by the partner countries. The wind power market is mature today. The actors in this market are identified. Wind farms have already been constructed in these countries.

Tunisia

For instance in Tunisia STEG has already selected a site to install additional 120 MW of wind power. The total capacity allowed within the regulatory framework in Tunisia by 2011 and the possibilities of the grid will be reached. An additional capacity of 60 MW has already been attributed to the auto-producers (cement producers for instance). So in these conditions the maximal capacity of integration of wind power will be over scored. ANME is preparing a wind atlas which will be released in the end of 2008; this study will present wind farm projects including socio-economical and environmental impact analyzes. Added that regulatory measures are under discussion but in a short horizon mechanisms such national FIT are not foreseen for Tunisia. Today, electricity is still subsidized in Tunisia and any increase of the electricity tariff is largely denounced by the consumers. For these reasons, the first step for Tunisia is that the tariffs are representative of the costs. The wind technology is well known by the local actors, but it could even be interesting, in the context of REMAP, to study "second class" project in order to supply the actual increase demand.

Turkey

No grants or subsidies currently exist for the development of wind projects in Turkey. The wind power production costs are next to the market price in Turkey today. Project financing is not common in the Turkish RE sector, but rather corporate financing. Existing wind projects were mostly financed by mid-term loans. IPPs are very common in Turkey, which should make it a lot easier to

establish demonstration projects. Moreover the wind sector already being very developed (lots of existing wind capacity and new wind applications are foreseen) and the best wind sites are already used up, so new sites would only be viable, if higher incentives for investors were to be put in place.

Algeria

In Algeria a working group has been constituted; it gathers member from CDER, CREDEG and MEM. 2 sites near Oran have been identified, and wind measurements will be made. For 2015 the specific objective set by the CREG for wind power is an installed capacity of 100MW.

Jordan

In Jordan, in any case, for Jordan or International investors, the government has to buy the land and then sell it. Currently, to develop renewable energy projects competitive tender are used; but maybe this organization will change with the new RE law.

General conclusions on Wind Power:

Due to the priority on CSP for all the countries, Wind Power is considering in the REMAP project as a second option. But Algeria and Jordan do not neglect the wind power, specifically thanks to a non saturation of the land available for Wind Power Plant and plans to develop some plants, in particularly in Jordan with three projects for a capacity of 220MW.

Projects Portfolio :

The construction of the first CSP plants can be the first step of a long term plan to decrease the fossil fuel dependence (of which long term prices are unpredictable). With the CSP technology the cost of electricity, drinking water, and even cooling will be known and stable.

The table hereafter summarizes the identified sites, technologies and capacities for each country. For the 4 countries a total of 10 Concentrated Solar Power projects and 7 Wind Power projects have been identified.

For the CSP, 4 options have been chosen:

- the hybrid gas-solar technology : commercial
- the solar tower technology: commercial
- the parabolic through technology: commercial
- the Linear Fresnel technology: under research and development

	Location	Technology	Capacity
Algeria	<i>Tamanrasset</i>	CSP Parabolic Through	10 MW
	<i>Algier</i>	CSP Solar Tower	1,5 MW
	<i>Djanet</i>	CSP Parabolic Through	10 MW
	<i>Ghardaia</i>	CSP Solar Tower	1,5 MW
	<i>Adrar</i>	Wind Power	-
	<i>Tiaret</i>	Wind Power	-



Jordan	<i>Qwera</i>	CSP Hybrid Gas-Solar	200 MW
	<i>Ma'an / Jafr</i>	CSP Hybrid Gas-Solar	200 MW
	<i>Kamsha</i>	Wind Power	60 MW
	<i>Fujaji</i>	Wind Power	60 MW
	<i>Aqaba</i>	Wind Power	100 MW
Turkey	<i>Urfa</i>	CSP Parabolic Through	50 MW
	<i>Ceyhan</i>	CSP Parabolic Through	50 MW
	<i>Antalya - Mugla</i>	Linear Fresnel	5 MW
	<i>Konya</i>	Linear Fresnel	5 MW
Tunisia	<i>Sousse</i>	CSP Parabolic Through	25 MW
	<i>Medenine</i>	CSP Parabolic Through	10 MW



Annexes

Annex 1

Proceedings of the National Workshop in Tunisia

Tunis 19 May 2008



ADEME



**Action Plan for high priority renewable energy initiatives
in Southern and Eastern Mediterranean Area**

SSP - Contract No. 044125

WP3.

Proceedings of the National Workshop

Tunis (Tunisia), 19 May 2008



Prepared by: OME

Date: 22 May 2008

Agenda

- Welcome STEG
- Partners introduction
- Presentation of the REMAP project : Ms Houda Allal, Coordinator – OME
- Solar and wind potential in Tunisia and identified project: Mr. Carsten Hoyer-Klick – DLR
- The financing of the projects: Mr. Michael Hoffmann – ESD
- Round Table: “Development conditions of CSP and wind power in Tunisia and national priorities”: All
- Synthesis and conclusions: Ms Houda Allal, Coordinator – OME

Participant list

- Ms Houda ALLAL – OME – France
- Mr. Nafaa BACCARI – ANME – Tunisia
- Mr. Abderraouf BEN MANSOUR – STEG – Tunisia
- Mr. Lassaad BEN RAHAL – STEG – Tunisia
- Mr. Chokri BEN SLIMANE – STEG – Tunisia
- Ms Fatma BERGAOUI – STEG – Tunisia
- Mr. Rim BOUKHCHINA – STEG – Tunisia
- Mr. Lassaad BOUKHIT – STEG – Tunisia
- Mr. Radhouan DAKHLI – STEG – Tunisia
- Mr. Nourredine DHOUIB – STEG – Tunisia
- Mr. Hachemi ESSEBAA – STEG – Tunisia
- Mr. Michael HOFMANN – ESD – England
- Mr. Carsten HOYER KLICK – DLR – Germany
- Mr. Taoufik LEJMI – STEG – Tunisia
- Mr. Mohieddine MEJRI – STEG – Tunisia
- Mr. Thomas NIESOR – OME – France
- Ms Noura RAHMOUNI – STEG – Tunisia

Minutes

The Tunisian REMAP workshop was organized by STEG and OME. It was the first workshop of 4 national workshops organized in the context of the WP3 « *Commitments towards wind and energy concentrated solar projects in the Southern and Eastern Mediterranean area* ». The other workshops will take place in Turkey, Algeria and Jordan. The meeting gathered about twenty participants from different STEG directions, ANME and project partners (DLR, 3E and OME)

The presentations are available directly by clicking on titles with hyperlinks.

Welcome from STEG (Ms Fatma Bergaoui – STEG)

Ms Fatma Bergaoui, Study and Plannification Director of STEG, opened the workshop welcoming all the participants. Ms Bergaoui underlined that the interest for the promotion of RE in Tunisia has been existing since any decades, especially with the introduction of PV, the development of hydro power, solar thermal, wind power... . The National target is to have 4% of wind power in the electricity mix by 2010. STEG is still working on the development of RE in Tunisia, keeping into account the necessity to have a good quality of service and acceptable economical conditions.

1. Presentation of REMAP and of the workshop (Ms Houda Allal – OME)

Within the Framework Programme 6 (FP6) of the European Commission, the REMAP project aims at defining and developing renewable energy priorities in Southern and Eastern Mediterranean countries. The total duration of the project is 2 years; the REMAP consortium gathers 11 partners from 9 European and Mediterranean countries (Algeria, Belgium, England, France, Germany, Jordan, Spain, Tunisia and Turkey). Two electricity generation technologies are considered: wind power and Concentrated Solar Power. Wind and Solar Potential data are collected and sites are identified. The majority of the deliverables will be public.

The goals of this workshop are to present the results of the different models to the local partners, to define technological priorities taking account the different barriers, the financing mechanisms available and the horizon foreseen for the actions.

Ms Allal has also given information on a new EC project, MED-CSD: Combined Solar power & Desalination in the Mediterranean. The MED-CSD kick off meeting will be the 5 and 6 June 2008 in Paris.

2. Solar and Wind potential in Tunisia (M. Carsten Hoyer Klick - DLR)

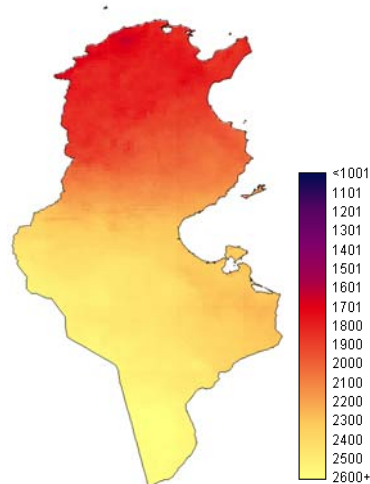


Carsten Hoyer Klick, DLR

Solar:

Maps of the solar Tunisian potential from different models and studies have been presented. The model used by DLR (for the MED-CSP study) gives very precise indications on the solar potential, but only data from the year 2002 have been treated. An enlargement to the 1991-2005 period seems to be necessary to prevent risks of variability and have more secure values.

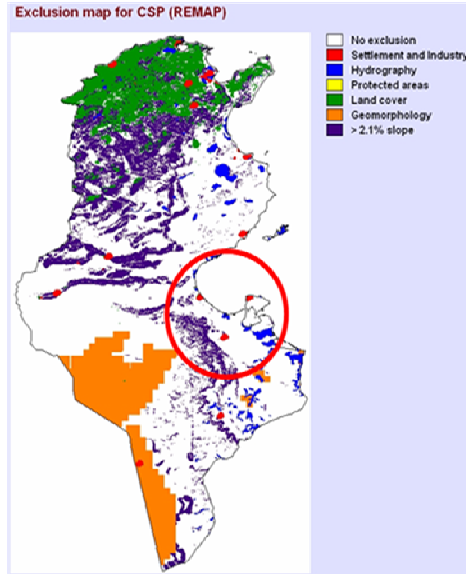
Figure 1. Tunisian solar Atlas



Source : DLR

To identify sites for the construction of CSP plants, exclusion zones have been defined (ground not available, protected areas...). A ranking system that takes into consideration many parameters (solar potential, proximity to the infrastructures...) is used to determine the optimal sites. The Middle-East area (near Gabès) has the best ranking with the chosen criteria.

Figure 2. CSP potential sites in Tunisia

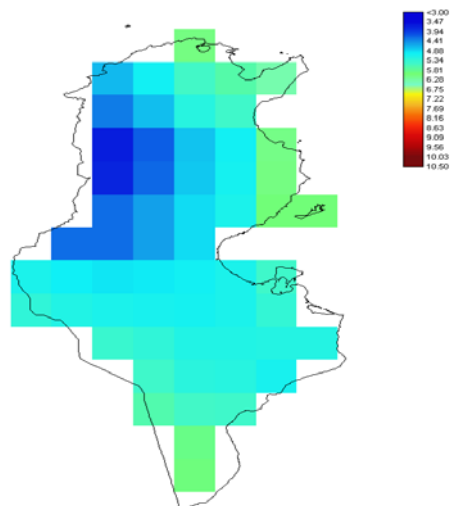


Source : DLR

Wind:

Concerning wind potential, the data available are less precise than those for solar potential. But the wind potential seems to be under evaluated in Tunisia and interesting sites have been preselected in the North area. A more complete evaluation of these potential sites requires more detailed and local input information.

Figure 3. Wind Atlas of Tunisia



Source : DLR

Conclusion:

To conclude, Tunisia has significant established solar resources and also potential wind resources. A more global conclusion from the REMAP project is that wind and solar resources data for large periods (5 to 10 years) are necessary to evaluate precisely the potential of each country. The availability of such data is important for industrial and other investors; detailed and reliable data are basic needs to have an effective development of renewable energies in any country.

Discussion :

Solar:

- **Mr. MEJRI – STEG :** Solar and wind potential are important in Tunisia but the exploitation of these resources depends on many conditions : technical, economical, financial... The intermittence of wind and solar resources is also a key parameter that has to be taken into account.
- **Mr. BACCARI – ANME:** Is there an important need of water in CSP plants? And what is the quality of grid needed (if the plants are installed in the South of Tunisia)?

Mr. HOYER KLICK – DLR : As for classical thermal power plants, cooling tower can be used in order to avoid the exploitation of huge quantities of water. A hybridation with a desalination plant can even be a solution to recover this lost thermal energy (in the case of a power plant built next to the sea). Concerning the integration into the grid, there is no special requirement compared to a classical thermal power plant.

- **Mr. ESSEBAA - STEG:** With the ranking tool is it possible to pinpoint the effect of existing infrastructures?

Mr. HOYER KLICK – DLR: Yes, the ranking system can be adapted if necessary to the strategy of local stakeholders.

Ms ALLAL – OME: Depending on the STEG strategy, the choice of the site can be, for instance, in a working area, an electrification area...

- **Mr. BEN MANSOUR – STEG:** Does the system of ranking take into account only the proximity of electrical lines or also the integration into the supply and demand load curve?

Mr. HOYER KLICK – DLR : The presented results for Tunisia are based on relative old data coming from Risoe. A more precise analyze is achievable but requires updated data on the supply & demand in a selected area, the utilization rate of the grid...

Mr. BEN MANSOUR – STEG : It can be also a good point to take into consideration that the construction of new electricity transport capacities is feasible if the demand appears.

- **M. BEN MANSOUR – STEG :** Is it possible to build an hybrid gas-solar power plant ? And can a concentrated solar field be added to an existing classical thermal power plant?

Mr. HOYER KLICK – DLR: Yes, numerous configurations are feasible:

- a water steam turbine with a gas back-up. A back up is a solution to manage easily the electricity generation,
- a thermal storage,
- a hybrid gas-solar with a CCGT. But in this case it is important to not oversize the steam turbine compared to solar field because it decreases the efficiency of the other elements. Consequently, the share of the solar resource may be between 30 and 50% in order to have an optimal efficiency of all the power plant.

Mr. MEJRI – STEG: Energy storage or hybridation with gas do not seem to be necessary as in Tunisia the demand load peak is during the afternoon.

Mr. HOYER KLICK – DLR : The solution of thermal storage could be interesting in the touristic areas. For instance it can allow the construction of cooling water grid, using thermodynamic machines which convert heat in cold.

- **Mr. HOYER KLICK – DLR :** There are 2 different systems of mirror technologies which are at an commercial or pre-commercial state : the parabolic trough system and the solar tower system. Another system, next to parabolic trough one, named Linear Fresnel is currently under R&D. But it is very promising in terms of cost and installation simplicity. ([see the pdf presentation for more details](#)).

Wind:

- **Mr. MEJRI – STEG :** STEG has already selected a site to install additional 120 MW of wind power. STEG is interested by the cheapest electricity available.

Ms ALLAL– OME : Consequently, we can consider that wind technology is well known by the local actors, but it could even be interesting, in the context of REMAP, to study “second class” project in order to have a more spread knowledge on wind energy.

Mr. BEN MANSOUR – STEG : Currently there is a saturation for wind farms in the North. But after studying more precisely the evolution of the demand it can be interesting to think about “second class” sites for the middle and south Tunisian areas.

Mr. MEJRI – STEG: The total capacity allowed within the regulatory framework by 2011 and the possibilities of the grid will be reached. An additional capacity of 60 MW has already been attributed to the auto-producers (cement producers for instance). So in these conditions the maximal capacity of integration of wind power will be over scored.

Mr. BAKARI - ANME : ANME is preparing a wind atlas which will be released in the end of 2008; this study will present wind farm projects including socio-economical and environmental impact analyzes.

- **Mr. BACCARI - ANME** : Is it possible to consider off-shore wind energy for Tunisia?

Mr. HOYER KLICK – DLR: Currently it seems that there is no data available on this issue.

Ms ALLAL– OME: The REMAP project focuses on existing data. In addition, off-shore technology is currently expensive compared to the on-shore one. Consequently a separate study is needed on the off-shore issue. It could be a recommendation for the “after REMAP”.

Other aspects :

- **Mr. MEJRI – STEG**: Is the CSP technology at maturity ?

Mr. HOYER KLICK – DLR : Yes, CSP technology is mature: new plant have been connected to the grid recently in Spain and there are power plants running since more than 20 years in United States.

- **Mr. DAKHLI – STEG**: What are your source of information for the electricity grid, the population, the road grid...?

Mr. HOYER KLICK – DLR : For the electricity grid the source is the AUPTDE (Arab Union of Producer, Transporter, Distributor of Electricity). These data are quite old. Concerning the population, the data are from the United Nations. The data for the road are also quite old. DLR needs to update these information with the knowledge of STEG in order to precise the results.

- **Mr. BEN RAHAL** : About an eventual strategy which consists in producing electricity in Tunisia in order to sell it to Europe, it necessary to keep in mind the issue of power transmission variation in the case of limited line capacities.

Conclusions on the technological aspects:

Ms ALLAL– OME :

- The wind technology is well known by the local actors, but it could even be interesting, in the context of REMAP, to study “second class” project in order to supply the actual increase demand.
- The priority of the REMAP project in Tunisia is the CSP, with many options to study in parallel (the area preselected by DLR is kept):
 - o An industrial project with 100% solar share,
 - o An industrial hybrid gas-solar project (new power plant or additional solar field to an existing power plant),
 - o R&D project with Linear Fresnel technology, with a possible financing from the EC with the FP7.

3. The financing of the projects (Mr. Michael Hofmann, ESD)



Michael Hofmann, ESD



For the WP4 of the REMAP project 2 financing models have been elaborated, the first one for wind projects and the second one for CSP projects. These models need local inputs such as the tax system in order to have realistic and concrete results.

Moreover, within the WP4, it is foreseen to implement a *Financing Advisory Board (FAB)*. This board will gather representative people from financing institutions who have experience and know-how in renewable energy financing issue. This board will give advices and information on the best practices, feedbacks from existing projects...The FAB will also help to identified and to achieve priority projects. ESD has already contacted potential members to set up this board.

Mr. Hofmann underlines the importance for the investors to have details on the potential sites and stable market conditions.

Many tools can be enforced to develop renewable energy, such as feed-in tariffs (FIT), green certificates, quotas... FIT have been especially successful in Germany. FIT ensure an income over a 20 years period. So FIT are an additional charge, shared between all the electricity consumers. This tool has entailed a significant development of the PV technology in Germany although the solar potential is not very appropriate for this technology.

Furthermore, the European Investment Bank has already financed R&D CSP projects. Consequently it can be an interesting partner for such a project in Tunisia.

Discussion :

- **Mr. MEJRI – STEG** : Giving that CSP is a new technology, the orientation within REMAP will be that the power plants will be owned at 100% by STEG. The most mature technologies will be favoured. Soft loans are also necessary to implement these projects.

Mr. BEN MANSOUR – STEG: In the case of a hybrid gas-solar power plant, it is mandatory that STEG is the owner. Currently there is no specific tool to push RE (only a tariff for over generation of electricity by self-producers, including wind power self-generation).

Regulatory measures are under discussion but in a short horizon mechanisms such national FIT are not foreseen. Today, electricity is still subsidized in Tunisia and any increase of the electricity tariff is largely denounced by the consumers. For these reasons, the first step for Tunisia is that the tariffs are representative of the costs. The FIT German model cannot be implemented directly in Tunisia.

- **Ms ALLAL – OME** : Considering the facts presented by Mr. BEN MANSOUR, the target will be to adapt the existing tools to the Tunisian situation and not to duplicate them. Consequently what are the available solutions, keeping in mind that the development of RE can bring many benefits for Tunisia?

Mr. HOYER KLICK – DLR : Firstly, the investors need to secure their investments under a long period and STEG could supply this demand by setting up Power Purchase Agreements. Secondly, in addition to the development of new technologies, supporting CSP could bring many other benefits to Tunisia:

- Saving of conventional resources (and so save financing power for a long period)
- Creation of more employment than in conventional power plants :
 - The structure which supports the mirrors can be produced locally,
 - During the construction period of the solar field the earthmoving work is significant and as a consequence needs a lot of operators,
 - During the operating period operators are needed to maintain the solar field
- Production of the mirrors, especially in the case of the Linear Fresnel system. This technology can be installed very quickly
- Creation of new and local industrial activities
- Exporting green electricity toward Italy at a long term horizon, which is a strategically point for Tunisia
- Protection of the environment

The first CSP plant can be the first step of a long term plan: avoid fossil fuel dependence (of which long term prices are unpredictable). With the CSP technology the cost of electricity, drinking water, and even cooling will be known and stable.

Mr. BEN MANSOUR – STEG : The mechanisms applied in other countries could be exploited in Tunisia, but it seems risky. If Tunisia makes long term PPA with private investors, STEG will pay the electricity more than it can sell it in the country. Selling electricity to Italy seems also complicated due to the grid regulation issues: variability of the resource, integration to the grid. In addition the electricity load curve is very marked in Tunisia, sometimes during the night the demand is below 50% of the day peak.

Mr. HOYER KLICK – DLR : In this case the exploitation of solar energy is adapted, because the demand and the supply evolve in the same way.

- **Mr. Hofmann – ESD :** About Linear Fresnel technology, the financing model is particular because the technology is on R&D. It is maybe an issue that can be studied by the STEG within the REMAP project.

Mr. ESSEBAA – STEG : Even for the parabolic through technology , the financing mechanism has to take into account the development cost. This over cost must be paid by someone. Is it possible that industrial exploit their R&D budget for it?

Ms ALLAL – OME : It is necessary to identify who benefit from such projects (in both international and local points of view) in order to share properly this over cost.

Mr. HOYER KLICK – DLR : A new financing mechanism adapted to the current Tunisian situation has to be found.

Conclusions on the financing aspects :

Mr. BEN MANSOUR – STEG: A parabolic through CSP project can be studied now. But concerning Linear Fresnel R&D technology, a more detailed analyze is needed. In any case STEG will own the installation.

Mr. ESSEBAA – STEG : The evaluation of R&D project is sometimes complicated to implement. It seems more interesting to have industrial project with an R&D part.

Ms ALLAL – OME : For the Linear Fresnel technology, the European Commission or the European Investment Bank could be financing resources. For the parabolic through technology which is more mature, 2 kinds of financing models could be studied: one for a hybrid gas-solar power plant and another for a pure solar power plant.

4. Global synthesis

Ms BERGAOUI thanks all the participants and STEG guest to this remarkable meeting. She thanks also OME for the co-organisation of this workshop and lets Ms ALLAL to make the conclusion.

Ms ALLAL underlines that the REMAP project priority for Tunisia is CSP, in the area pre-selected by DLR. The different technologies, with different maturities, have to be analyzed by the partner (DLR, Labein, ESD, 3E...) with the support of STEG. At the same time, a financing scheme adapted to Tunisia will be elaborated in cooperation with ESD and partners from the WP4. The benefits of using solar energy and CSP technology will be identified and quantified after dialogues with all the actors.

OME will study the financing possibilities for a demonstration project within the FP7.

Moreover, in order that the local partners have a more realistic view on the CSP technology a technical visit in the operating Spanish power plants could be organized. Mr. HOYER KLICK is in charge of this point (dates will be proposed as soon as possible).

An equivalent work will be lead for the wind technology in the North of Tunisia.

The next steps of the REMAP project are the other national workshops in Algeria, Turkey (13 June in Ankara), and Jordan (7 July in Amman). The 18th month meeting which gathers all the consortium partners will take place in Amman on 8 and 9 of July. The final meeting could be in Montpellier during the Energaia international conference on RE. All participants are welcomed.

Ms ALLAL thanks STEG for the hospitality and the excellent organization of the day, and all the participants for the good quality of shared information which makes successful this workshop.

Annex 2

Proceedings of the National Workshop in Turkey

Ankara, 13 June 2008



ADEME



**Action Plan for high priority renewable energy initiatives
in Southern and Eastern Mediterranean Area**

SSP - Contract No. 044125

WP3.

**Proceedings of the
National Workshop in Turkey**

Ankara, 13 June 2008

Prepared by: OME

Date: 26 June 2008

Agenda

- ✓ Welcome EIE
- ✓ Introduction of the partners
- ✓ Presentation of the REMAP project, Ms Houda ALLAL, Coordinator, OME
- ✓ Solar and Wind Potential and identified sites in Turkey, Mr. Carsten HOYER-KLICK, DLR
- ✓ Presentation of the selection criteria tool, Acciona
- ✓ Financial aspects, Mr. Mickael Hofmann, ESD
- ✓ Round Table “Requirement for the development of CSP and wind technologies in Turkey, orientations and national priorities”, All
- ✓ Conclusion and forthcoming

Minutes

1. Opening, Mr. Atilla GÜRBÜZ, Deputy General Director EIE

Turkey is really interested to integrate renewable energies in its energetic mix, especially wind and solar energy. Today 250 MW of Wind Power is installed in Turkey. Four new wind farms are foreseen to be set up this year; as a consequence the capacity will reach about 470 MW. Concerning solar energy, solar water heating is well developed in Turkey: the total surface of thermal panels is 2.5 millions of m².

2. Introduction of the project and the workshop, Ms, Allal HOUDA, OME

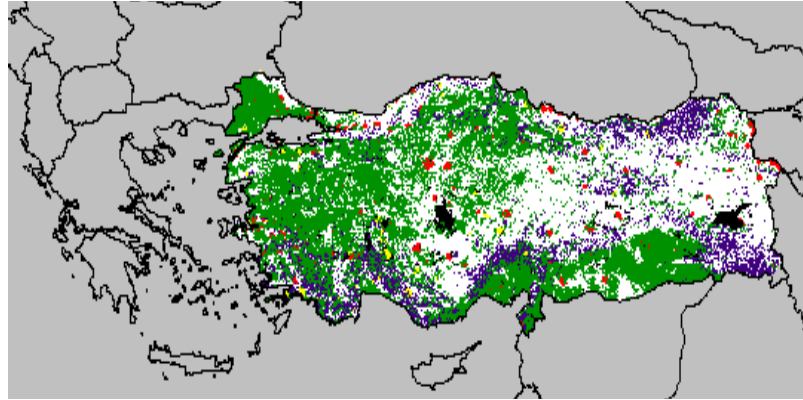
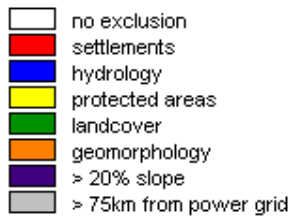
The objectives of the REMAP project are to work with key stakeholders with the following themes:

- Compilation of a solar and wind energy resource atlas for the Southern and Eastern Mediterranean area;
- Identifying and prioritising potential demonstration sites for wind and concentrated solar projects in Algeria, Tunisia, Jordan and Turkey;
- Recording a set of commitments to be made by major stakeholders to push forward a few wind and concentrated solar thermal energy projects in the region;
- Proposing a credible financing scheme for the identified priority renewable demonstration projects in the region;
- Elaborating an action plan for a few well identified initiatives able to be implemented;
- Disseminating the results of the project to as wide an audience in Europe and the Mediterranean region as possible.

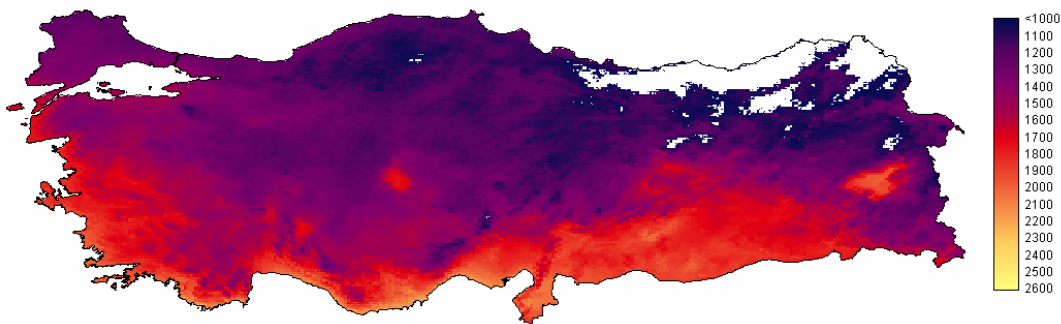
3. Solar and wind potential and identified sites in Turkey, Mr. Carsten HOYER-KLICK, DLR

Solar

To identify the possible sites for a CSP plant construction, the first step is to produce an exclusion map:



Then the available solar resource is modeled:



Annual sum of direct normal irradiance in kWh/m² in Turkey from the DLR MED-CSP/SOLEMI data set in 2002

In order to size the solar aperture and optimize the solar field it is important to have a good knowledge of the solar resource. A solar resource data base of about 10 years is necessary to have a good precision on the average annual solar radiations.

The model developed by DLR gathers 2 kinds of information:

- Ground measurements which gives a temporal average of the solar resource for a very location.
- Satellite data which is a surface average snapshot of the solar resource.

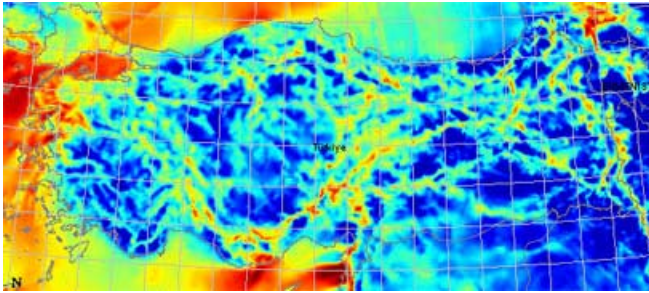
After validation these data have to be treated in order to know the solar potential. Within the MED-CSP/SOLEMI studies, the Mediterranean countries solar radiations of the year 2002 are known. Data are also available for the years 1991-2005. But these data have to be treated and checked in order to have a good average of the solar resource,.

To take into account all the key elements necessary to choose the best locations, a system of ranking has been set up. Hereafter an example of the value that can be used:

Site Ranking based on:

	Value		Points	
	Min	Max	min	max
Resource DNI	1900	2300	2	20
Transmission	0	75	5	0
Substations	0	75	10	0
Settlements	0	50	5	0
Roads	0	50	5	0

As a result to make a precise ranking local data from the Turkish partners are essential.

Wind

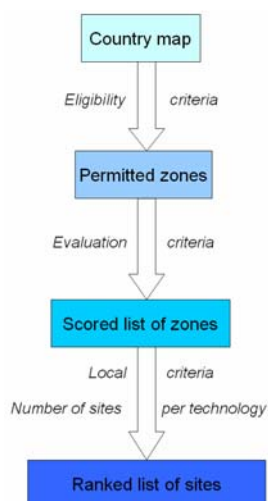
Concerning wind the steps presented before may be also completed to determine the good location for the farms. For the wind potential detailed map from REPA are already available.

REPA wind potential of Turkey

4. Presentation of the selection criteria tool for wind, Acciona**Criteria definition**

Criteria are separated in 3 domains:

- Eligibility → permitted or unpermitted zones
- Evaluation → score to each permitted zone
- Local → non susceptible of generating exclusion or evaluation GIS maps

Site definition process

Land issues: Land cover, Land use and Local topography (Roughness, Orography, Obstacles, terrain availability)

Environmental issues: Population safety, Impacts on habitat and animals movements, Natural risks...

Wind resource: Wind speed, wind density, prevailing wind direction

Access to electricity grid: For a wind farm > 5 MW a connection to the High Voltage Grid is necessary

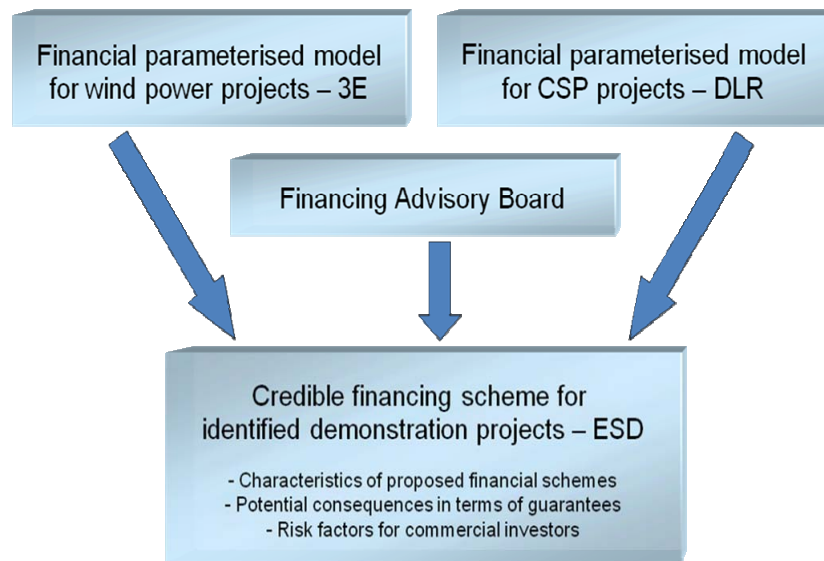
Access to infrastructures

Other aspects: Social acceptance, Proximity to technological centers, Public organizations support

5. Financial aspects, Mr. Mickael Hofmann, ESD

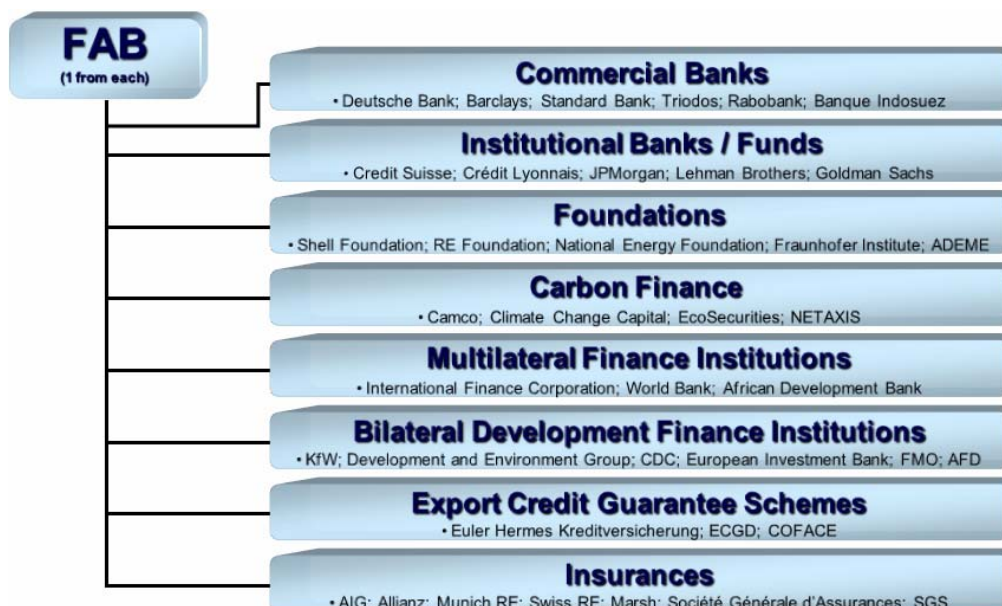
The main objectives of the WP4 are to:

- Provide financial advice for project development
- Provide information for financial services (e.g. insurances, carbon firms)
- Provide information on 'best practice' in financing renewable energy projects
- Provide guidance on best opportunities for renewable energy projects



Within the REMAP project 2 financing models have been developed, one for CSP and one for wind power. These models may be completed by national and local inputs in order to have exploitable results.

In addition, a [Financing Advisory Board \(FAB\)](#) will be implemented. The goal of this FAB is to help local partners on the financial issues in the renewable energy domain. Participants for the FAB have been already identified:

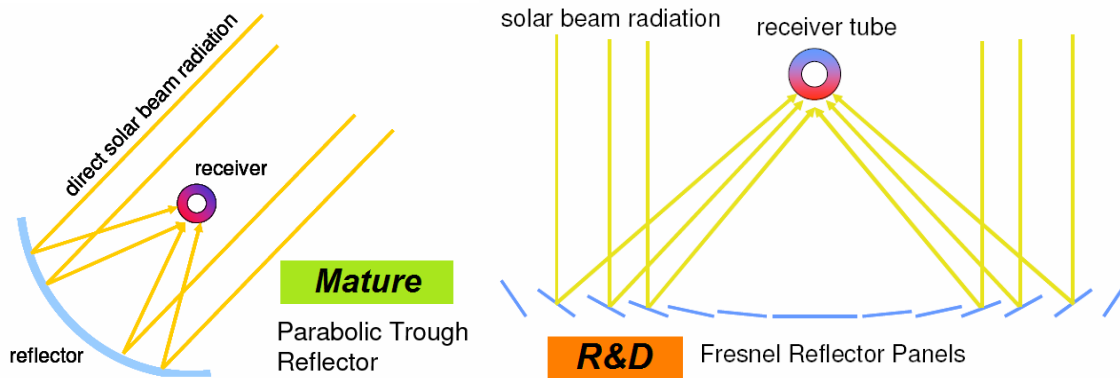


VERs (Verified Emission Reductions, i.e. Voluntary Carbon Market Certificates) are already established in Turkey, whereas CERs (Certified Emission Reductions, i.e. Kyoto Carbon Market Certificates) are not.

But Turkey likely ratification of the Kyoto Protocol (announced on 11th of June) has demonstrated a long-term commitment of the Turkish government regarding reducing the country's CO₂ emissions. This can only be positive for our REMAP project. Turkey will belong to the Annex 1 country group. For the first Kyoto commitment (2008-2012), Turkey will not be submitted at a greenhouse gases emission target.

6. Presentation of the CSP technology, Carsten HOYER-CLICK, DLR

New CSP power plants have just been connected to the grid in USA (Nevada Solar One, 64MW, in 2007) and in Spain (Andasol I, 50MW+, in 2008). So parabolic trough is mature today, the Levelized Economic Cost (LEC) in Spain is about 0.21 \$/kWh for the Andasol I power plant. For this power plant the investment cost was 4 400 \$/kW. In order to decrease the cost of the mirror and the complexity of the structure a new technology is under R&D; this system uses linear Fresnel Reflector Panels.



The Linear Fresnel system is not as efficient as the parabolic through one but it is very simpler. For instance absorber tubes are fixed in the Linear Fresnel system. For the parabolic trough system, all the structure has to be linked to a very precise tracking system in order to optimize the reception of solar radiations.

Another advantage of Linear Fresnel is that the structure can be manufactured very easily, creating new local jobs.

Without a thermal storage a CSP plant runs for approximately 2000 hours per year. This peak production is not a problem for Turkey as the grid is well developed.

There are 3 main options to make thermal energy storage:

- Molten salts : a cold tank (280°C) + a hot tank (400°)
- Concrete block with tube into them.
- Phase change materials (pilot of this option at DLR)

The mirrors used in CSP plants are a classic technology; there are just “high quality” mirrors with a good reflectivity (>95%).

Discussion

Concerning the specific conditions (especially sand storm) that a CSP plant has to face, the Californian plants which have been running from more than 20 years has shown a good resistance. The only issue is that the mirrors have to be cleaned in order they keep their reflectivity. And as any thermal power plant a water or dry cooling is necessary.

The average current costs are between 15 and 20 c€ per kWh for solar only or near solar only power plants. These costs depend on the local conditions: solar potential, operating costs, land costs.... So inputs from local partners are very important for the financial model.

Regarding the CSP plant size, the optimal capacity is currently near 50 MW for a commercial plant. Such decentralized power production has a higher cost than a Nuclear power plant of 1 GW for instance, but the stability of the grid is improved with a large number of small power plants.

7. Round Table “Requirement for the development of CSP and wind technologies in Turkey, orientations and national priorities”, All

As part of the REMAP project, there will be a focus on CSP in Turkey. This is related to the wind sector already being very developed (lots of existing wind capacity and new wind applications are foreseen) and the best wind sites are already used up, so new sites would only be viable, if higher incentives for investors were to be put in place.

CSP focus - potential sites

On the subject of the land costs, they are very high in the Turkish touristic area (South West) but there is also an important need of electricity and drinking water in this area. As a result the general feedback was such that there was a preference among the local participants for bi- or tri-generation plants (including desalination), possibly also in collaboration with local universities (e.g. as R&D projects). In the South East Area the land costs are lower and significant surfaces are available, so CSP is a solution to supply the electricity demand.

Four specific areas for CSP plants were suggested which DLR will further analyse regarding their respective solar resources and also with respect to potential constraints. For the 2 sites located in the touristic area the study will focus on CSP – Desalination demonstration plants using the linear Fresnel technology.

Financing situation - political - regulatory – promotional aspects

About the way to set up FIT, each European country which is using it has its specificity:

- In Germany, when a company begins to receive a FIT for a power plant, the value is fixed for 20 years. But each years, for new power plants, the FIT value decreases by 5%.

- In Spain the FIT system is very flexible. It is a premium FIT that can be adjusted easily in order to reach the real costs. In addition a cap for total installed CSP capacities in Spain which could benefit from FIT has been instituted in order to accelerate the investments.

As a conclusion a guideline of the incentives which already exist may be established to help partner countries.

No grants or subsidies currently exist for the development of wind projects in Turkey. The wind power production costs are next to the market price in Turkey today. It would be beneficial to the REMAP project, if it was possible for CSP projects. Project financing is not common in the Turkish RE sector, but rather corporate financing. Existing wind projects were mostly financed by mid-term loans.

EMRA (the Turkish Energy Market Regulatory Authority) confirmed that it will consider changing the existing FIT (which is so far flat across all RE technologies) so that solar technologies could potentially benefit from an adapted FIT. PV and CSP will benefit from the same FIT.

IPPs are very common in Turkey, which should make it a lot easier to establish demonstration projects. There was also a general agreement that IPPs should be a very appropriate channel to promote the REMAP demonstration projects in Turkey.

8. Conclusion and forthcoming, Ms. Houda ALLAL, OME

For Turkey the REMAP project will focus on CSP technologies, parabolic through which is mature and linear Fresnel which is under R&D. The development of CSP in Turkey will be supported by an under discussion FIT. The Financial Advisory Board under construction within the WP4 would provide guidance to implement such projects.

For the R&D projects EC funding is possible under the Seventh Framework Programme (FP7, 2007-2013). But banks like the European Bank of Investment or the African Bank of Development could also be involved. EIE approves the work done within the REMAP project and will promote the results of the project.

The next step of the REMAP project will be the 18th month meeting in July 8th and 9th; and the final meeting which will take place in Montpellier in December 11th and 12th during the Energaia international forum on renewable energy.

Annex 3

Proceedings of the National Workshop in Algeria

Algier, 28 June 2008



ADEME



**Action Plan for high priority renewable energy initiatives
in Southern and Eastern Mediterranean Area**

SSP - Contract No. 044125

WP3.

**Proceedings of the
National Workshop in Algeria**

Algier, 28 June 2008

Prepared by: OME

Date: 2 July 2008

Agenda

- ✓ Welcome CREDEG, M. Said GUEZZANE
- ✓ Introduction of the partners
- ✓ Presentation of the REMAP project, Ms Houda ALLAL, Coordinator, OME
- ✓ Renewable energies in Algeria, situation and prospects, Ms. BOUZID, Ministry of Energy and Mines
- ✓ Solar and Wind Potential and identified sites in Algeria, M. Christoph SCHILLINGSs, DLR
- ✓ Financial aspects, M. Geert DOOMS, 3E
- ✓ Round Table “Requirement for the development of CSP and wind technologies in Algeria, orientations and national priorities”, All
- ✓ Conclusion and forthcoming

Participant list

Mme AISSAOUI	Chef de Projet éolien	CREDEG
M. BAGHLI	Ingénieur à la Direction Générale de l'Engineering	SONELGAZ
M. BELHAMEL Maïouf	Directeur	CDER
Dr. Houda BEN JANNET ALLAL	Responsable du Département ER&DD Coordinateur REMAP	OME
Mme BENMILOUD	Ingénieur	CREDEG
M. BOUCHAIB	Ingénieur	CREDEG
Mme BOUZID	Sous Directeur des Energies Renouvelables	Ministère de l'Energie et des Mines
M. Badis DERRADJI	Président Directeur Général	NEAL
M. Mohamed DERRICHE	Responsable Technique	NEAL
M. Geert DOOMS	Ingénieur Projet	3E
M. Lazhar FATNASSI	Chef de Projet Analyse et Modèles	CREDEG
M. Saïd GUEZZANE	Président Directeur Général	CREDEG
M. Amar KHELIF	Chef du Département Energies Renouvelables	CREDEG
M. Ahcene LATAMENE	Directeur de l'Optimisation et Valorisation de la Production d'Electricité	Sonelgaz
Melle Djamila MOHAMMEDI	Directrice de la Stratégie	Sonelgaz
M. Thomas NIESOR	Ingénieur	OME
M. Christoph SCHILLINGS	Dipl. Geograph Dr. RER. Nat	DLR
M. ZAATOUT	Ingénieur à la Direction Générale du Développement et de la Stratégie	SONELGAZ

Minutes

9. Introduction of the project and the workshop, Ms. Allal HOUDA, OME

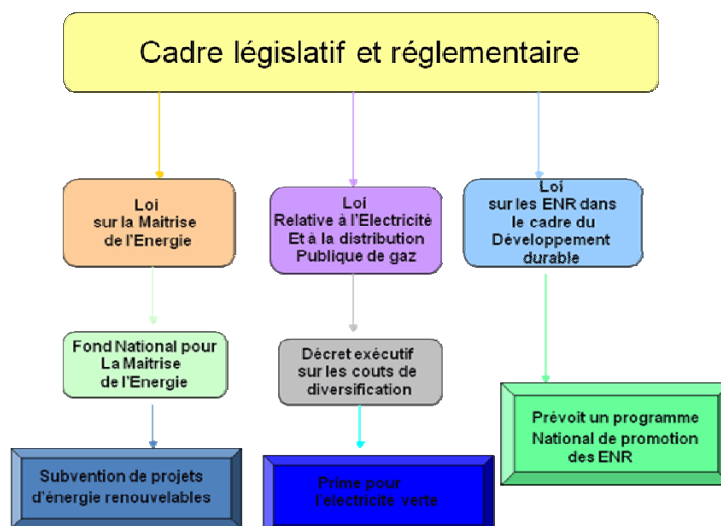
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10. Renewable energies in Algeria, situation and prospects, Ms. Chahrazed BOUZID, MEM

Presentation

Currently, the share of renewable energy in the Algerian energy balance is very limited (for instance only 0.02% of the national electricity consumption come from RE). About electricity production the target set by the CREG (Regulatory Commission on Electricity and Gas) is a share of 6% of renewable energies + cogeneration in 2015. There are 2 important ongoing projects in Algeria: a 10 MW wind farm in Tindouf, and a hybrid gas (150MW) – solar (35 MW) power plant in Hassi R'Mel. An incentive framework is under construction:



Discussion

M. GUEZZANE (CREDEG): There are a lot of non counted PV installations in Algeria, especially for the monitoring of drillings. The MEM has also made a technical guide on PV about the minimum conditions which may be respected.

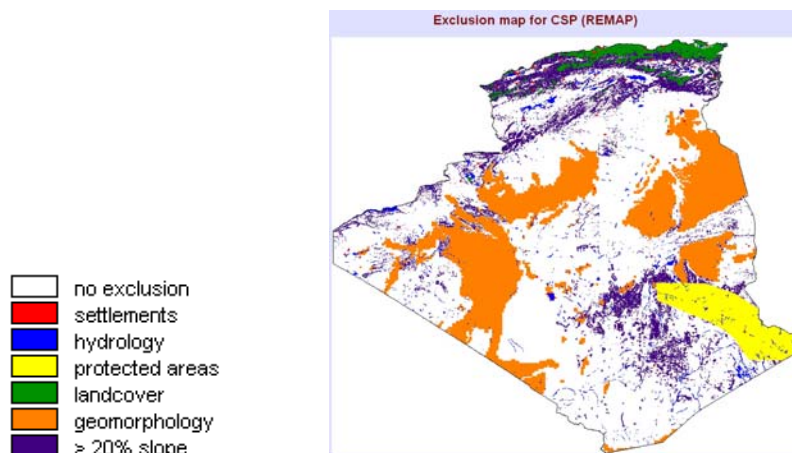
M. BELHAMEL (CDER): There are also non identified installed capacities of PV due to the fact that there is no restriction for the importation of PV panels.

Ms. BOUZID (MEM): A programme to promote renewable energies is going to be presented to the government. The target will be to reach 12% of the electricity consumption in 2027 with RE and cogeneration.

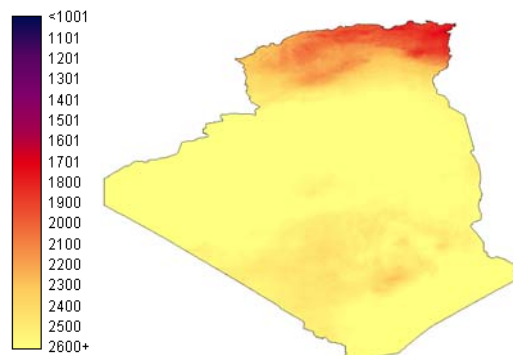
11. Solar and wind potential and identified sites in Algeria, Mr. Christoph SHILLINGS, DLR

Solar

To identify the possible sites for a CSP plant, the first step is to produce an exclusion map:



At the same time the available solar resource is modeled:



Annual sum of direct normal irradiance in kWh/m² in Turkey from the DLR MED-CSP/SOLEMI data set in 2002

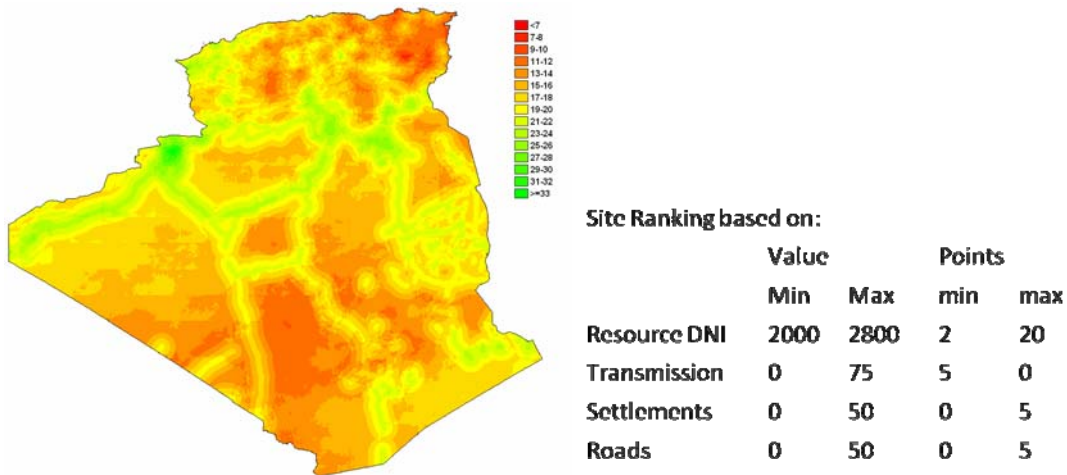
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The model developed by DLR gathers 2 kinds of information:

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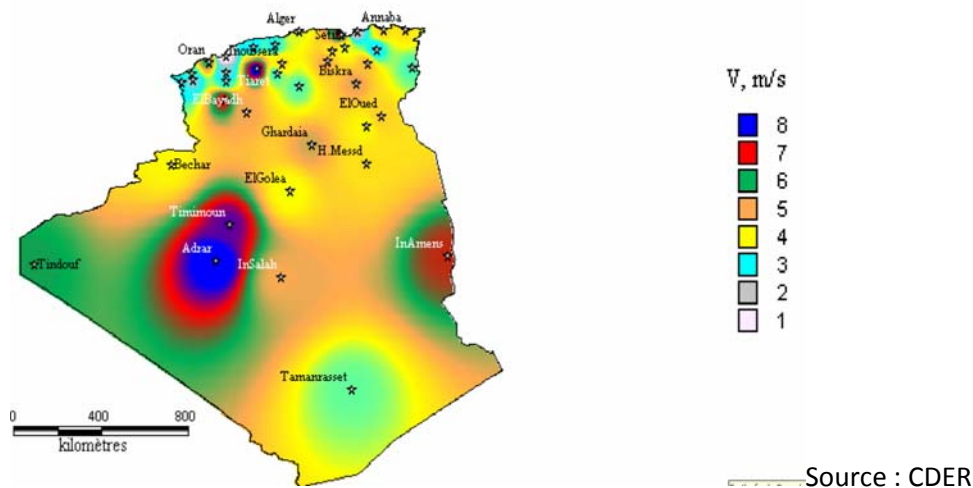
After validation these data have to be treated in order to know the solar potential. Within the MED-CSP/SOLEMI studies, the Mediterranean countries solar radiations of the year 2002 are known. Data are also available for the years 1991-2005. But these data have to be treated and checked in order to have a good average of the solar resource.

To take into account all the key elements necessary to choose the best locations, a system of ranking has been set up. Hereafter an example of the value that can be used (most preferable sites in green):



As a result to make a precise ranking local data from the Algerian partners are essential.

Wind



Concerning wind, similar steps than those presented before for CSP may be also completed to determine the good location for the farms. For the wind potential map from CDER are already available.

Discussion

M. MOHAMMEDI (Sonelgaz): For wind farms a connection to medium voltage grid is sufficient.

M. DERRADGI (NEAL): The grid map used to make the exclusion map is not complete. There is an isolated medium voltage grid (220 kV) around Adrar and In Salah.

M. BELHAMEL (CDER): The hybrid gas-CSP project of Hassi R'Mel will be a pilot project for the North Africa region. Feedbacks on this plant will be useful for all the next plants in this region. The hybridation with gas is a solution to avoid the issue of the storage of energy.

M. DERRADGI (NEAL): It could be interesting to build hybrid gas-CSP plants next to the marginal gas field. For instance near Adrar. We do not have to focus only on the parabolic through technology, central receiver or linear Fresnel technologies are other possibilities.

M. GUEZZANE (CREDEG): It is necessary also to build CSP power plants where there is a demand, as in Tindouf or Djanet.

M. DERRADGI (NEAL): What point will be studied in the economical analyze: the use of storage, the hybridation with gas?

M. DOOMS: Yes all the possibilities can be studied with the model develop for REMAP.

M. BELHAMEL (CDER): We can also think about the addition of solar field to existing fossil power plant.

M. GUEZZANE (CREDEG): But we do not have to forget that the priority within this project is to build 100% or near 100% renewable power plants. Energy efficiency is also an issue that needs attention. Algeria may have laboratories to monitor consumption of the equipments which are imported.

M. ZAATOUT (Sonelgaz): In addition, the REMAP project aims at promoting sustainable development, so it seems justified having project in the south of Algeria.

M. BELHAMEL (CDER): Near Alger there are many research centers who could participate to a CSP demonstration project.

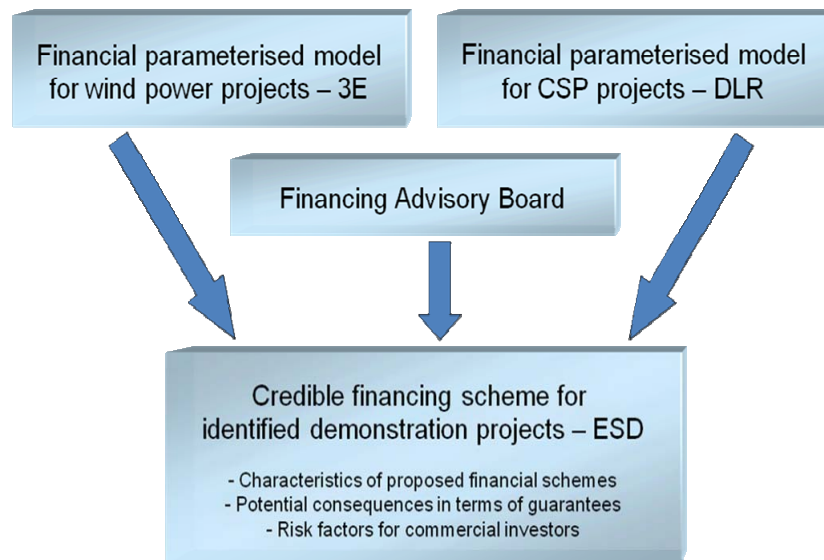
M. GUEZZANE (CREDEG): About wind power, a working group which gather member from CDER, CREDEG and MEM has been constituted. 2 sites near Oran have been identified, and wind measurements will be made. For 2015 the specific objective set by the CREG for wind power is an installed capacity of 100MW.

12. Financial aspects, Mr. Geert DOOMS, ESD

Presentation

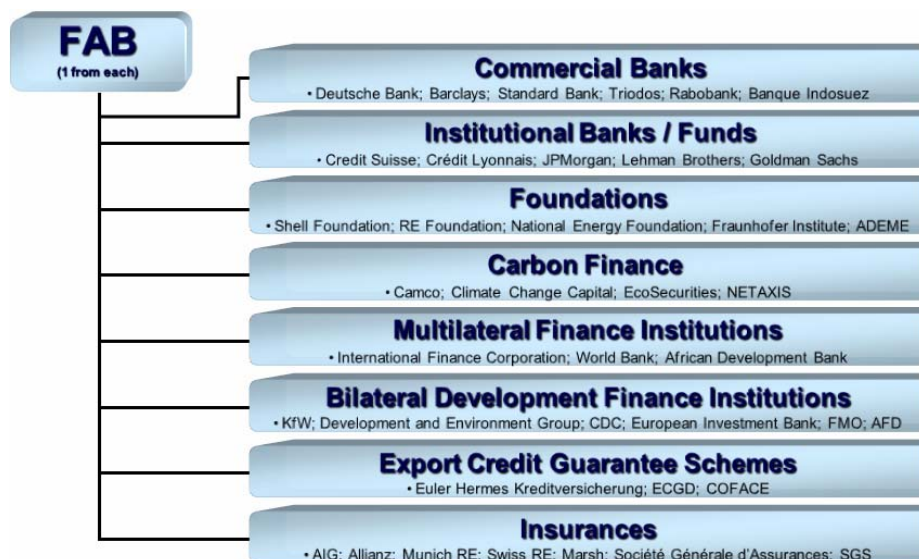
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- Provide guidance on best opportunities for renewable energy projects



Within the REMAP project 2 financing models have been developed, one for CSP and one for wind power. These models may be completed by national and local inputs in order to have exploitable results.

In addition, a [Financing Advisory Board \(FAB\)](#) will be implemented. The goal of this FAB is to help local partners on the financial issues in the renewable energy domain. Participants for the FAB have been already identified:



Concerning the Kyoto Protocol, in addition to the Clean Development Mechanism, there is a voluntary market in which Verified Emission Reductions (VERs) are traded. VERs are more flexible than Certified Emission Reductions (CERs) because they can be given more quickly (within some months vs. 2 years for CERs).

Verified Emission Reductions (VERs): A unit of greenhouse gas emission reductions that has been verified by an independent auditor, but that has not yet undergone the procedures and may not yet have met the requirements for verification, certification and issuance of CERs (in the case of the CDM) or ERUs (in the case of JI) under the Kyoto Protocol. Buyers of VERs assume all carbon-specific policy and regulatory risks (i.e. the risk that the VERs are not ultimately registered as CERs or ERUs). Buyers therefore tend to pay a discounted price for VERs, which takes the inherent regulatory risks into account. (source <http://carbonfinance.org/>)

Discussion

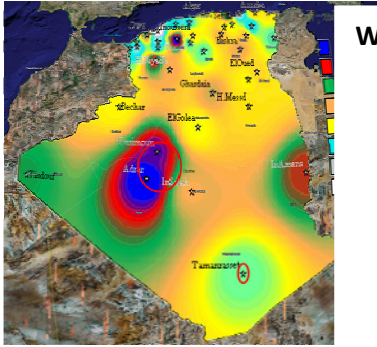
M. DERRADGI (NEAL): In order to develop private investment a more detailed decree on FIT is necessary. The owner of the demonstration project will be a national institution, NEAL could play this role. The project finance model is known in the country and could best be applied for the projects. The NEAL is constructing a hybrid CSP project, 5.1% solar. The NEAL project has a bilateral contract with Sonatrach because Sonatrach is an eligible industrial.

Ms. BOUZID (MEM): Concerning this issue a detailed law text is under discussion at the MEM.

M. BELHAMEL (CDER): It will be interesting to have feedbacks on the incentive frameworks established in Europe.

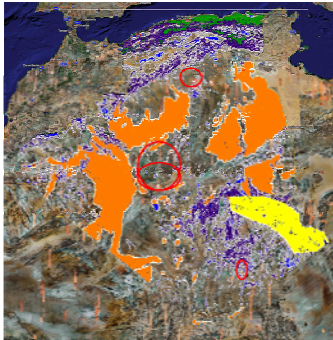
13.Round Table “Requirement for the development of CSP and wind technologies in Algeria, orientations and national priorities”, All

CREDEG wants to have the projects where they face to some power problems: preferably proven technologies. CDER wants to have commercial available CSP technologies to boost the CSP installation as soon as possible, R&D technologies should be in the vicinity of researchers (including international). NEAL wants a diversification of CSP technologies that could enlarge the experience in CSP in Algeria. After discussion, the conclusion was to have both wind and CSP project within REMAP. 3 wind sites have been located and 4 sites for CSP plants:



Wind projects:

- Adrar: minigrid, high wind potential, isolated.
- Timmoun: isolated.
- Tiaret: grid connected.



CSP projects:

- Tamanrasset: in the south, CSP hybrid with diesel. Advantage: the marginal cost for producing electricity is higher than in the north of the country. Proven technology is needed because of the distance.
- Alger: installing a R&D Ulich sister Solar Tower.
- Djanet: place of interest, touristic, historical. Proven CSP hybrid diesel, mini-grid.
- Ghardaia: CSP/NG Network (R&D capacities).

14. Conclusion and forthcoming, Ms. Houda ALLAL, OME

About CSP it is important to divide clearly 2 kinds of project. Firstly, commercial projects with proven technology in locations where the cost of the fuel is important and/or where a transport of the fuel by truck is necessary. Secondly, pure R&D projects to develop a local knowledge on the CSP technologies. This separation is essential to avoid a loose of trust in this technology due to failed projects.

For the R&D projects EC funding is possible under the Seventh Framework Programme (FP7, 2007-2013). But banks like the European Bank of Investment or the African Bank of Development could also be involved. Another possibility could be the cooperation under the "Union pour la Méditerranée" process. A regional carbon fund is under negotiation between the OME Members. EC can also provide help in funding studies on the modeling of wind and solar potential.

The next step of the REMAP project will be the 18th month meeting in July 8th and 9th; and the final meeting which will take place in Montpellier in December 11th and 12th during the Energaia international forum on renewable energy.

Annex 4

Proceedings of the National Workshop in Jordan

Amman, 7 July 2008



ADEME



Action Plan for high priority renewable energy initiatives in Southern and Eastern Mediterranean Area

SSP - Contract No. 044125

WP3. Proceedings of the National Workshop in Amman Jordan, 7 July 2008



Prepared by: OME

Date: 11 July 2008

Agenda

- ✓ Welcome Mr. Malek KABARITI, President of NERC
- ✓ Introduction of the partners
- ✓ Presentation of the REMAP project, Ms Houda ALLAL, Coordinator, OME
- ✓ Solar and wind potential identified projects in Jordan, Mr. Christoph SCHILLINGS, DLR
- ✓ Financing aspects, Mr. Michael HOFMANN, ESD & Mr. Geert DOOMS, 3E
- ✓ Round table “Requirements for the development of CSP and wind technologies in Jordan, orientations and national priorities”, All
- ✓ Synthesis and conclusions, Ms Houda ALLAL, Coordinator, OME

Participants list

Minutes

15. Jordan situation, Mr. Malek KABARITI, President of NERC

A Royal Committee for energy has been set up in order to upgrade the national energy strategy. This committee has defined national targets. Renewable energies participation will reach 10% of the total primary energy consumption by 2020. For this horizon, the specific targets are 600 MW for wind power and 600 MW for solar power. To achieve these objectives a law on renewable energy is currently submitted to the parliament. This law aims at promoting national and private investments in renewable energies. Incentives like import duty and taxes exemptions are foreseen in this law. In addition an energy efficiency law and a fund dedicated to energy efficiency and also to renewable energy projects will be implemented soon.

Consequently REMAP is an adapted way to enforce an indispensable regional cooperation in renewable energies. About this regional issue a paper for TREC has been prepared with the help of the Club of Rome.

16. Introduction of the project and the workshop, Ms. Houda ALLAL, OME

The objectives of the REMAP project are to work with key stakeholders with the following themes:

- Compilation of a solar and wind energy resource atlas for the Southern and Eastern Mediterranean area;
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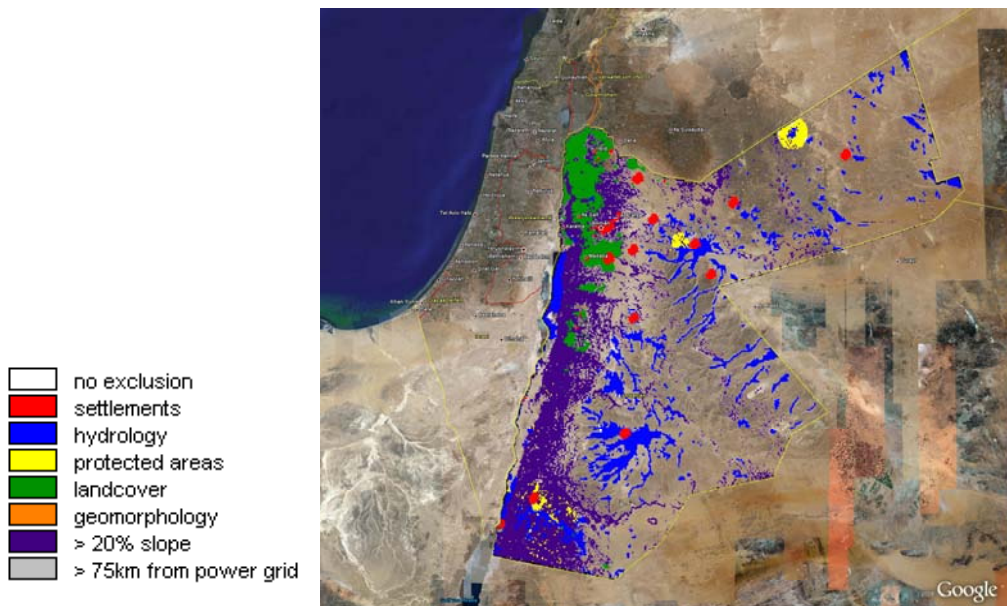
Deliverables and contacts are available on the website: <http://www.ome.org/remap/>

17. Solar and wind potential and identified sites in Amman, Mr. Christoph SHILLINGS, DLR

a. Presentation

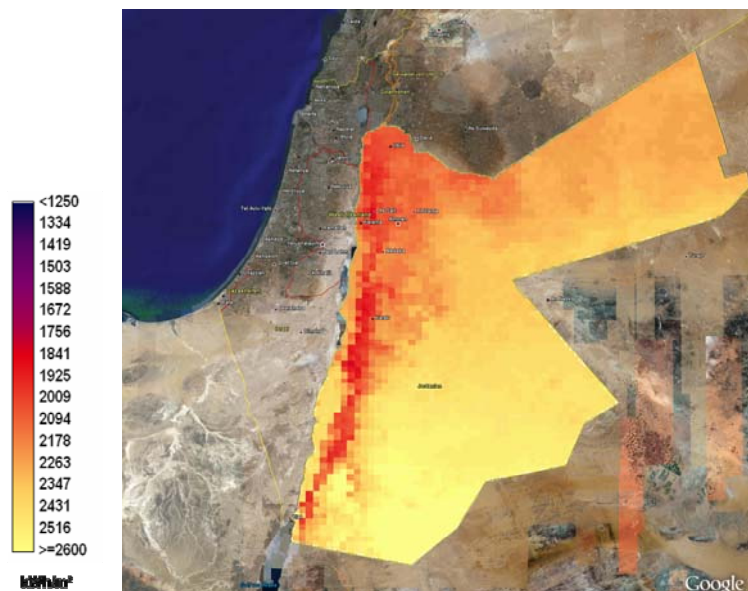
i. Solar

To identify the possible sites for a CSP plant, the first step is to produce an exclusion map:



Source : REMAP, DLR, 2008

At the same time the available solar resource is modeled:



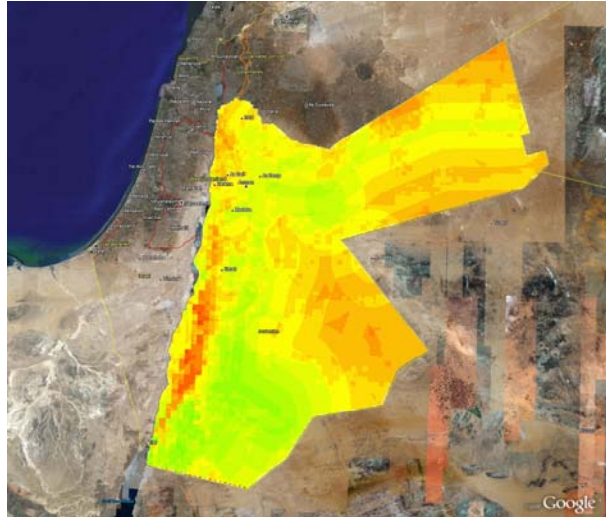
Source : REMAP, DLR, 2008

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A system of ranking has been set up to take into account all the key elements and so to choose the best locations. Hereafter an example of the value that can be used (most preferable sites in green):

Site Ranking based on:

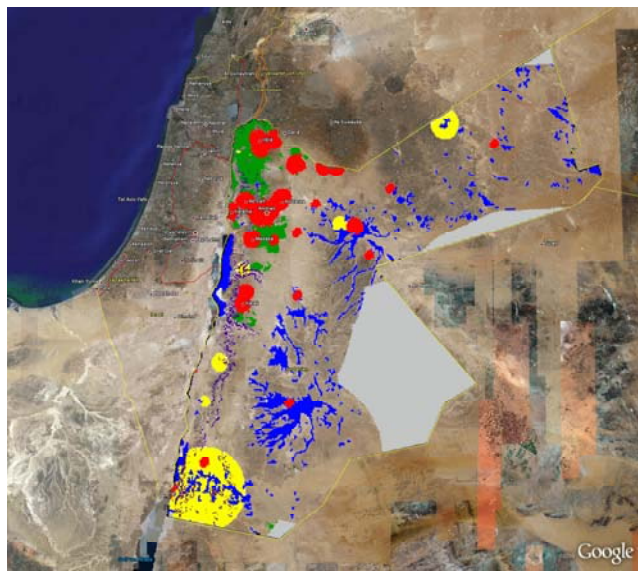
	Value		Points	
	Min	Max	min	max
Resource DNI	2000	2800	2	20
Transmission	0	75	5	0
Settlements	0	50	0	5
Roads	0	50	0	5



Source : REMAP, DLR, 2008

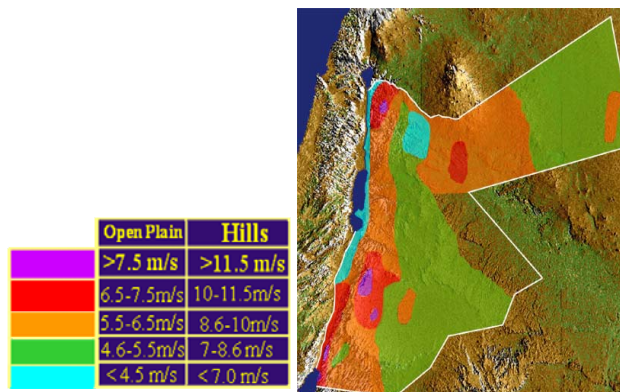
ii. Wind

Concerning wind, similar steps than those presented before for CSP may be also completed to determine the good location for the farms. An exclusion map for wind farms has been defined by DLR:



Source : REMAP, DLR, 2008

For the wind potential map from NERC was already available:

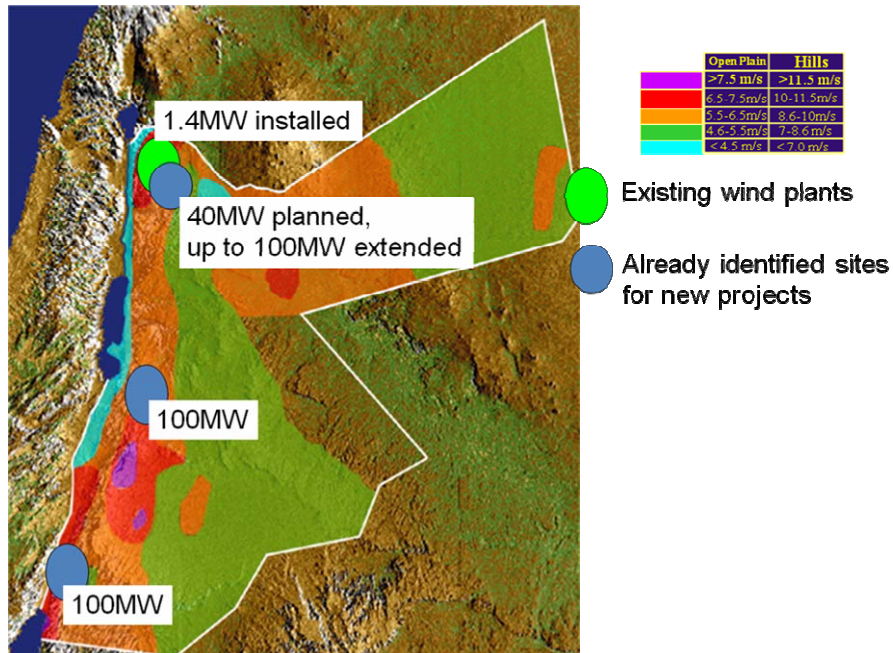


Source : NERC

b. Discussion

i. Wind

Mr. Khaled DAOUD (NERC): An updated version of wind potential is available now. In Jordan the best sites for wind energy are on shore. 3 Wind projects have been already identified/planned:



Source : REMAP, NERC, 2008

Mr. Mikel FERNANDEZ (LABEIN - TECNALIA): The wind farm project in the south of Jordan seems to be in a protected area.

Mr. Khaled DAOUD (NERC): Indeed it is, but after negotiations NERC has obtained that 70 km² could be used for a wind farm.

Mr. Michel CASSELMAN (3P): Are there different wind regimes in Jordan?

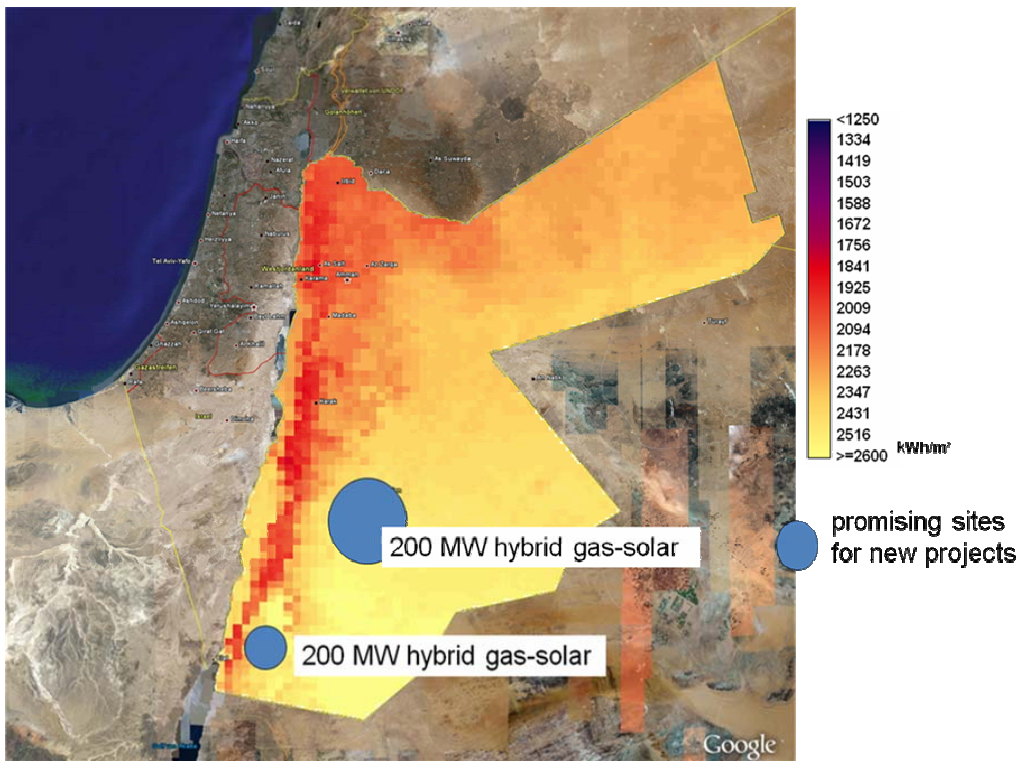
Mr. Khaled DAOUD (NERC): Yes.

Ms Houda ALLAL (OME): So about wind within REMAP, 3 projects can be considered: extension from 40MW to 100 MW of the wind farm planned in the north and the two identified projects of 100 MW installed capacity each. Under the REMAP project is there a priority between wind power and CSP?

Mr. Khaled DAOUD (NERC): No because the national targets are the same, but definitely more work is necessary for CSP projects as it is not mature as wind power. For that reason assistance from EC or World Bank is needed to implement CSP plants.

ii. Solar

Mr. Khaled DAOUD (NERC): 2 sites have been identified for hybrid gas – CSP plants (solar share of 15-20%):



Source : REMAP, DLR, 2008

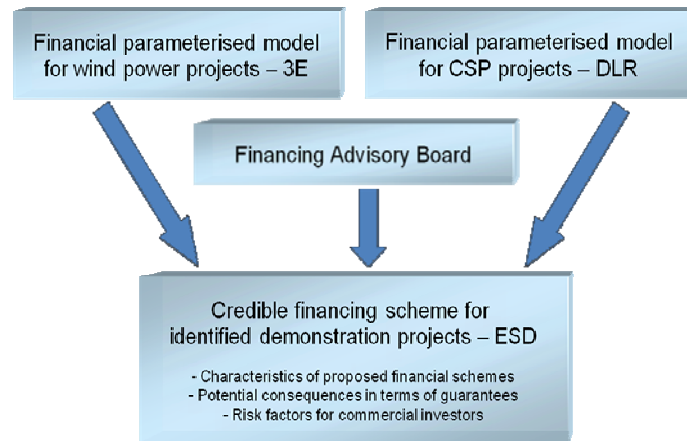
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18. Financing aspects, Mr. Michael HOFMANN, ESD & Mr. Geert DOOMS, 3E

a. Presentation

The main objectives of the WP4 are to:

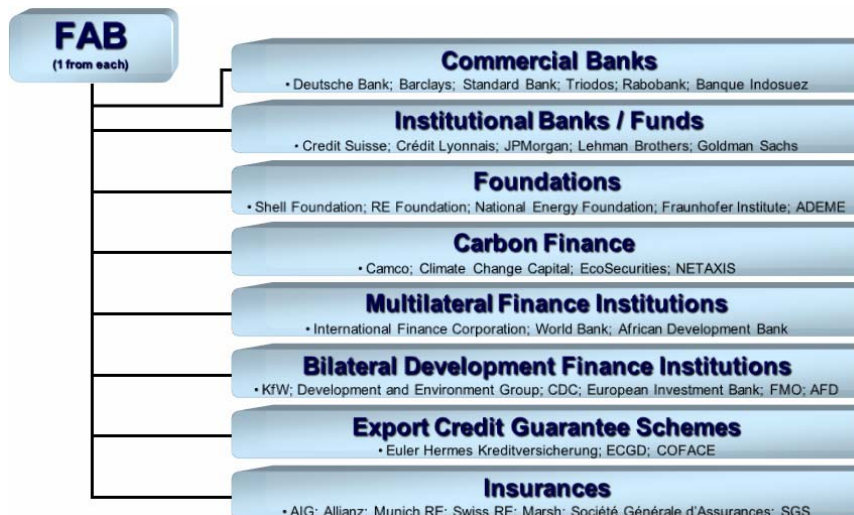
- Provide financial advice for project development
- Provide information for financial services (e.g. insurances, carbon firms)
- Provide information on 'best practice' in financing renewable energy projects
- Provide guidance on best opportunities for renewable energy projects



Source : REMAP, ESD, 2008

Within the REMAP project 2 financing models are developed, one for CSP and one for wind power. These models may be completed by national and local inputs in order to have exploitable results.

In addition, a Financing Advisory Board (FAB) will be implemented. The goal of this FAB is to help local partners on the financial issues in the renewable energy domain. Participants for the FAB have been already identified:



Source : REMAP, ESD, 2008

About CDM it is important keep in mind that the additionality of the project has to be proved. The project cannot receive Certified Emission Reductions (CERs) if it is already bankable.

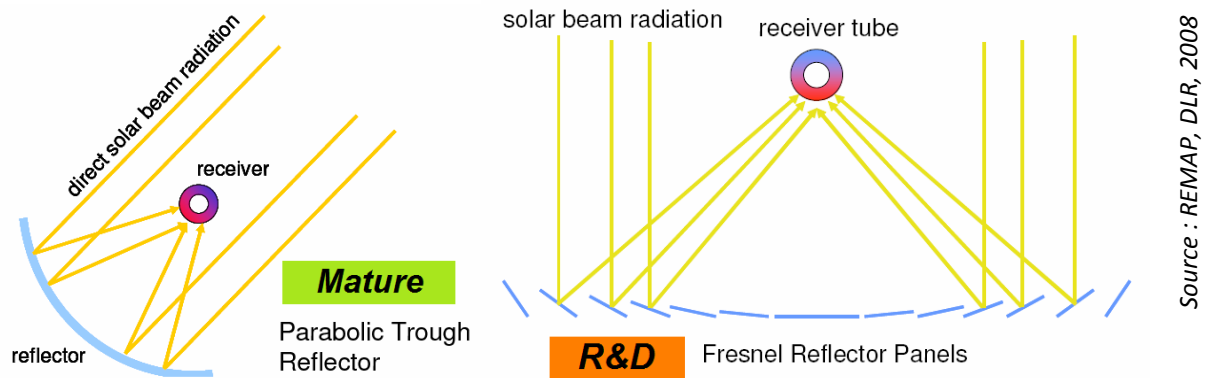
b. Discussion

Mr. Khaled DAOUD (NERC): About the land price, it can be considered very marginal. In any case, for Jordan or International investors, the government has to buy the land and then sell it. Currently, to develop renewable energy projects competitive tender are used; but maybe this organization will change with the new RE law.

Mr. Suleiman AL-HYARI (NEPCO): The NEPCO (National Electric Power Company) asks for capacities and choose the tender with the lowest price which corresponds to the technical requirements. About the electricity transportation, the connection between the power plant and the grid needs always an agreement with NEPCO. Only the electricity distribution is still public in Jordan; the distribution is divided by geographical area but the price level is the same everywhere.

19. CSP technology, Mr. Christoph SHILLINGS, DLR

New CSP power plants have just been connected to the grid in USA (Nevada Solar One, 64MW, in 2007) and in Spain (Andasol I, 50MW+, in 2008). So parabolic trough is mature today. In order to decrease the cost of the mirror and the complexity of the structure a new technology is under R&D; this system uses linear Fresnel Reflector Panels.



The Linear Fresnel system is not as efficient as the parabolic through one but it is very simpler. For instance absorber tubes are fixed in the Linear Fresnel system. For the parabolic trough system, all the structure has to be linked to a very precise tracking system in order to optimize the reception of solar radiations.

Another advantage of Linear Fresnel is that the structure can be manufactured very easily, creating new local jobs.

Without a thermal storage a CSP plant runs for approximately 2000 hours per year. This peak production is not a problem if the grid is well developed.

There are 3 main options to make thermal energy storage:

- Molten salts: a cold tank at 280°C + a hot tank at 400° (mature).
- Concrete block with tube into them (R&D).
- Phase change materials (pilot of this option at DLR laboratory).

The mirrors used in CSP plants are a classical technology; there are just "high quality" mirrors with a good reflectivity (>95%).

20.Synthesis and conclusions, Ms Houda ALLAL, Coordinator, OME

Due to the maturity of wind power, CSP will be the priority within REMAP. In addition to the projects already identified to produce electricity it could be interesting to take into account the water shortage challenge also. The solution can be combined solar-desalination plants.

To disseminate the results of the REMAP project a brochure will be edited. This brochure will sum up the work done within REMAP and present a portfolio of tangible projects.

For the R&D projects EC funding is possible under the Seventh Framework Programme (FP7, 2007-2013). But banks like the European Bank of Investment or the African Bank of Development could also be involved. Another possibility could be the cooperation under the “Union pour la Méditerranée” process. A regional carbon fund is under negotiation between the OME Members. EC can also provide help in funding studies on the modeling of wind and solar potential.