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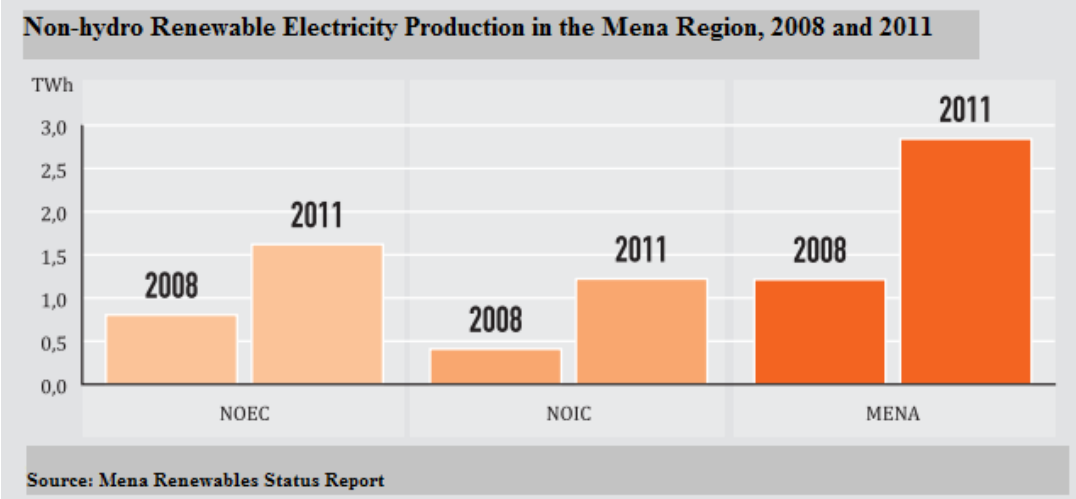
Content

1. RE market in MENA Countries

The twenty one MENA (Middle East and North Africa) countries were clustered into two sub-groups: Net Oil-Exporting Countries (NOEC): Algeria, Bahrain, Egypt, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, Syria, United Arab Emirates, and Yemen, and Net Oil-Importing Countries (NOIC): Djibouti, Israel, Jordan, Lebanon, Malta, Morocco, Palestinian Territories, and Tunisia.
Renewable energy markets and energy policies are changing in MENA, NOEC and NOIC countries. Investing increases progressively and more than one hundred new projects are in development. The region looks decided to exploit the plenty of resources of renewable energy that they have and to diversify their energy production in the next ten years.

1.1 RE Situation in MENA

MENA region has the biggest worldwide potential for energy solar generation. If this geographic zone reaches its total potential, it could generates three times the demanded energy in the whole world. Also they have a high potential for wind energy.
This development is happening very fast. According with the "MENA Renewable Status Report, MENA 2013" from 2008 to 2011 the generation of non-hydropower renewable energy power has doubled to 3 terawatt-hours (TWh) and they are growing faster than the conventional energy sources.



Installed Renewable Energy Capacity in the MENA Countries.

INSTALLED CAPACITY (MW)

	Solar		Wind	Biomass and Waste	Geothermal	Hydro	Total
	PV	CSP					
Algeria	7.1[c]	25[a]	0[a]	0[b]	0[b]	228[a]	260.1
Bahrain	5[b]	0[b]	0.5[a]	0[b]	0[b]	0[b]	5.5
Egypt	15[a]	20[a]	550[a]	0[b]	0[b]	2,800[a]	3,385
Iran	4.3[c]	17[b]	91[a]	0[b]	0[b]	9,500[a]	9,612.3
Iraq	3.5[d]	0[b]	0[b]	0[b]	0[b]	1,864[a]	1,867.5
Kuwait	1.8[c]	0[b]	0[b]	0[b]	0[b]	0[b]	1.8
Libya	4.8[a]	0[b]	0[b]	0[b]	0[b]	0[b]	4.8
Oman	0.7[c]	0[b]	0[b]	0[b]	0[b]	0[b]	0.7
Qatar	1.2[c]	0[a]	0[a]	40[a]	0[a]	0[a]	41.2
Saudi Arabia	7 (2013)	0[b]	0[b]	0[b]	0[b]	0[b]	7
Syria	0.84[c]	0[b]	0[b]	0[b]	0[b]	1,151[c]	1,151.84
UAE	22.5[a]	100 (2013)	0[b]	3[a]	0[b]	0[b]	125.5
Yemen	1.5[a]	0[b]	0[b]	0[b]	0[b]	0[b]	1.5
Total NOEC	**75.24**	**162**	**641.5**	**43**	**0**	**15,543**	**16,464.74**
Djibouti	1.4[c]	0[b]	0[b]	0[b]	0[b]	0[b]	1.4
Israel	269[a]	0[b]	6[b]	27[a]	0[b]	7[d]	309
Jordan	1.6[a]	0[b]	1.4[a]	3.5[a]	0[b]	10[a]	16.5
Lebanon	1[a]	0[b]	0.5[a]	0[b]	0[b]	282[a]	283.5
Malta	12[b]	0[b]	0[b]	0[b]	0[b]	0[b]	12
Morocco	15[a]	20[a]	291[a]	0[b]	0[b]	1,745[a]	2,071
Palestinian Territories	1[a]	0[b]	0[b]	0[b]	0.023[a]	0[c]	1.023
Tunisia	4[a]	0[a]	154[a]	0[b]	0[b]	66[a]	224
Total NOIC	**305**	**20**	**452.9**	**30.5**	**0.023**	**2,110**	**2,918.42**
TOTAL MENA	**380.24**	**182**	**1,094.4**	**73.5**	**0.023**	**17,653**	**19,383.16**

Source: MENA Renewables Status Report 2013 a2012 b2011 c2010 d2009

Different projects are being made right now in many countries. Here we show some of them, differentiating Middle East from North Africa.

1.1.1 Middle East

United Arab Emirates

Masdar City, Abu Dhabi

Here stands out as the most glamorous project in development of renewable energies. The whole city is being designed to have zero GHG emission. Which means all is produced from green energy there: industry, housing, power-plant, transports, etc.

Concentrated Solar Plant, Abu Dhabi, UAE.

Although no unified federal energy policy, the efforts of the Emirate of Abu Dhabi have laid the foundations in the United Arab Emirates of Masdar, a state-owned vehicle. The financing of the Emirate for renewable energy is clear with example, as 66 local companies involved in the solar power plant 100 MW Shams 1, the majority of which did not exist before. Investment in renewable energy in local communities has also grown, as in Masdar and Taqa. Backed by the state, they have become active global investors as Masdar taking stakes in the London Array offshore wind world's largest and Gemasolar farm and in the Spanish CSP project that uses breakthrough energy storage. At

the same time, the state has promoted R & D and leadership through the Masdar Institute and hosting IRENA (International Renewable Energy Agency), international organization with 159 member countries.
Masdar Institute has already produced for the first time in the region patents in clean technologies, some companies with potential for its implementation. The sustainable development of Masdar City has also brought a number of recognized industry leaders in renewable energies, such as Siemens and General Electric energy, to establish their regional headquarters in the Emirate. Dubai plans to achieve 1,000 MW of solar power and have further strengthened northern emirate of Ras al-Khaimah that has followed a similar approach on a smaller scale with the creation of a campus clean technology by the respected Swiss school, École Polytechnique Fédérale from Lausanne and a research and technology centre is run by the Swiss team. However, given the limited sized market right now, the UAE are focused more on investment products manufactured abroad (as in Germany) than on the development of a local industry.

Jordan
Wind power
The country has a high wind potential, particularly in the north and west of the country where the wind speed annual average is 7 m/s. An atlas of Jordan winds existed since 1988 and it was updated in 1999. Two wind farms exist today in Jordan: Al Ibrahymia (capacity of 4 x 80kW) created in 1986 and Hofa (capacity of 5 x 225 kW) created in 1996. These sites are operated by CEGCO. Following the completion of these two parks, MEMR announced in 2001 the launch of an international tender for the construction of a wind project with a capacity of 75-80 MW on the principle of a BOO (Build, Own & Operate). Three sites were selected: Hofa / Irbid; Al-Fujaij /Al Shobak and Wadi Araba / Aqaba.
Between two propositions, MEMR has appointed an international consultant to evaluate the technical and financial proposals of candidates and assist in negotiations. The project ultimately failed due to the bankruptcy of one of the investors and the failure of negotiations with the other. One of the constraints was the electricity prices offered by the developers of these wind farms (about 7 USD cents /kWh).
The prices are very competitive with electricity repurchase prices of NEPCO (from about 4 USD cents /kWh). The current thinking in MEMR is intended to identify measures to reduce the production cost of wind energy. In addition, a project of GEF (GEF $ 6 million USD) approved in August 2006, aims to promote the development of wind energy market in Jordan.
The future plans are the construction and commissioning of the Fujaij sites and Shobak (tenders planned or in progress), contributing to the creation of 100 to 160 MW. An estimated 600 MW could be installed by 2020 and 300 by 2015.

Photovoltaic Power
The photovoltaic power generation is relatively undeveloped in Jordan, and is limited to isolated areas, for example for pumping water (103 kW), hospitals (7 kW), communications equipment (19 kW), and isolated police stations (17 kW) or for other uses (25 kW). This sector is considered unattractive economically, and not among the priorities of local authorities. The total installed capacity is estimated at 0.5 MW in 2006.
Yet, Jordan has an interesting potential in the sunshine plan and land availability. A hybrid power generation and desalination project is being implemented in Aqaba, with funding support from the European Union. The project includes the installation of 35,000 m2 of solar panels and allows the production of 8.5 MW of electricity, 10 000 m3 of desalinated water and 20 MW of air conditioning. According to national authorities, the potential of this technology could be very important, although it is at this stage of an experimental project.
The authorities are considering the possibility of promoting the installation of a manufacturing unit of solar panels in the south. Discussions are also under consideration for the opportunity to develop solar power plants, reaching 100 to 150 MW of installed capacity by 2015.

Solar Water Heating

The technology of solar water heaters has developed strongly during the 1980s in Jordan about 1 million m^2 were installed, developed to equip 20 to 25% of the housing stock. This percentage is estimated at 15% now, knowing that a significant number of SWH installed are no longer operational.

The dynamism of the market has allowed the emergence of several local fabricants. This phase of growth came to a halt with the devaluation of the Jordanian Dinar (JD) in 1989, which resulted in a significant increase in the price of equipment (the average price increased from 200 to 400 JD), the components are largely imported. The current market is estimated at about 10000 m^2 per year, mostly covered by local producers, although competition from import materials. In the absence of an incentive framework, the market fails to grow significantly.

Maybe an establishment of a support mechanism for SWH with the support of electricity distribution companies will be given in the coming years.

Biomass/Waste

The biogas recycling project Russeifah, north of Amman, has been operational since 2000. It is the only project for energy recovery landfill gas in Jordan. The operator, Jordan Biogas Company, was set up as part of the project as a joint venture between Amman Municipality

(Greater Amman Municipality) and national power generation company (CEGCO). This institutional arrangement allows the municipality to take advantage of some 13 million tonnes of household waste buried on the site of Russeifah, and CEGCO diversify its park facilities. The project was initially (in 1998) of a GEF grant of about € 2.5 million, as well as technical support from the Danish cooperation for the training of technical personnel. The facilities include landfill gas collection wells (12 in total), a generator with a power of 1 MW and a digester producing biogas from slaughterhouse waste, waste restaurants and leachate (capacity: 60 tons/day).

The biogas used for electricity generation thus comes both from the landfill and digester. However, the compost produced by the digestion could be used, the salt content (due to slaughterhouse waste) is too high. An extension project is presently contemplated as regards the collection of biogas discharge (passage 12-84 wells) and the electric capacity (3.5 to 5 MW). This extension could be a CDM[1] project with the potential CERs[2] (about 250,000 tCO_2 per year) will be attractive to potential buyers. Revenues from the sale of carbon credits then addition to revenue from the sale of electricity, which will ensure the economic balance of the project.

Development and exploitation of the potential biomass of other major shocks (including the site of Ghabawi, near Amman). Feasibility study of the operation of sewerage biogas or recovery of biomass from the agricultural sector. Furthermore, reflections on the introduction of waste incineration unit site (about Amman Municipality) lead to consider the production of electricity from waste recycling. The cost of capital and operating (compared to landfill sites), however, is a major barrier to the development of such facilities.

Geothermal Energy

Geothermal energy is not developed at this time in Jordan, with the exception of a few tourist and agricultural facilities (greenhouses). A study on the potential for geothermal energy in 2006 was conducted under the supervision of MEMR[3]. The findings of the study indicate that the geothermal potential could be used only for limited applications (for example, in agriculture).

Saudi Arabia

The Kingdom of Saudi Arabia is focusing on training internally, location in employment, and research and development (R&D) and prioritising provisions for increasing use of renewable energies. In

[1] Clean Development Mechanisms
[2] Certified Emission Reductions
[3] Ministry of Energy and Mineral Resources

February 2013, Saudi Arabia published the KACARE[4] programme, a White Paper describing a competitive procurement process, aiming to install 54 GW of renewable energy by 2032.
The most important thing is: local content is a priority in evaluating project proposals KACARE different bidding rounds which will increase by 50% or more, depending on the item or service introductory call, 60% or more in the first round, and 70% from there onwards. It is clear from the White Paper that a national outsourcing is key, stating that "while K.A.CARE is aggressively pursuing the development of the local value chain, projects will be expected to escalate their local content inclusion accordingly." Each bid project is evaluated for the pricing and not only for its "qualifying criteria," which include the experience, development status, and local content of the project. The criteria for scoring is 70% on price and 30% based on the classification criteria.
Local content will be assessed on how much is spent locally and how much is spent for the whole project, with highest points given for programmes spending at least 60% locally. According to the content of KACARE, it is probably that a local manufacturing plant needs to be established by working together with technology companies, in order to comply with the anticipated scale deployment. Developers are required by Program Saudi Arabia to give back to the local community and economy by investing in training, research, and local manufacturing. There will be a 1% tax charge on the project income for the Fund Formation of Solar Energy, local projects in development of renewable energies. Tax incentives are offered also for the employment of nationals and developers working in the location work of Saudi Arabia in the top 5% will be paid above the mean for these workers.

Although Saudi Arabia is more recent to renewable energy, KACARE was established since 2010 and national and Black only paper strategy announced in 2013, the volume and value of the investments proposed in the 2032 period, could be a great influence for laying out activities relevant to the value chain in the Kingdom in the years to come.

Engineers from NREL and K.A.CARE installing a rotating shadowband radiometer near Riyadh.

1.1.2 North Africa

Egypt

Some institutions for developing renewable energies in Egypt have been being developed since the 1990s. First by way of the Wind Energy Technology Centre (WETC) and a National Renewable Energy Development Organisation (REDO) and later the Industrial Modernisation Centre (IMC).The

[4] King Abdullah City for Atomic and Renewable Energy

WETC is responsible for technical evaluation, testing, R&D, and certification of wind turbines, and trains workers in operation and maintenance.
REDO is responsible for assessing and certification of renewable energy systems, including wind energy and PV. The IMC's aim is to allow development in the local markets. The Renewable Energy and Environment Protection Programme is a specific system that has been established to develop the local renewable energy value chain in the country. It provides technical and economic aid to industrial establishments by means of studies and information about renewable energies, including technical capabilities, investment needs, and associated operation and maintenance. It has additional aims of generating debate around the current procedures, and supporting developers in search of licensing with technical help.
In the area of wind power, Egypt has various supply chain manufactures which are local, such as Ferrometalco, the Arab Organisation for Industrialisation (AOI), and the Sewedy Wind Energy Group (SWEG). SWEG works together with SIAG Schaff Industries AG in tower production facilities, and also with Spanish company in which it is a shareholder, M Torres, who manufactures wind turbines, therefore allowing an otherwise not so easy access to experience and knowledge about turbines and wind energy.
The blades are manufactured by the company, Sewedy, and is aiming to localise its supplies. There is significant opportunity for developing a local market. According to NREA[5], 30% of components used in existing wind projects are locally produced, and that share could reach 70%. Local system integrators top the PV market including Middle East Engineering & Technology (MEET), Arabian Solar Energy & Technology Co (ASET), and suppliers that work in design, installation of components, operation and maintenance.
About a quarter of the PV modules used in the country are manufactured locally. Nonetheless there is a large possibility of manufacturing plastic composites locally, as well as specialised glass, electric components, switch gear, aluminium frames, and other system auxiliaries required for integrated PV systems.
The first CSP plant in Kuraymat started functioning in 2011. Around 40% of the value of the solar field was generated locally; NREA proposes that in the future this could rise to 60%. A obstacle in further developing the manufacturing in CSP plants locally has to do with the accessibility of sensitive knowledge regarding the highest-value components. These are the parabolic mirrors, the parabolic-trough receiver, and the heat transfer fluid. It is important to point out that Egypt and Algeria are the only countries in the MENA area to have the only manufacturing plants that are able to produce float glass; although they have not yet met the quality and technical conditions necessary for CSP parabolic mirrors.

Tunisia
Prosol. Solar Water Heating (SWH)
Prosol is a program to develop the SWH in Tunisia jointly developed by the Tunisian Ministry of Industry, Energy and Small and Middle Size Enterprises (MIEPME); the National Agency for Energy

Egypt's Zafarana wind farm along the Red Sea

[5] New & Renewable Energ

Conservation of Tunisia (ANME); and the United Nations Environment Programme (UNEP). Prosol was backed by the Italian-led Mediterranean Renewable Energy Program (MEDREP) and launched in April 2005. The goals of this program according to the "Climate Policy Initiative Report, San Giorgio Group Case Study: Prosol Tunisia" are:

1) A mechanism to facilitate consumers' access to credit and overcome the lack of tailored end-user financing options - by facilitating a temporary interest rate subsidy (7% in the first twelve months, 3% in the following six), a 50% reduction in interest rates (from ~12% to ~6%), and longer repayment terms (from 3 years to 5 years).

2) A series of awareness-raising campaigns. Only SWH models with 200 and 300 litres capacity compliant with certain quality standards were commercialized with the backup of Prosol Residential (ANME, 2005). This implies that households contracting loans in the first 12 months of the Program were charged a 0% interest rate, 4% in the subsequent 6 months (Touhami, 2011; Menichetti and Touhami, 2007).

3) Addressed consumers' scepticism about SWHs and informed commercial banks about renewable energy (RE) investments and associated market potentials.

4) A capacity-building strategy to ensure local domestic financial institutions and technology providers develop long-term knowledge and expertise.

5) An accreditation scheme for suppliers/installers and SWH models, as well as monitoring procedures to ensure the quality and reliability of systems which are important factors in stimulating and sustaining demand.

6) The development of carbon credits under a programmatic Clean Development Mechanism (CDM) – in phase two – that will be used to finance the continuation and scale up of the Program itself.

For more information, see the 1.2 paragraph.

Wind Power

Tunisia has an operational wind farm of 19.3 MW installed at the site of Sidi Daoud, northeast of Tunisia, in the Cap Bon region. Following the acceleration policy decisions of the extension of the wind farm, STEG[6] decided in a first step to install additional 35 MW at the site of Sidi Daoud. These additional capabilities are expected to come into service in 2008, producing around 105 GWh annually. This will be a CDM application. According to the 11th Plan, STEG should also install an additional 120 MW in 2010, producing around 360 GWh annually.

This will also be the subject of a CDM application. Beside the STEG wind farm, it could also be that self-producers (like some cement plants, whose sites are well endowed with wind resources), opt for wind energy to meet part their electrical needs. These projects would be carried through CDM applications.

The latest estimates from 40 to 50 MW could be put into operation by 2010. It is unlikely that other wind turbine applications are considered by 2010. Tunisia's government has excluded the opening of the wind power from independent producers. This decision was primarily justified by technical impossibility for STEG, for absorbing greater amounts of such energy, whose contributions are deemed too random. These results therefore remain below the proposals of the strategic study on the development of renewable energy in Tunisia, whose conservative scenario was expecting an installed capacity of 310 MW by 2010, 1090 MW by 2020, and 1800 MW by 2030.

By 2011, Tunisia would have a 175 MW wind farm, owned by STEG, supplemented with 40-50 MW held by potentially self-producers. In the absence of major overhaul of the Tunisian position on the opening of wind power, both IPP that self-production, it is difficult to expect to exceed these figures. Obviously, the current redemption prices of electricity from wind power (maximum 50 millimes[7]/

[6] Sociètè Tunisienne del'Electricitè el du Gaz. (english name: Tunisia Company of Electricity and Gas)

[7] 1000 millimes= 1 tunisian dinar

kWh), and lack of support from the FNME[8] or FODEC[9], it will be difficult for Tunisian investors or foreign interest in the destination of Tunisia wind field.
For projects in self-production, reflection is currently underway via the assembly of CDM operations and the establishment of measuring masts. The companies concerned are advancing rather slowly, waiting for more visibility on the part of the authorities. A potential thrill of the carbon market could generate some progress on the part of some companies, especially those related to international groups potentially affected by GHG[10] reductions obligations in Europe. Ad-hoc funding mechanisms, national or international, could therefore have a good catalyst for wind power in self-production

Biomass/Waste
Aware of the impact of the use of wood energy on forest resources in the north of Tunisia, ANME[11] launched as early as 1990 in the Kef region, and with the support of German cooperation, a technology diffusion pilot project to the reduction or substitution of consumption of wood for making bread. It was the "improved tabouna[12]" a kind of earth dome for the preparation of bread tabouna, headed by a metal cover, which was adopted for commercial distribution.
Improved tabouna reduces by about half the consumption of wood for the preparation of bread tabouna, averaging a reduction of 15% of the total wood consumption in a household. ANME had then tried to introduce market mechanisms, previously supported by the formation of a network of 12 artisans in the North West region, awareness raising and outreach in rural areas, and the identification and involvement of trader shops in rural areas to ensure local relay broadcast. However, market mechanisms have not been able to function, satisfying flow fault improved tabounas.
ANME had abandoned the commercial distribution approach and assured by its own means, distribution door to door covers. The selling price cap was set at 3 DT[13], whereas the cover contain 9 DT; either a grant from ANME of about 6 DT per unit. Again, given the limited human and logistical resources ANME, the scope of dissemination of improved tabounas remained modest, not more than 1,000 households per year. After this experience, since 2000,
ANME has adopted a new strategy based on local NGOs[14] such as Relay Broadcast. The lids are then provided free of charge to NGOs on the basis of an agreement signed between them and the ANME. Until today, ANME has signed agreements with a dozen NGOs working mainly in the North West area.
Quantitatively, achievements, however, remain low given the "potential demand" tabouna in Tunisia, estimated at about 200,000. Indeed, at the end of 2002, the program has enabled the distribution of about 12,000 lids, which covers only 6% of the potential. However, the strategy adopted by ANME since 2000, based on NGOs as scattering vector, seems to give good results. There has been growing at a real demand expressed by these NGOs.
In the field of biogas, a pilot industrial biogas production was achieved in 2000 in the area of Hammam Sousse. This project consists of the value of poultry manure in an industrial unit for poultry production. The digester is of a volume of 300 m^3 and is capable of processing approximately 4 tons per day. The production capacity of the facility is estimated at 120 m^3 of biogas per day. The bulk of the product gas is used for the production of electricity through two generators 24 kVA each operating alternately.
The setup has encountered many operational problems, mainly because of supply problems droppings, mainly due to the lower activity of the farm during the spring and summer, and the drop in temperature during the months winter which did not allow optimal production level digesters. Other

[8] National Fund of Energy Conservation
[9] Development of Industrial Competitiveness Tax
[10] Greenhouse Gas
[11] National Agency of Energy Conservation
[12] Typical Tunisia Bread
[13] Tunisian Dinar
[14] Non-Gubernamental Organizations

biogas recovery experiments were conducted by the National Sanitation (ONAS), in four of its sewage treatment plants (Charguia, Choutrana, Nabeul and Monastir). These experiments have, however, inconclusive results; due to various technical failures; including the lack of experience in the conduct of biogas recovery systems and electrical generation, sand overload, strong corrosion caused by H2S, lack of maintenance of generators, etc.

Biogas and biofuels could have a significant potential in Tunisia, but the two sectors, as well as their potential, are still unknown. On biogas, the strategic study of renewable energy development considered a voluntarism scenario; projecting the installation of 28 MW of electrical generators from biogas by 2010.

This goal now seems unobtainable, but a reflection could be initiated, and assembly of electrical generation operations from landfills could be seriously considered by 2009-2010. Projects could include the emerging and following the installation of two CDM operations already registered by the Executive Council: the project on the discharge Jebel Chekir, and the grouping 9 regional landfills. These 10 discharges receive 80% of household waste generated annually by Tunisia.

Projects currently considering simple gas flaring, but the addition of electric generators could eventually be considered. As a first approximation, 5-10 MW could be considered for Jebel Chékir, and around 10 MW for the second draft 9 discharges. These projects have however been no formal decision on the part of government nor funding research approach to date. In addition, three new small landfills have recently been the subject of preparing a Project Information Note (PIN) for a CDM application.

The project has seen the recovery and use of methane for the purpose of generating electricity for an estimated capacity of 1.3 MW. The 11th Plan has meanwhile mobilized projected a potential of about 10 MW by 2011, with an investment volume of 10 MTD. The second potential use of biomass for biofuels. The idea of implementing energy crops in Tunisia is now making its way.

Three main paths are considered:

- The recovery of used cooking oils: A project is currently being assembled by a private developer. Recycled oil would come, however, in addition to biofuels, particularly from rapeseed, to be imported.
- The cultivation of Jatropha: This option is seriously explored the extent that Jatropha is easy to cultivate, and could apparently adapt well on degraded land in central and southern Tunisia. The cultivation of Jatropha would, moreover, be an interesting opportunity for reuse of waste treatment water. In addition, a Jatropha project would be eligible for the CDM, which would be more in the profitability of the project.
- Rapeseed cultivation: This option is also considered, but unlike the Jatropha culture requires fertile land and also significant amounts of water, which can pose the question of competition with food crops. The 11th Plan projected a total investment volume in the biofuels sector, of the order of 31 MTD over the 2007-2011 period. But he has not provided any contribution from FNME or state budget for the development of this sector.

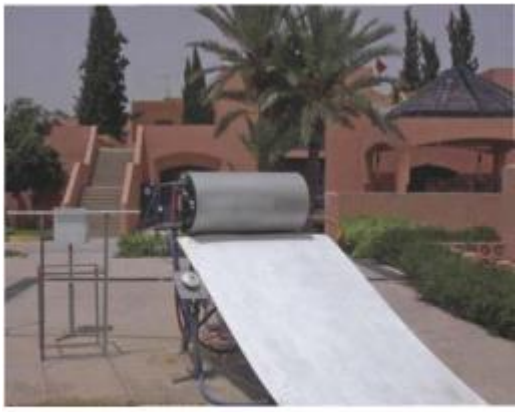
Morocco

Promasol (SWH)

PROMASOL comes from the name “PROgramme national de développement du MArché de chauffe-eau SOLaire” (Development of the National Market for Solar Water-Heaters). Existing since 2002, its objective is “changing [people’s] perception about the use of the solar water-heater and its contribution within the framework of a new approach to energy integrating renewable energies, and creating energy efficiency.”

Concerning resources in solar power, Morocco has great but largely underused potential. The land is equipped with panels in only 5.3 m^2 per 1,000 inhabitants. Not like in Tunisia, Jordan, Turkey and Germany, where the rate to 1,000 inhabitants are 16.6 m^2, 83 m^2, 110.2 m^2 and 115.2 respectively. This said, given the naturally available energy resources, a solar water heater (SWH) in Morocco produces almost double the energy as the same SWH in Germany.

As well as helping to reduce the dependence on fossil-fuel based energies imported from other countries, this programme works towards a further aim of creating a custom of using SWHs. Reaching this target would mean a culturally more and more easy access to solar water heating as an alternative energy power, including people living on the lower end economically of the population.
Another way of achieving this target is by public involvement. Use of SWHs by the lower income population could rise by offering tax incentives, and raising awareness of the different benefits of SWH: generation of employment, less pollution, and easier access to energy in areas where there are high resources, but those used are imported and this more limited.



Companies wishing to have their SWH certified by PROMASOL have their products tested at the CDER's facility in Marrakesh

For more information, see the 1.2 paragraph.

Wind Power
The ONE[15], the other Moroccan groups and several partners private investors, Moroccan or foreign, acquire an experience which will consider all possible ways when the law about the liberalisation of the electricity sector is enacted; this experience shall include:
• The wind farm Koudia Al Baida/Abdelkhalek Torres concession (BTO: Build Transfer Operate) between ONE and a private consortium. Innovative arrangements are contracted between partners.
• The Tetouan wind farm project by Lafarge Morocco: self-production / Production independent.
• Other wind projects (mainly Essaouira and Tangier): NEB investments assure their own maintenance and operation of facilities. A total of 64 MW installed; the resource is properly known, although the precise data remain built to meet the needs of investors.
• The Essaouira park, 60 MW, produced in 2007; Tangier, 140 MW. It is anticipated equipment 1,000 MW between 2009 and 2012: Taza, Tarfaya, Tangier, Laayoune, Dakhla. Is a perspective 1200 MWinstalled in 2012.
ONE could lead the development of 1,000 MW on its own and through agreements with private developers ("concessional PPA"). Given the uncertainties on the Spanish network (10-15 c€ / kWh), it may increase interest in wind power.
There is therefore good purchase outlook on the open market which will be site. It is also envisaged the gradual establishment of rates redemption, and the purchase obligation on the regulated market the regulated producer and single buyer. Some current discussions focus on the establishment of a fund wind power to support private sector investment and address the issue of costs between a regulated producer single purchaser and private producer.

[15] National Office of Electricity

Tanger Wind Farm, Morocco

1.2 Government Programs

According to the MENA Renewables Status Report:

"Policy deployment and target-setting are now a widespread phenomenon across the region. As of May 2013, all 21 MENA countries have renewable energy targets (19 of which have specified targets by technology), up from just five countries in 2007. If realised, the targets would result in 107 GW of installed capacity in the MENA region by 2030."

As can be seen in the movement of renewable energies in countries which are better known for exporting oil, there is high rate of targets, for example Saudi Arabia has an objective of 54 GW of renewable energy by the year 2032. A further 18 countries of the MENA members, are promoting the use of renewable energies.

At least seven of the member countries have put in place FITs, and they are being considered or developed in three NOEC. Net metering is operational in seven countries, and tax incentives, reductions of capital subsidies and other such incentives are in place for use of renewable energies in eleven member countries. This said, despite these policies being established by national governments to promote renewable energy usage, the most practised in the end was public competitive bidding for fixed quantities and public financing. More than 15 MENA members have public financing or public competitive bidding, directly or indirectly.

In many of these cases, the policies prioritise the installation of solar PV, CSP and SWH, which shows the quality of solar energy resources in the territory, and the ever lowering price of technologies. The next most favourable is wind power. However in some of the countries in the area, the constant political instability creates an obstacle in the ever increasing interest in renewable energies.

Regional Cooperation in RE

There are many regional and regionally based institutions that are interested in the development of in renewable energy in the MENA countries. These are: the International Renewable Energy Agency (IRENA), a 160-member country intergovernmental organisation with its headquarter in Abu Dhabi; the Regional Centre for Renewable Energies and Energy Efficiency (RCREEE), also based in Egypt; the Masdar initiative in Abu Dhabi; the King Abdullah City for Atomic and Renewable Energy (K.A.CARE) in Saudi Arabia; the League of Arab States, headquartered in Egypt, which carries out a series of energy activities; and the Qatar Foundation and Qatar National Food Security Programme

(QNFSP), which have programmes on renewable energy; and the Mediterranean Renewable Energy Center (MEDREC), based in Tunisia.
Renewable energies are being deploying through several initiatives. The German Federal Ministry for Environment, Nature Protection and Nuclear Safety (BMU) and the Deutsche Gesellschaft Für Internationale Zusammenarbeit (GIZ) in partnership whit a country of the Mena region have organised the Middle-East and North Africa Renewable Energy Conference (MENAREC) since 2014. The MENAREC is working to promote and strengthen regional partnerships on renewable energy development; foment the development of the most promising renewable energy technologies; make a discussion about the national renewable energy programmes of the MENA countries; and identify obstacles and barriers that so far hinder the renewable energy development in these countries and look for potential solutions.
The Mediterranean Solar Plan (MSP) started in 2008 in the framework of the Union for the Mediterranean (UfM), aims to establish an enabling policy framework for the intensify and large-scale rollout of renewable energy and energy main objectives to be achieved by 2020: developing an additional 20 GW of renewable energy production capacity, and getting significant energy savings throughout the region. The MSP and the UfM are working together with the European Union, the Arab League, the 43 member states and other stakeholders.
Also exist some private sector companies that are cooperating to promote renewable energy and renewable energy developments in the Mena region. The Desertec Industrial Initiative is one example of this cooperation. It is fully funded by the private sector and promotes the creation of energy for domestic use in Mena and for export to Europe. The technologies that they are using are solar and wind energy.
The MEDGRID consortium bet for develop a required grid infrastructure (high-voltage, direct current) to make possible the large-scale renewable energy deployment. In 2012 was created the recently launched, Renewable Energy Solutions for the Mediterranean (RES4MED) initiative. The RES4MED is a “network of networks” make to facilitate the communication among different institutional and industrial initiatives in Mena aims to analyse the required conditions for an integrated electricity market in the Mediterranean area promoting the renewable energy and its possible solutions.

Morocco
Official Institution
CDER is the institution responsible for the promotion of renewable energies. Human resources are important CDER (150 people), but its budget and very low (20 MDh operating mainly for wages, and 3 investment MAD). The only areas where the CDER means are those where BdF provide support (Promasol, steam, etc.). So far the activities of CDER remained mostly directed towards RE projects (by including COS), public and rural; CDER little work with industry.

Promasol. Bussines Plan
In 1997 was created Promasol. It is a key component of a program involving UNDP[16] and the Moroccan ministries of Agriculture, Environment, and Energy and Mines with a view to preserving environment, sustainable development, and promoting renewable energies. It aims to promote the SWHs market in Morocco. Another different programs are working for implementing solar- energy-based solutions in other fields such as hammams heating (traditional steam rooms) and rural electrification through photovoltaic systems.
A funding agreement was signed in 2001 between the UNDP and the Moroccan Ministry of Energy and Mines (MEM) and therefore Promasol was created. Its management was controlled by the Centre de Développement des Énergies Renouvelables (CDER - Centre for Development of Renewable Energies) and in the framework of cooperation between the MEM, the FGEF, the UNDP, and other partners. Its cost, which amounted to 43,270,000 US.

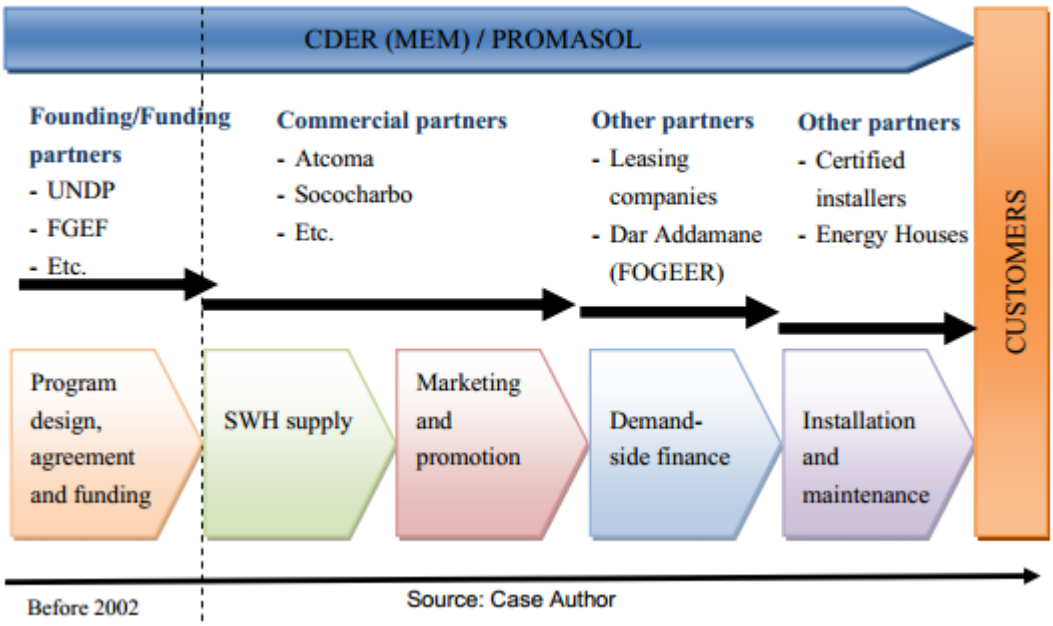
[16] United Nations Development Program

BREAKDOWN OF THE PROGRAM COSTS (2002-2008)

Cost and Funding	
FGEF	2,965,000
Co-funding	
CDER	250,000
UNDP	250,000
Government of Andalusia	400,000
National electricity office (ONE)	350,000
MOR/97/004 (UNDP-funded project on environment protection and natural resources management-Energy Section 1998-2004)	500,000
Joint funding pertaining to equipment of public and private sectors	
Contributions in kind[8] (By CDER and the MEM)	38,155,000
Local distributors	250,000
	100,000
Total cost of the program	US$43,270,000

The study case "PROMASOL: Democratizing access to Solar Water Heaters" say:
"On the supply side, and before PROMASOL started, there were only about five SWH importers and supposedly no local manufacturers in the whole country. As the program could not promote the SWH market with such a limited supply capacity, in 2005 it created a financial support mechanism known as 'Solar Industry Accompaniment' (SIA). This tool is meant to financially help industrialists with investment projects related to the local manufacturing of SWHs.
The support is twofold: first, with regard to the investment part, PROMASOL covers 20% of all expenses related to the equipment purchasing and installation; second, it pays back up to 80% of all expenses pertaining to the organization and certification of the manufacturing process.
Three local SWH producers benefited from this initial support, namely, Atcoma, Capsolair, and First Metal and, at least two new plants for manufacturing SWH were created. Three other companies were eventually added to the first three: Phototherme, Spolyten and Sococharbo.
Just about one year after this support got initiated; all beneficiaries were able to significantly increase their sales of SWH: Atcoma (15.5%); Capsolair (22%); Phototherme and Sococharbo (13%), and

ACTORS INVOLVED IN PROMASOL



Source: Case Author

Spolyten (108%)."

Tunisia
Official Institution
ANME is responsible for the conduct of the state policy in the field of renewable energy. ANME should always be responsible for the encouragement of ER state policy.
Tunisia has a regulatory arsenal encourage ER since 1985. In principle, the national and international energy context pushes strengthening and diversification of regulations on ER

Strategies
The RE strategic quantitative targets of facilities and energy savings for the years 2010, 2020 and 2030. Four main sectors are subject to genuine development proposals in the future: wind power, solar thermal, solar photovoltaic, and biogas. The 11th Plan has set slightly different objectives of the proposals of the strategic study. The objectives of the 11th Plan essentially cover four components for the whole period 2007-2011.

- Dissemination of 540,000 m^2 of solar collectors in the period.
- Installation of 155 MW wind centralized.
- Electrification of 500 households with photovoltaic cells.
- Development of biofuels sector.

Funding
The financing of the development of industries should be done in various ways, depending on the sector. As for solar, residential PROSOL is still continuing with the same recovery system credits through STEG, while loans are now provided by one local bank (in this case, Attijari Bank of Morocco which bought an existing Tunisian bank) at rates far more attractive than the usual market rates.
Note that solar water heaters are subsidized at 20%; with a ceiling of 100 dinars per m^2. Following residential PROSOL be a real change in scale of the market, and is now subject to a CDM application. Tertiary PROSOL will also be financed by the banking system, and will receive the same FNME premium rate. In addition, a contribution of UNEP (financing Italian Ministry for the Environment) will also accompany tertiary PROSOL. This contribution will be served in the form of interest subsidy on the one hand, and partial contribution to the maintenance costs of solar systems, for 4 years, on the other.
The project will also be a CDM application. The wind program STEG should be financed through external financing lines (especially Spanish), at least for the first tranche of 35 MW. In terms of the PV project; they will be financially supported by the Japanese and Spanish cooperation. For biofuels, funding arrangements are not yet arrested, but a private project oil recovery

Prosol
Prosol ('Program Solaire') is an end-user financing facility jointly developed by the Tunisian Ministry of Industry, Energy and Small and Middle Size Enterprises (MIEPME); the National Agency for Energy Conservation of Tunisia (ANME); and the United Nations Environment Programme (UNEP). Prosol was backed by the Italian-led Mediterranean Renewable Energy Program (MEDREP). Launched in April 2005, it aimed to accelerate the penetration of SWH in the Tunisian residential sector by engaging local financial institutions to provide credit lines to consumers.

Jordan
Energy Efficiency/Renewable Energy
Official Institution
Several ministries are involved in the EE / RE policies and strategies:
– Prime Minister: policy coordination.

- Ministry of Energy and Mineral Resources (Ministry of Energy and Mineral Resources - MEMR), which defines the policies in this area and oversees the various public companies in the production, transmission and distribution of energy. This Ministry has a direction of renewable energy and energy efficiency.
- The National Energy Research Center (NERC) is a public research institution and development attached to the Royal Scientific Society (RSS), whose mission is primarily to provide technical expertise to implement policies in this area.
- The Ministry of Environment supports initiatives for improving the environmental footprint of industrial production, via the Jordan Clean Production Program initiative. Furthermore, the General Secretariat of the Ministry of Environment is the Designated National Authority (DNA) under the Kyoto Protocol's flexible mechanisms. The DNA is in an establishment phase and contributes to the organization of tenders for the few CDM projects identified (mainly in the area of power generation).

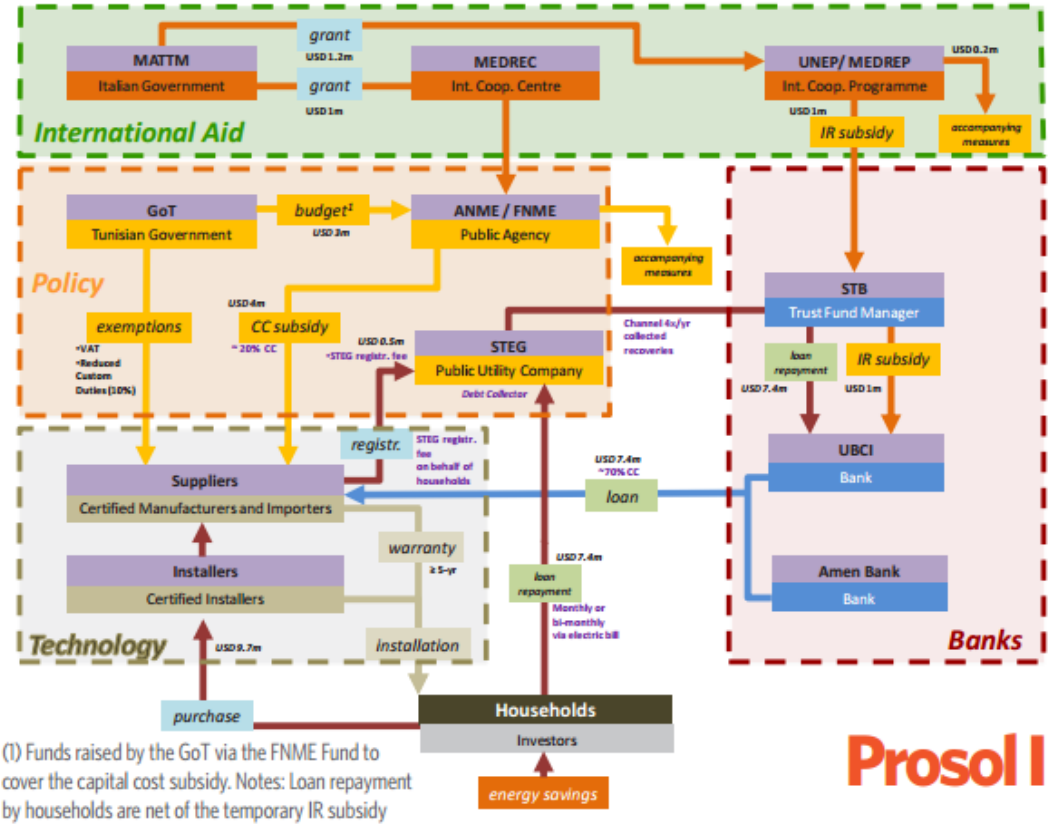
In the electricity sector, the main actors are:

- Regulatory Commission of Electricity (Electricity Sector Regulatory Commission - ERC), whose establishment dates back to 2001, following the adoption of the General Law on Electricity modified (No. 113) in 1999, especially for authority to regulate the agencies involved in the production, transmission and distribution of electricity; establish pricing methods to resolve disputes between operators and to support the liberalization of the sector.
- NEPCO (National Electric Power Company) since the reform of the network operator sector, both one buyer and one retailer to distributors. The process of the electricity sector restructuring was initiated in 1996 with the Electricity Act (Act No. 10 of 1996) and the establishment of the National Electric Power Company (NEPCO) to replace the former Jordan Electricity Authority (JEA), dating from 1967.
- CEGCO (Central Electricity Generating Company) is by far the largest producer at present, accounting for about 85% of production. The state owns 75% of CEGCO but is being sold its shares. Dubai Capital could then buy 51% of CEGCO. The ongoing privatization process covers 51% of CEGCO, IDECO 100%, 100% Samra Electric Power Generation Company, recently created to operate the plant Samra (300 MW combined cycle).
- The distribution amounts to three companies: Jordan Electric Power Company (JEPCO), a private company, Irbid District Electricity Company (IDECO) and Electricity Distribution Company (EDCO). Jordan Biogas Company is a joint venture between CEGCO and the Greater Amman Municipality (Greater Amman Municipality), intended to exploit the biogas produced by the discharge Ruseifeh.

In the mineral resources sector, may also be mentioned my following institutions:

- The Natural Resources Authority (NRA), responsible for the exploration of geological resources and issuing licenses for the exploration and exploitation of these resources.
- The National Petroleum Company (NPC) leads the exploration and exploitation of certain sites such as Risha (natural gas).
- The Jordan Petroleum Refining Company (JPRC) has a monopoly over most of the import, refining and distribution of petroleum products. However, the concession contract awarded for refining expires in 2008, which could lead to a major transformation of the refinery to match the changing demand. In addition, significant investments are also needed to improve the supply and storage system in the port of Aqaba and other strategic points.
- The Committee on Atomic Energy (Atomic Energy Commission) was created in 2001 to identify the potential of nuclear energy and to promote the transfer of civilian nuclear technology.

Figure 2. Key stakeholders involved in Prosol I and Prosol II and their linkages.



(1) Funds raised by the GoT via the FNME Fund to cover the capital cost subsidy. Notes: Loan repayment by households are net of the temporary IR subsidy served by MATTM via UNEP. Financial flows represent the sum of flows for the year 2005-2006, actualized to USD 2005.

Law

There is no specific law for EE / RE at present. However, such a law is proposed and could be published in July 2007. In the electricity sector, the Jordanian government wants to encourage the installation of independent producers (Independent Power Producers - IPP), especially in the context of BOO facilitated by the privatization law in 2000 (law No. 25).

Finalization, adoption and implementation of a law on EE & RE, within a period of 3 years (including the time required for the development and adoption of implementing legislation).

Strategies

An Energy Master Plan, prepared in 2004, defines the main elements of the country's energy policy. This plan is being revised under the direction of a National Commission on Energy (Royal Committee on Energy and Renewable Energy) designated January 29, 2007 and chaired by Prince Hamza. The new strategy will probably be available in July 2007. This strategy could set the following objectives:

- 8-10% share of renewable energy by 2020.
- 15 to 20% of energy savings on the horizon 2020 compared to the baseline scenario.

Moreover, Jordan continues with some oil companies (Shell particular) R & D projects to exploit national resources in oil shale (oil shale). This resource could be used to power electricity generation facilities totalling 500 MW according to sources.

Finalization and implementation of the revised Energy Master Plan, probably providing for a strengthening of energy production objectives from renewable sources and energy efficiency.

Funding

The Energy Master Plan 2004 provided an indicative overall financing need more than $ 3 billion for the development of the energy sector for the next 10 years, of which USD 450 million for renewable energy. The MEMR is studying the possibility of setting up a fund for the development of renewable energy and energy efficiency. This fund, whose operational modalities are being studied (the end of the study is scheduled for September 2007), could benefit from a donation from the GEF, as well as revenue from a tax on the sale of electricity.
Initially intended to finance rural electrification. As part of the rural electrification project started in 1992, it was expected that a "son" (or 0.01 JD) -then two from 1997- collected on each kWh sold or assigned to electrification rural areas. It is generally accepted today that the majority of target regions are now largely electrified.
Establishment of the national fund for renewable energy and energy efficiency, from the end of 2007.

Renewable Energy
Official institution
The MEMR is responsible for the promotion of renewable energy, and has a dedicated department and the support of NERC.

Law
Specific legislation is being drafted. Furthermore, the next electricity law could also integrate support mechanisms for renewable energy.
Adoption and implementation of the future law on energy efficiency and renewable energy, in preparation.

Strategies
Jordan has conducted several studies on the development of renewable energy for 15 years. The authorities have recently announced the goal of reaching 3% of energy consumed from renewable sources by 2015. This goal, seen as ambitious by most observers will be achieved mainly through the development of wind energy. The necessary investments could amount to USD 450 million, according to national strategy for 2004.
The national energy strategy is currently under review by the authorities. Renewable share targets could be worn up to 10% by 2020 as part of the new strategy. So far, Jordan has received a grant from the World Bank (from a Japanese funds) of about US $ 1 million for four studies on the development of renewable energy, on the following aspects:

- Potential development of wind energy, geothermal potential.
- Opportunities offered by renewable energy in industry.
- Study of barriers to renewable energy development in Jordan.

This latest study, conducted by the firm Lahmeyer, was completed in late 2006. It is expected to provide elements of a possible law on renewable energies. For now, thinking about how to improve the competitiveness of renewable energy was launched as part of this work (the national authorities have ruled out the possibility of establishing a feed-in tariff). Among the measures envisaged by the authorities include:

- Provision of land by the State (not feasible when the land is private).
- Development of the amortization period.
- Support for the network connection by State
- Granting subsidized loans (this aspect may encounter implementation difficulties since the State generally provided subsidized loans for social programs)
- Sale of carbon credits.

Funding
The funding of renewable energy projects and energy efficiency in Jordan is provided in part by international donors for innovative projects (biogas from waste, for example) and national commercial banks. Possible establishment of a fund dedicated to the development of renewable energy and energy

efficiency could provide financial support for RE projects, for example through the provision of subsidized loans, or other study grants support.

1.3 Different Technologies used in MENA countries and their applications

SOLAR ENERGY

SOLAR WATER HEATING

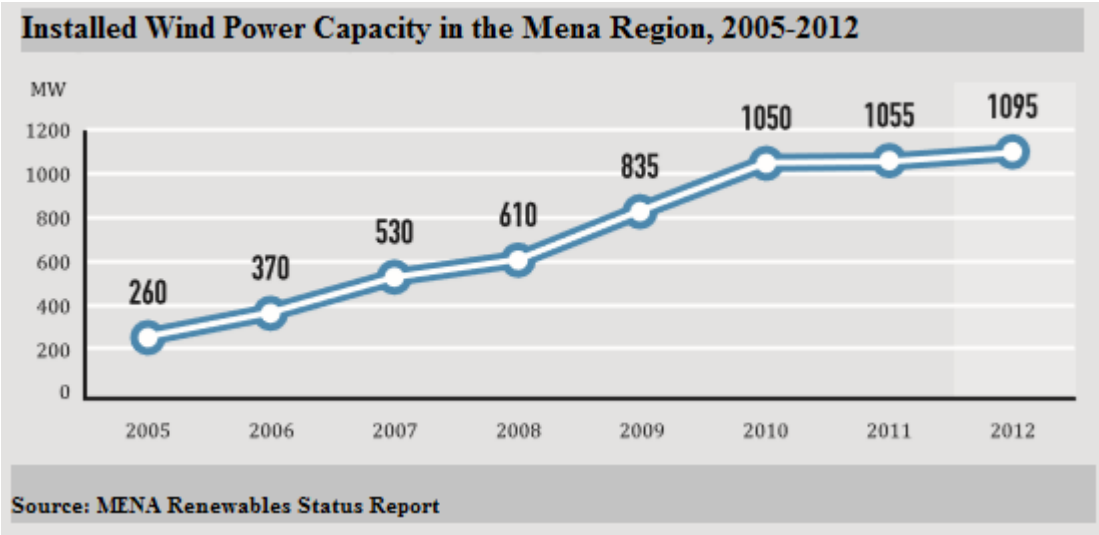
Solar Water Heating Installed Capacity in the Mena Countries

		Total Capacity (MW_{th})	Total Collector Area (m^2)
NOEC	Algeria (2012)	0.21	300
	Egypt (2012)	525.0	750,000
	Libya (2012)	0.021	30
	Syria (2010)	420.0	600,000
NOIC	Israel	2,917.8	4,168,245
	Jordan (2012)	350.0	500,000
	Lebanon (2012)	245.0	350,000
	Malta (2011)	35.952	51,360
	Morocco (2012)	245.0	350,000
	Palestinian Territories (2012)	1,120.0	1,600,000
	Tunisia (2012)	437.5	625,000

Source: MENA Renewables Status Report

CONCENTRATED SOLAR PLANTS

WIND ENERGY



1.4 Business and future possibilities

According to Bloomberg New Energy Finance (BNEF), in 2012 new investment in renewables in the MENA region was USD 2.9 billion, an increase of almost 40% over 2011 and a 6.5-fold increase compared to 2004. Between 2011 and 2012 the regional investment increase was due largely to new projects in Morocco owned by the Saudi Arabian project developer, investor, and operator ACWA Power International, which included the 160 MW capacity CSP plant at Ouarzazate, valued at USD 1.16 billion.

World Bank financed also this project through the Climate Technology Fund (one of the Climate Investment Funds). At Tarfaya in Morocco there is a 300 MW wind farm that also obtained debt financing, 563 millions from the Banque Centrale Populaire and the Attijariwafa Bank and the same from Nareva Holdings SA. This project is being developed by the Moroccan company Nareva Holdings SA and International Power plc.

Some oil and gas companies have entries in the solar market. Over the last three years, Saudi Aramco, Saudi Arabia's oil and gas company, financed either entirely or partially (with the King Abdullah Petroleum Studies and Research Center in the case of the Riyadh plant) three solar PV projects in the Kingdom for a total of at least 17 MW installed capacity.

Another international oil and gas companies such as France's Total SA has a 20% stake in the world's largest CSP plant in operation. The UAE's 100 MW Shams 1 project and Royal Dutch Shell plc, through its Japanese subsidiary Showa Shell Sekiyu KK, financed the development of the 0.5 MW Farasan Island PV plant in Saudi Arabia and it is valued at USD 765 million.

There are more companies interesting in increasing their renewable energy activities, not only the oil and gas ones. For example, Electricité de France SA (EdF), the world's largest electric utility company, invested in the development of an 18 MW solar PV power plant in Israel about USD 72 million. Abengoa, a Spanish company has a 20 % stake in Abu Dhabi's Shams 1 project.

Investments in wind power are led mostly by national companies and renewable energy authorities. Somelgaz financed the development of a 10 de l'Electricité et du Gaz (STEG) and the development of a 34.3 MW wind farm in Sidi Daoud, Tunisia. Egypt's New and Renewable Energy Authority (NREA) has get from a consortium of banks to develop the 200 MW NREA and KfW Gulf of El Zeit Wind Farm about USD 455.5 million.

The Renewable Energy Authority of Libya (REAOL) announced that it would finance Phase I of its planned 120 MW wind farm in Darnah with the first 60 MW currently under preparation and with a

disclosed value of USD 127 million. Political instability in the region was not a biggest problem for the renewable energy.
The sector was growing since 2009 although that happens and the lack of comprehensive renewable energy policy frameworks and incentive schemes continue to remain barriers to investment. Egypt, Libya, and Tunisia saw declining investment following the Arab Spring and due to the scarcity of stable, long-term transparent policies. Energy subsidies for fossil fuels is a key challenge, mostly in net-oil exporting countries, as they change the energy markets by negatively affecting the price competitiveness of renewable energy sources. Government investment and finance from development banks continue to dominate in the region.

Public and Private Investments
Some banks, including the World Bank Group are supporting different programmes of investment in renewable energy cooperating with government ministries and publicly owned electricity generation companies.
However the public sector investment has dominated so far. But the potential opening of the electricity markets is reflected in new liberalisation policy proposals in recent years and in the opportunities for off-grid energy projects. These are widening the scope for private-sector participation.
How the private households and enterprises are particularly important in the significant development of SWH in the region, as well as in developing off-grid solutions for small communities and farmers, as well as for irrigation and water desalination is clear. In 2012, for example, private investments created the German renewable energy project in Egypt. The installation in the rural Wadi El Natrun includes a 50 kW PV system, four small wind turbines, and provide water for irrigation is another example.

New Investment in Renewable Energy, by Country, 2009-2012 (Million USD)

	2009	2010	2011	2012
Algeria	—	—	33	—
Bahrain	—	—	—	—
Egypt	—	923	—	—
Iran	—	—	—	136
Iraq	103	—	—	—
Kuwait	—	—	—	—
Libya	—	132	—	—
Oman	—	—	—	—
Qatar	—	—	—	—
Saudi Arabia	—	15	47	22
Syria	—	—	—	—
UAE	52	20	843	—
Yemen	—	—	—	—
Total NOEC	155	1,091	923	158
Djibouti	—	—	—	—
Israel	263	355	830	814
Jordan	—	—	—	—
Lebanon	—	—	—	—
Malta	—	—	—	—
Morocco	—	8	309	1,898
West Bank & Gaza	—	—	—	—
Tunisia	57	—	—	—
Total NOIC	320	363	1,139	2,712
Total MENA	474	1,454	2,062	2,870

Source: MENA Renewables Status Report

1.5 Future projects with Renewable Energy

Some Arab States around the Persian Gulg have expressed interest in developing ambitious projects in the future. For example, Saudi Arabia's project to produce the country's annual demand for electricity from solar farms by 2020. It is consider unrealistic by many commentators. Kuwait which has recently set the target of generating 10% of its electricity from sustainable sources by 2020 too. And UAE has a target of 7% of its electricity production from renewable sources.

All the 21 Mena countries, including two subnational jurisdictions have policy targets for renewable energy. Some targets are for shares of total primary or final energy supply, heat supply, total amount of energy production from renewables, or installed electric capacities of specific technologies. Most targets are for the years between 2020 and 2030.

The region has significant developments in 2012 as eleven countries introduced new policy targets. We can see this increasing momentum in the NOEC, all but three new targets were in these countries. Egypt approved in July 2012 the Egyptian Solar Plan that set a target for 2,800 MW of CSP and 700 MW of solar PV by 2027. In Iraq announced a target of 400 MW of wind and solar capacity by 2016. Saudi Arabia will produce 25 GW of CSP, 16 GW of PV, 9 GW of wind, 3 GW of waste-to-energy, and 1 GW of geothermal by 2032 (representing 20% of total electricity production). Qatar want a 2% renewable electricity by 2020 and introduced a plan to add 640 MW of solar PV by 2020.

In Yemen are working to get 400 MW of wind energy installed and 6 MW of biomass capacity as they set in 2009 in its National Renewable Energy and Energy Efficiency Strategy, which aims to produce 10–15% power generation from renewables by 2025. In 2012, Libya set a plan that includes a gradual increase in its renewable electricity target from 3% by 2015 to 7% by 2020 and 10% by 2025. Kuwait and Oman have the same goal. Their targets are focused on the creation of 10% of the electricity generation from renewables, by 2030 in Kuwait and 2020 in Oman.

In the NOIC countries, the Palestinian Territories set a target of 10% renewable share of electricity generation by 2020 as well as capacity targets. Lebanon will produce 40 MW of hydro, 15–25 MW of biogas, and 60–100 MW of wind capacity by 2015. Djibouti announced a target of 100% renewable energy by 2020 even when it had no renewable energy production in 2009. Taken together, the targets indicate an additional capacity of more than 50 GW by 2020 and 107 GW by 2030. This compares with non-hydro renewable energy capacity of some 1.7 GW at present, and indicates the scale of the region's renewable energy ambitions.

Sidebar. Saudi Arabia's large-scale renewable energy plan:

Saudi Arabia has the biggest plan for renewable energy in the world. According to the "MENA Renewables Status Report", Saudi Arabia wants:

"In 2012, Saudi Arabia unveiled its ambitious renewable energy capacity targets: 25 GW of CSP, 16 GW of solar PV, 9 GW of wind, 3 GW of waste-to-energy, and 1 GW of geothermal by 2032. In February 2013, the country released a White Paper detailing the proposed competitive procurement process of its K.A.CARE programme. Over the next two or three years, the programme plans three tendering rounds: the introductory round, then the first and second procurement rounds.

Together, they will account for about 7 GW of renewable energy projects. In the introductory bidding round, scheduled for the first half of 2013, K.A.CARE is targeting 500–800 MW of renewable energy projects. In the first round, it is targeting 2–3 GW of renewables capacity, of which 1,100 MW will be solar PV and 900 MW CSP, and in the second round, it is targeting 3–4 GW of renewables capacity, of which 1,300 MW will be solar PV and 1,200 MW CSP. The timing for the sequential rounds after the introductory round will be determined based on the length of each preceding round. It is expected that a single procurement round will last between six and 10 months.

Although these plans are well under way, they are not included in this section as projects in the pipeline due to the fact that the tenders have not yet been launched. Nevertheless, once these projects come on line they will significantly affect the dynamics of renewable energy markets in the region. By 2030, Saudi Arabia is expected to become not only the leader of the MENA countries in terms of renewable energy capacity, but also a major player in the world. In addition, the multiple impacts of this plan are not limited to Saudi Arabia's borders. Over the next few years, the region's renewable

energy landscape is expected to change significantly, with NOEC taking the lead. Although the figures for projects in the pipeline provided in this section indicate the NOIC as leaders today, there are clear signs that political momentum in favour of renewables."

Overall Renewable Energy Share Targets in the Mena Countries

		Renewable Energy Targets and Target Dates
NOEC	Algeria	6% of electricity generation by 2015; 15% by 2020; 40% by 2030, of which 37% is solar (PV and CSP) and 3% is wind
	Bahrain	5% by 2020
	Egypt	20% of electricity generation by 2020, of which 12% is wind
	Iran	—
	Iraq	2% of electricity generation by 2016
	Kuwait	5% of electricity generation by 2020; 10% by 2030
	Libya	3% of electricity generation by 2015; 7% by 2020; 10% by 2025
	Oman	10% by 2020
	Qatar	At least 2% of electricity generation from solar by 2020
	Saudi Arabia	—
	Syria	—
	UAE	Dubai: 5% of electricity by 2030; Abu Dhabi: 7% of electricity generation capacity by 2020
	Yemen	15% of electricity by 2025
NOIC	Djibouti	30% of rural electrification from solar PV by 2017 100% renewable energy by 2020
	Israel	5% of electricity generation from renewables by 2014; 10% by 2020
	Jordan	7% of primary energy by 2015; 10% by 2020
	Lebanon	12% of electrical and thermal energy by 2020
	Malta	10% of final energy from renewables by 2020; 14% of electricity by 2020; 6% of heating and cooling by 2020; 11% of transport by 2020
	Morocco	42% of installed power capacity by 2020
	Palestinian Territories	25% of energy from renewables by 2020; 10% (or at least 240 GWh) of electricity generation by 2020
	Tunisia	11% of electricity generation by 2016; 25% by 2030; 16% of installed power capacity by 2016; 40% by 2030.

Source: MENA Renewables Status Report

Renewable Energy Capacity Targets by Technology in the Mena Countries

		Solar		Wind	Biomass, Geothermal, and Hydro	TOTAL
		PV	CSP			
NOEC	Algeria					
	by 2013	6 MW	25 MW	10 MW	—	41 MW
	by 2015	182 MW	325MW	50 MW	—	557 MW
	by 2020	831 MW	1,500 MW	270 MW	—	2,601 MW
	by 2030	2,800 MW	7,200 MW	2,000 MW	—	12,000 MW
	Bahrain	—	—	—	—	—
	Egypt					
	by 2020	220 MW	1,100 MW	7,200 MW	—	8,520 MW
	by 2027	700 MW	2,800 MW	—	—	10,700 MW
	Iran					
	by 2013	—	—	1,500 MW	—	1,500 MW
	Iraq					
	by 2016	240 MW	80 MW	80 MW	—	7,700 MW
	Libya					
	by 2015	129 MW	—	260 MW	—	389 MW
	by 2020	344 MW	125 MW	600 MW	—	1,069 MW
	by 2025	844 MW	375 MW	1,000 MW	—	2,219 MW
	Kuwait					
	by 2030	3,500 MW	1,100 MW	3,100 MW	—	7,700 MW
	Oman	—	—	—	—	—
	Qatar					
	by 2020	640 MW		—	—	640 MW
	Saudi Arabia					
	by 2022	17,350 MW		6,500 MW wind/waste-to-energy/geothermal		23,850 MW
	by 2032	16,000 MW	25,000 MW	9,000 MW	3,000 MW waste-to-energy 1,000 MW geothermal	54,000 MW
	Syria					
	by 2015	45 MW	—	150 MW	—	195 MW
	by 2020	380 MW	—	1,000 MW	140 MW biomass	1,520 MW
	by 2025	1,100 MW	50 MW	1,500 MW	260 MW biomass	2,910 MW
	by 2030	1,750 MW	—	2,000 MW	400 MW biomass	4,200 MW
	UAE	—	—	—	—	—
	Yemen					
	by 2025	4 MW	100 MW	400 MW	6 MW solid biomass; 200 MW geothermal	710 MW
NOIC	Djibouti	—	—	—	—	—
	Israel					
	by 2020	1,750 MW		800 MW	210 MW biogas and biomass	2,760 MW
	Jordan					
	by 2020	300 MW	300 MW	1,200 MW	—	1,800 MW
	Lebanon					
	by 2015	—	—	60–100 MW	15–25 MW biogas; 40 MW hydro	115–165 MW
	by 2020	—	—	400–500 MW	—	455–565 MW
	Malta					
	by 2020	28 MW	—	110 MW	7 MW biogas; 15 MW solid biomass	160 MW
	Morocco					
	by 2020	2,000 MW		2,000 MW	2,000 MW hydro	6,000 MW
	Palestinian Territories					
	by 2020	45 MW	20 MW	44 MW	21 MW solid biomass	130 MW
	Tunisia					
	by 2016	140 MW	—	430 MW	40 MWsolid biomass	610 MW
	by 2030	1,500 MW	500 MW	1,700 MW	300 MW solid biomass	4,000 MW

2. RE Training and courses in Mena Countries

In the following pages there is a database of universities that impart any course or degree in relation with renewable energy. The database is from some countries in the Mena region. It is made from a website that offers a list of universities (webometrics.com). People have to know that it is not completely accurate, due to some points: maybe the website have not all the universities in the country, some pages are only in Arabic and I could not find any information, some universities have the website in English or French but they are incomplete, etc. This database is made to compare the training situation between different countries and between this region and Europe. The European one is only a sample from the region Andalusia in the south of Spain.

2.1 Universities which study in RE in Mena Countries

Jordan

Al-Hussein Bin Talal University

Renewable Energy Research and Development Center

The center was created to increase the public awareness about the importance of utilizing the renewable energy and to offer studies, consultancy and solutions in the field of renewable energy, energy efficiency and management.

Middle East University of Amman

Faculty of Engineering

This Faculty has a Department of Renewable Energy Engineering but its website is under construction and I cannot find more information about it.

American University of Madaba

Faculty of Engineering

Electrical Engineering (Bachelor Degree)

This degree contains a course called "Energy Conversion System". This course examines energy classification sources including renewable energy power plants.

Algeria

Kasdi Merbah University of Ouargla

Faculty of Hydrocarbons, Renewable Energy and Earth Sciences.

Renewable Energy (Master Degree)

More information about was not found. In the website appears only the call for the inscription.

Djillali Liabes University of Sidi Bel-Abbès

Faculty of Technology

Electrical Engineering (Bachelor Degree)

Renewable Energy is one the fields of study offered in this degree.

Polytechnic Military School

Faculty of Engineering

Electrical Engineering (Bachelor Degree)

In the first year of this degree there is a subject about Renewable Energy specialized in wind and photovoltaic energy and fuel cell.

Bahrain

Information has not been found.

Egypt

Helipolis University for Sustainable Development

Faculty of Engineering and Technology

Energy Engineering (Bachelor Degree)
Energy engineers are prepared to work in the following fields: power station industries, production lines, process industry, wind farms, photovoltaic industry and its utilities, general industries and entrepreneurship.

Cairo University
Faculty of Engineering
New and renewable energy (Course)
I have found this course in a course list but I could not find which degree it belongs.

Ain Shams University
Faculty of Engineering
Electrical Engineering (Bachelor Degree)
In the second year it has a subject called "Energy Conversion" where they study about renewable methods of energy conversion such as solar energy, solar cells, batteries or wind-energy generators.

Irak
Information has not been found.

Iran
Tarbiat Modares University
Faculty of Electrical and Computer Engineering
Power Engineering (Master Degree)
It contains a course based in Renewable Energy.

Shahid Beheshti University
They had a Conference on Renewable Energy in September 9-10, 2014. It was the first joint Germany-Iran. Its slogan was "Technology Driven Innovation-Advancing the World through strategic partnerships".

Materials and Energy Research Center
Ministry of Science, Research and Technology
The Department of Energy is actively engaged in investigations in the areas of renewable energies such as solar, wind, bioenergy, and other similar energies and their substitution for fossil fuels. The department, also, investigates the methods of improving fuel consumption efficiency, reduction of environmental pollutant caused by consuming fossil fuel and other fields relevant to the energy environment.
It has the following laboratories:
-Energy conversion and Storage Lab.
-Solar Energy Lab.
-Energy and Environment Lab.
-Biodiesel Lab.
-Environmental Biotechnology Lab.
-Chromatography Lab.
-Environmental Catalysts and Adsorbents Lab.

Israel
Ben-Gurion University of Negev
Albert Katz International School for Desert Studies
Desert Studies (Master Degree)
This master is about Agriculture and Biotechnology for Sustainable Development, Ecology of

Drylands, Solar Energy and Environmental Physics, Irrigation and Plant Environment, Environmental and Aquatic Microbiology and Environmental Studies.

Holon Institute of Technology
Faculty of Engineering
Electrical and Electronics Engineering (Bachelor Degree)
It contains any subject about renewable energy but I could not find the study plan.

AFEKA Tel-Aviv Academics
College of Engineering
Energy Engineering (Master Degree)
The subjects of the master are about producing energy of its classic and renewable sources, converting it to electrical energy, transporting and distributing energy among consumers and consumption of energy by the end users.

Kuwait
Information has not been found.

Lebanon
Lebanese University
Faculty of Engineering
Renewable Energy (Master Degree)
It studies about generation of electrical and thermal energy from renewable sources.

Saint-Esprit de Kaslik University
Faculty of Engineering
Electrical and Electronics Engineering (Bachelor Degree)
Electrical and Electronics Engineering (Master Degree)
The electrical and electronics engineer will be able to work in the following areas:
-Industrial production.
-Production and distribution of electric energy.
-Smart home automation
-Renewable energy (production of "clean" energy)

Beirut Arab University
Faculty of Engineering
GR.ENE.CO Green Energy for Green Companies
Green Energy for Green Companies is a project that aims to contribute to the reduction of the use of non-renewable energy sources especially for the farm industry- in favour of renewable energy sources in the Mediterranean Sea basin.

Libya
Information has not been found.

Qatar
Information has not been found.

Morocco
Mohammed V University of Rabat.
School of General Technology
-Energy Efficient Construction (University Technology Diploma. DUT)

At the end of the training, beneficiaries will be able to:
- To make technical energy audit and management of energy in building.
- Correction of sound insulation of a building
- Techniques related to sizing photovoltaic installations.

Cadi Ayyad University of Marrakech
Semlalia Science Faculty
-Energy Efficiency and Renewable Energy (Bachelor Degree)
In this course they offer some subjects in relation with solar and wind energy and energy efficiency in some aspects of the Engineering.
-Energy and Environment (Master)
Master specialized in how to produce energy trying to care of the environment as much as possible.

Mohammed Premier University
School of Technology (Oujda)
Electric Engineering/ Renewable energy (University Technology Diploma. DUT)
In this university you can study electric engineering having a specialization in renewable energy through some elective subjects.

Science Faculty (Oujda)
Renewable Energy (Bachelor Degree)
Renewable Energy (Master Degree)
This master and degree are a new option to have a completed training in renewable energy sector.

Hassan II University of Casablanca
Aïn Chock Science Faculty
Solar and Wind Energy (Bachelor Degree)
The objectives of this formation are to educate high technicians specialized in renewable energy and energy efficiency, particularly in solar and wind energy and mixed technicians.
Renewable Energy and Energetic Systems (Master)
This training was designed to meet three requirements:
- Cover a national trade demand in emerging sectors: renewable energy
- Responding to political and economic goal of reducing the invoice oil from Morocco through diversification of energy resources
- Contribute to the protection of the environment by reducing CO2 emissions.

Al Akhawayn University (Ifrane)
School of Science and Engineering
Sustainable Energy Management (Master Degree)
This master's program focuses on renewable energy production, transformation, distribution and management.

Abdelmalek Essaadi University
Science Faculty (Tetuan)
Energy (Bachelor Degree)
It is based in energy production from renewable and non-renewable sources.
Energy and Environment Engineering (Master)
The master contains courses that are grounded in sustainable energies such as photovoltaic, thermal solar, wind energy, biomass, etc.

Applied Sciences National School (Tanger)
Eco-Energy and Industrial Environment Engineering (Bachelor Degree)

Sidi Mohamed Ben Abdellah University of Fes
Technology School
Thermal and Energy Engineering (University Technology Diploma. DUT)
This program studies the importance of the energy in our world and regretting that is very important to bet on renewable energy sources.

Dhar El Mehraz Science Faculty
Energy (Bachelor Degree)

Hassan II University of Mohammedia-Casablanca
Technic and Science Faculty (Mohammedia)
Renewable Energy and Energy Efficiency (Advanced Cycle Diploma. DCA)
It is focused on sustainable energy sources for energy generation, transmission and conversion.

Ibn Zohr University of Agadir
Science Faculty (Agadir)
Materials, Energy and Environment Engineering (Master Degree)
It contains some subjects about renewable energy sources.

Multidisciplinary School (Ouarzazate)
Renewable Energy Operating Techniques (Bachelor Degree)
It is a new and modern bachelor about the differents techniques used for operating renewable energy, such as wind power, solar energy, etc.

Hassan I University
Applied Sciences National School (Khouribga)
Energy Process and Environment Engineering (Bachelor Degree)
It is bases on the different process that are necessary for generation of energy.

Technology School (Berrechid)
Industrial and Renewable Energy Engineering (University Technology Diploma. DUT)
It is an industrial engineering with a specialization in Renewable energy.

International University of Rabat
Energy Engineering School
Energy and Renewable Energy Engineering (Bachelor Degree)
Different kinds of energy generation, renewable and the classic ones, are studied in this degree program.

Hassan I University of Settat
Science and Technology Faculty
Energy Efficiency, Renewable Energy and Geothermal Energy (Bachelor Degree)
Electro technology and Renewable Energy Technology (Bachelor Degree)

Sultan Moulay Slimane University of Béni Mellal
Multidisciplinary School
Renewable Energy (Bachelor Degree)
This bachelor is focused in renewable energy generation.

Moulay Ismaïl University
Technology School (Meknès)

Renewable Energy and Energy Efficiency (Bachelor Degree)
The courses of this degree program study the importance of renewable energy use and energy efficiency.

Private University of Fes
Engineering Science Faculty
Renewable Energy (Bachelor Degree)
They do not offer information about.

Private University of Marrakech
Renewable Energy Engineering (Bachelor Degree)
In this degree there are some subjects about the generation, commercialization, promotion and impact of renewable energy.

Oman
Sohar University
Faculty of Engineering
Electrical and Informatics Engineering (Bachelor Degree)
It contains a subject in the area of Renewable and Sustainable Energy.

Caledonian University College
College of Engineering
Electrical Power Engineering (Bachelor Degree)
In the last year of this studies you can choose a subject that is intended to cover alternative sources of electrical energy sources such as solar thermal, solar photovoltaic, wind, biomass and waves.

Palestina
An-Najah National University
Faculty of Engineering and Information Technology
Electrical Engineering (Bachelor Degree)
Elective course based on Renewable Energy System Power is offered in the course description of this degree.

Islamic University of Gaza
Faculty of Engineering
Electrical Engineering (Bachelor Degree)
It has a subject called “Renewable Energy Fundamentals” based on basics of solar and wind energy, components of solar and wind energy systems and their sizing, design of solar and wind energy models and other renewable energy sources.

Qatar
Information has not been found.

Saudi Arabia
University of Tabuk
College of Engineering
Electrical Engineering (Bachelor Degree)
It has some subjects in the field of Renewable Energy such as Renewable Energy Systems, Renewable Energy Sources and Smart Grids. This topic is also studied in another different subjects like Energy Conversion and Generalized Machines Theory.

Jazan University

Faculty of Engineering
Electrical Engineering (Bachelor Degree)
They offer a subject in the last year of studies called Renewable Energy.

Prince Mohammad Bin Fahd University
College of Engineering
Electrical Engineering (Bachelor Degree)
As you can read in its website, one of the tracks of this degree is that the electrical power engineers have career opportunities in renewable energy, but I cannot find more information about it or the study plan of this degree.

Syria
Higher Institute for Applied Sciences and Technology
Research and Development in HIAST
They have some research activities. The renewable energy projects include:
-Building the wind and solar atlas related to the Syrian Araba Republic.
-Studying, analysing and comparing the different features of the mechanic materials.
-Improving the raw model performances related to solar energy investment.

Tunisia
Free Universty of Tunisia
Private Polytechnic Institute
Electrical Engineering (Bachelor Degree)
It has a subject of "New and Renewable Energies" in the fifth semester. This course is of 3 credits.

ISET Technology Studies Institut of Gafsa
Electrical Engineering (Bachelor Degree)
It contains a subject called "Electrical Networks" based on distribution and uses of electricity, energy economy and renewable energy, theoretical and laboratory training.

Private Mediterranean Polytechnic School of Tunis
Climatic and Energy Engineering (Bachelor Degree)
In this degree there are some subjects about the influence, commercialization, promotion and impact of renewable energy.

Technologic Institut of Gabès.
Electrical Engineering (Bachelor Degree)
This training covers:
-Basic education (mathematics, physics, English, communication and corporate culture)
-Electrical engineering (renewable energy, electrical and electronics engineering)
-IT industrial systems (industrial networks, automatism)

ESPITA Private School of Engineering
Electrical Engineering (Bachelor Degree)
This degree offers a fourth year of specialization. One branch that is offered is electrical systems and renewable energy.

Turkey
Istanbul Technic University
Institute of Energy
Research institute that hosts a Renewable Energy Department conducting theoretical and applied studies.

Sakarya University
Faculty of Engineering
Electrical and Electronics Engineering (Bachelor Degree)
It contains as elective course “Renewable Energy Sources”.

Erciyes University
Faculty of Engineering
Energy Systems Engineering (Bachelor Degree)
It study about Renewable Energy in some subjects such as Introduction to Energy Engineering, Renewable Energy Sources or Plumbing.
Energy Systems Engineering (Master Degree)
It contains some courses specialized in Solar Energy, Biomass and Conversion Technologies and Hydrogen Energy Technologies.

Mersin University
Faculty of Engineering
Electrical and Electronics Engineering (Bachelor degree)
It have a subject about photovoltaic systems and its objectives are having the students ability to understand concepts of stand-alone and grid-connected photovoltaic systems operation whit applications.

Adnan Menderes University
Faculty of Engineering
Electrical and Electronics Engineering (Bachelor Degree)
It has a course based on Renewable Energy Sources.

Trakya University
Faculty of Engineering

This car was presented in TÜBITAK in Izmit Körfez circuit on 17th of August in 2014. It is a solar car named “Pehlivan” that is designed by our engineering students joined to contest for the first time as it came in third position among 20 solar cars.

United Arab Emirates
Masdar Institute
Electrical Power Engineering EPE (Master Degree)
EPE covers subjects related to integration of renewable energy to power systems, power electronics applications and experimental design, power system stability and control, dynamic systems, control

and optimization techniques in power systems.

Birla Institute of Technology
Offshore Campus (Ras al Khaimah)
Electrical and Electronics Engineering (Bachelor Degree)
It is related to some different fields including energy generation with renewable sources.

Yemen
British University in Yemen
Faculty of Engineering and Computing
Electrical Engineering and Renewable Energy (Bachelor Degree)

2.2 Universities whit studies in RE in Europe
Like we said before, the next database is just a sample from a European region. This region is Andalusia in the south of Spain in the Iberian Peninsula. Andalusia has been a traditionally agricultural region, compared to the rest of Spain and the rest of Europe. Andalusia's interior is the hottest area of Europe, with cities like Cordoba and Seville averaging above 36º C in summer high temperatures. This region has the perfect climatic conditions for developing renewables energies in it like all the Mediterranean basin.

Andalusia (Spain)
University of Sevilla
Technic School of Engineering
Energy Engineering (Bachelor Degree)
It contains many subjects in reference whit the renewable energy and energy efficiency as solar energy, solar energy in construction, biomass, geothermal, etc.
Industrial Technology Engineering (Bachelor Degree)
Inside of the Electrical engineering Department there is a subject about “Integration of Renewable Energy” where they study renewable power plants and a comparison of them with the non-renewable ones.
Electric Energy Systems (Master Degree)
It has an elective subject called “Introduction of Renewable Energy in Electrical Systems”.
Thermal Energy Systems (Master Degree)
They study solar energy in low and high temperatures, energy efficiency in construction, renewable energy such as gas turbine, cogeneration, etc. Some of them are elective subjects and other are obligatory.
Smart Grid and Energy Transport (Master Degree)
It provides a high qualification specialized in smart cities technology, smart grid, renewable energy, smart transport, automation, energy efficiency, waste, efficient vehicles, new materials, etc.

University of Huelva
Technic School
Energy Engineering (Bachelor Degree)
As at University of Seville they study a lot of subjects about renewable energy including solar energy, wind energy, biomass, etc.

University of Malaga
School of Engineering
Electrical Engineering (Bachelor Degree)
It has an elective subject about “Integration of Renewable Energy in the electric grid”.
Energy Engineering (Bachelor Degree)

The goal of this career is to learn the fundaments of energy technology and systems to transform them into mechanic, thermal or electrical energy emphasizing in a sustainable and efficient energy use.
Industrial Technology Engineering (Bachelor Degree)
It contains an elective subject called "Renewable Energy" where the study the fundaments of this technology.
Smart Grid and Energy Transport (Master Degree)
The same as in University of Seville, they work together.
Electrical Energy Systems (Doctorate Degree)
It research topics are: electric power systems, monitoring and control of power systems, transitory regime and stability in power systems, integration of renewable energies in the electric grid, electricity markets, electrical machines and drives.

University of Cordoba
Polytechnic School of Córdoba
Electrical Engineering (Bachelor Degree)
It study the application of renewable energy in an elective subject.

Polytechnic School of Belmez
Energy and Mines Resources Engineering (Bachelor Degree)
The objective in this degree is to know the energy and mines resources and how to work with them.

University of Jaen
Polytechnic School of Linares
Energy Engineering (Bachelor Degree)
The Energy Engineering is about study the different energy sources, conventional, renewable and nuclear.

Postgraduate Studies Centre of Jaen
Renewable Energy (Master Degree)
This master provides of a technic formation in renewable technologies of energy production, specialized in photovoltaic energy and biomass.
Photovoltaic Energy System Technology (Master Degree)
This course studies all the different applications of photovoltaic energy such as stand-alone, grid-connected, pumping and another aspects, for example the business possibilities of this technology.

Energy and Environment Studies Centre of Jaen
Renewable Energy (Doctorate Degree)
The goal of this course is maximizing the energy studies and its influence in the environment, renewable energy development and research.

International University of Andalusia.
Technology Centre of Malaga
Photovoltaic Energy Systems (Master Degree)
It studies the different application of photovoltaic energy, similar to the study plan of the same master in Jaen.

University of Cádiz
School of Engineering of Algeciras
Renewable Energy (Master Degree)
In this master they study the fundaments of Renewable energy and its different uses and applications.
Industrial Technologies Engineering (Bachelor Degree)

In this studies you will have some subject as “Power Plants” where you will study the basics of renewable plants.

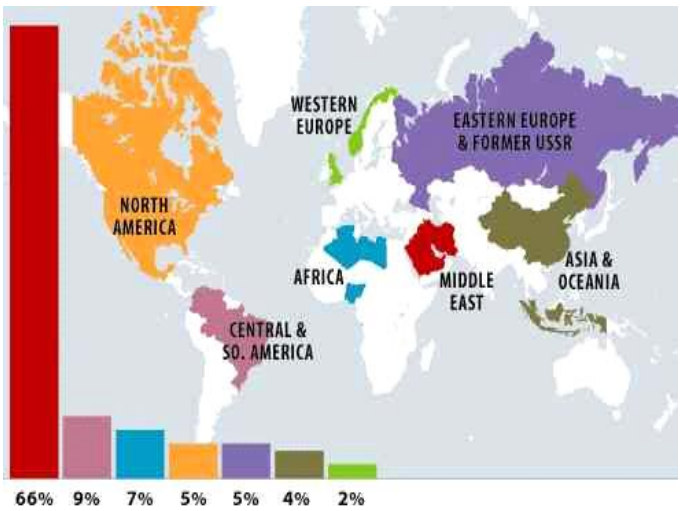
School of Engineering of Cádiz
Industrial Technologies Engineering (Bachelor Degree)
In this studies you will have some subject as “Power Plants” where you will study the basics of renewable plants.

University of Almeria
Polytechnic School
Electrical Engineering (Bachelor Degree)
In this university they have this degree with a specialization in Renewable Energy in the last year. This module of this studies has 30 credits.

Comparison

- **Mena Countries VS Europe**

In this part we proceed to compare the situation of Renewable Energy studies in Europe and MENA countries. Only with a fast search in google you can realise how different is it. When you write in google “universities with RE studies in Europe” you find 105.000.000 results and when you put “universities with RE studies in Mena countries” you have 18.500.000 results. This is only an advance of what is happening.
Checking our data base of universities the difference is abysmal. The data base of Andalusia is only a representation of the situation in Europe, but looking in the Andalusian universities websites we have found eight of ten universities which have different courses based on RE: twelve different bachelor in electrical or energy engineering, eight master and two doctorates programs.
In the Mena region there are some countries where we did not find too much degrees or courses and we visited about two thousand universities or research institutes and centres websites. For example in Bahrain, Iraq, Kuwait, Libya and Qatar. In Iraq the universities websites are most of them only in Arabic and when they have translation, the English translation is very poor and difficult to find information in it.
Other countries such as Jordan or Iran have one or two universities with official bachelor with studies in the area and one or two centres or institutes with non-official studies or research groups. We found that in more than one hundred webs visited between universities, institutes, research centres, etc. in each country.
Special mention deserves Morocco. In this country, one of the poorest in the region, we have found 16 universities, 19 bachelors, 6 master and some research center. Undoubtedly Morocco is the country that has a better future in the area. The Moroccan government set a program similar to European 2020 Horizon. They expect a twenty per cent of the energy consumed in Morocco comes from sustainable energy sources. This program is more ambitious than the European one because actually in Morocco almost a nine per cent of the energy come from renewable sources and in Europe there is a 17 per cent.
Looking at the next image we can understand why they are not worried about renewable energy.



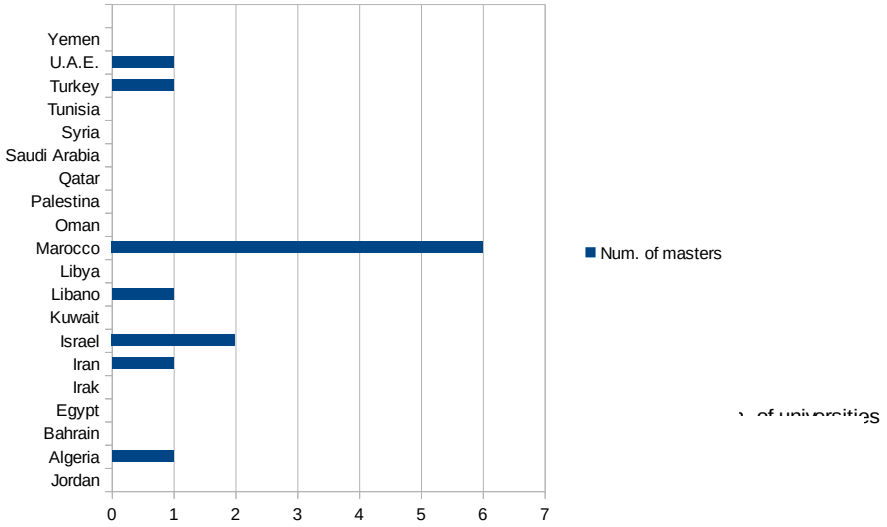
In Middle East are the sixty per cent of the world oil reserves. For this reason in the most of the universities of the countries of this area you can find a Petroleum Engineering or a specialization in Petroleum in Electrical Engineering instead of a RE Engineering or a specialization in this area. They should start to change their mentality. RE are the future, not only because the oil is an inexhaustible resource also if we want to bet for a better future, for a sustainable development.
This lack of education creates a deficit of qualified people for working in the current projects so that they are deriving in the requirement of exterior help.

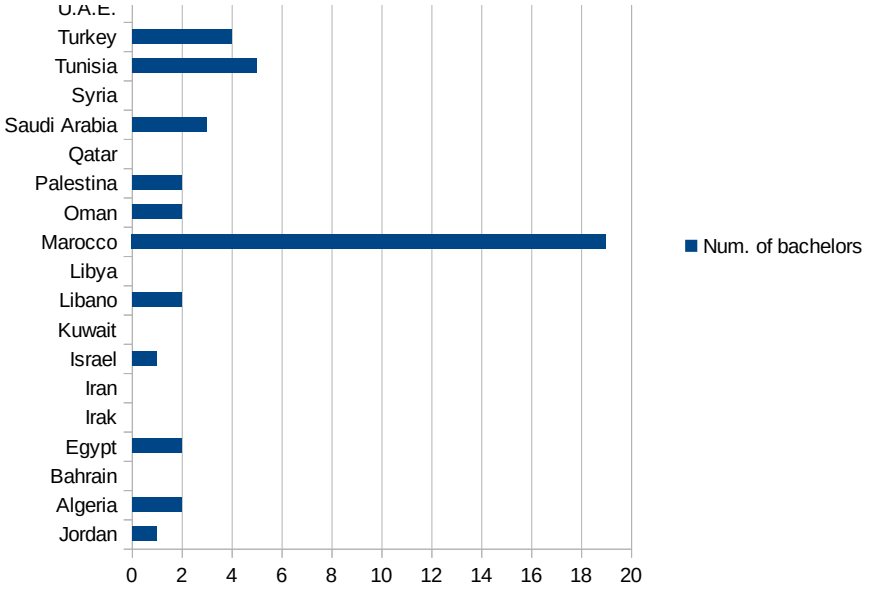
- **Jordan VS Europe**

Jordan is on the average of Middle East, in a retarded position respect Europe. Analysing about 100 websites from different universities, institutes or research centres we only found three universities, in one of them the American University of Madaba, they offer the bachelor Electrical Engineering with a subject about RE. In two others we found a research centre and a department. In Al-Hussein Bin Talal University there is the Renewable Energy Research and Development Center and in the Middle East University of Amman, in the faculty of engineering there is a Department of Renewable Energy.
The searching in Jordan was difficult. Not all the universities offer the English or French website and some of them were really old and they do not show any clear information about the study offers.
Before the absence of official studies and international universities, the modernization of the universities and the courses that they offer is the only exit towards a sustainable future and for making Jordan as a competitive country in RE.
Also this need of formation causes another different needs. For example qualified people for working and investing in RE companies. There are no workers and no engineers formed in the material. Jordan citizens are educated to think in oil companies, they do not think about make new companies of RE, or to became a photovoltaic installer. Jordan should change some study plans to get an improvement in the future, to get conscious people about the
environment and the importance of the sustainable energy in nature and in the world. If they want to bet for the renewable energy they should bet for formation in the area.

- **Jordan VS Mena Countries**

In the following graphs there is a comparison of every country of the Mena Region in number of universities, bachelors, masters and another courses, institutes, research centres or others. In number of universities we can see with this graph that Jordan is in the average. Only Morocco stand out. Jordan has 3 universities like Israel, Egypt, Algeria, Lebanon and some more.





Jordan has only a bachelor to offer but is still in the average, as the graph marks off.
Just a few countries in the region have masters in the materia, Jordan is not included.

2.3.4 Jordan VS North Africa

As we can see in the graphs North Africa is over Jordan in the material. Countries like Morocco and Tunisia have a very good training in the area. Mainly Morocco has a lot of universities that offer any studies in sustainable energy or in energy efficiency or something similar. Jordan as Morocco and Tunisia is in the Net oil-importing countries. For this reason Jordan should learn from this countries and invest in formation and projects in renewable energy to achieve independence from the Net oil-exporting countries and get its energy autonomy.
The graph above is about the funds for renewable energy in Morocco, Tunisia and Jordan. This is a graphical way to see how big the difference between the money is than North Africa destines to Renewable Energy promotion and the money than Jordan invest.

2.3.5 Middle East VS North Africa

North Africa wins clearly Middle East. Only Libya is the country in North Africa where I could not find any university with renewable energy studies. Algeria and Egypt are on the average of the rest of

the countries. Tunisia have some more than the other and Morocco is outstanding. As we creased before, maybe this is because both of them, Morocco and Tunisia are in the group or Net oil-importing countries while Libya, Algeria and Egypt in the Net oil-exporting countries. Also when we see the projects in both regions, North Africa is always more ambitious than Middle East. Middle East have a very big emptiness in renewable energy formation, something that have to change thinking in the future.

Summary of investment and financing requirements

Countries Operations	Morocco		Tunisia		Jordan	
	Investment needs per year, M€	External financing needs, M€	Investment needs per year, M€	External financing needs, M€	Investment needs per year, M€	External financing needs, M€
EE Industry, small operations	30-40	10	12	8	2	0
EE Industry, medium size investments	30-50	20-40			4	3
Cogeneration	30	20	17	12	2	2
Conversion to natural gas	20	15	2	1	4	3
EE private commercial	15	10	6	4	5	3
EE public sector	10	5			N.A.	N.A.
RE in industry (wind)	50	40	12	9	5	4
Biomass	5	5	6	6	2	2
TOTAL	190-220	125-145	55	40	24	17

3. Energy situation in Jordan

3.1 Energy sources in Jordan

Jordan has a population of 6,000,000 distributed among 89,200 km^2, sharing borders with Syria, Israel, Iraq and Saudi is growing at an average rate of 7% annually. The population lives mostly in urban centers, especially in the northwest of the country, occupying 10% of its surface. Although it has a high solar and wind potential, currently the country's only generates between 1 and 2% of its electricity from renewable energy sources.

The main consume energy in Jordan is 51% oil and 40% d electricity, characterized by the predominance of the transport sector 36%, followed by the sectors of industry and residential 23%. The electricity consumed in Jordan is divided into 41% of the residential sector, 25% for the commercial sector and water pumping corresponds to 17%.

Energy demand is growing at 3.7% and is expected to continue its growth on an annual average of up to 6%. Jordan must Importer over 96% of its energy, which costs the country 19.5% of GDP. A

doubling of electricity demand is anticipated, estimated 5,770 MW in 2020, this deficit translates into investments in this sector 21 billion dollars to 300 MW power producer annually.

3.1.1 Non renewable sources

Small quantities of crude oil were discovered in the decade 80, but that only represents 1% of the country's oil imports. There is no coal production and is producing a very slow development of natural gas, accounting for 10% of annual requirements of the country.

Jordan lacks energy resources compared to other Middle East countries such as Egypt, Syria, Israel and Palestine, so this is supported by imports of crude oil, petroleum products and natural gas from neighboring countries. This costs the country 40% of the capital of the same, requiring import 90% to supply the country.

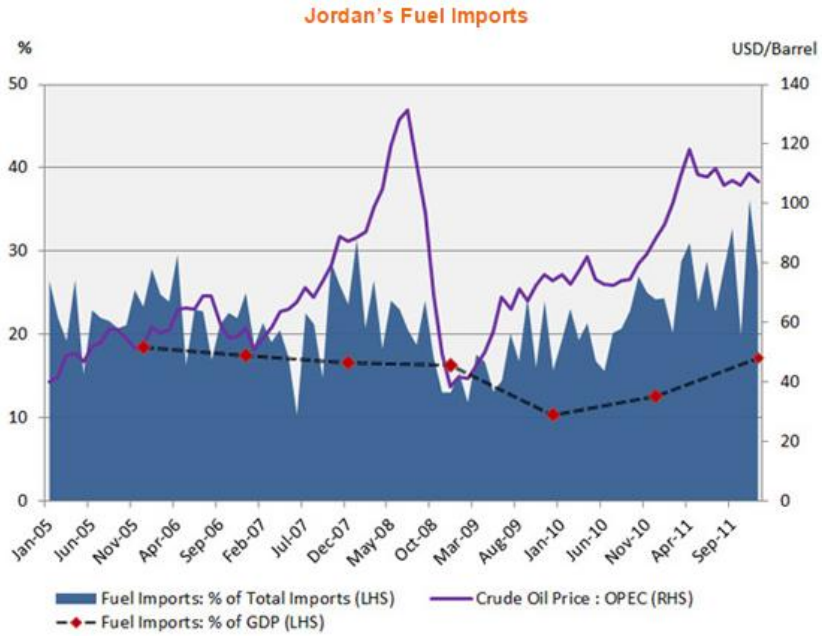
In 2003 the construction of a pipeline with Egypt, carrying the natural gas to the country's largest thermal power Aqaba is finalized. One of the non-renewable resources used by the country's oil shale, able to cover up to 60% of the territory of Jordan, but its operation is still in its early stages and overlooking the development.

It has a generating capacity of 3,600 MWe and estimated a requirement of 5,000 MWe to 2020 MWe to 8,000 and 2030, the latter is estimated that one third corresponds to nuclear energy. Presents a serious water deficit of 600 million cubic meters per year, pumping 160 million currently with high concentrations of radionuclides.

Its reserves of non-renewable energy types, such as fossil fuels are estimated at 2% of the country's power, and its reserves by 1 million barrels of oil and 200 billion cubic feet of natural gas. They have resources Shale oil with a high potential so that the country plans to build a power plant in 2017. Hydrocarbon Exploration conducted on the border between Jordan and Iraq could increase the energy reserves of the country.

Since Jordan does not have sufficient resources this is undertaking several deals with the country to import oil from Iraq, building a pipeline to carry 100 million cubic feet/day of natural gas and pipeline that is capable of providing 1 million bbl/day of oil, thus contributing 88% of total primary energy demand.

Its main energy source is the Arab Gas Pipeline (AGP) from Egypt who suffered a decline in import up to 81% in 2012 due to conflicts and thus boosted imports of oil from Iraq.



Sources: CEIC, 2012.

One can observe imports required by Jordan in a period of 10 years ranging between 10 and 35% of the energy required by the country and as the passage of time is increasing gradually.

Petroleum (Thousand Barrels per Day)		Previous Year				Latest Year
	History	Jordan	Middle East	World	Rank	Jordan
Total Oil Production	(1980-2013)	0.16	27,600	89,750	115	0.16
Crude Oil Production	(1980-2013)	0.02	24,466	75,951	92	0.02
Consumption	(1980-2013)	108.61	7,817	89,128	73	110.59
Estimated Petroleum Net Exports	(1980-2013)	-108.44	19,783	--	173	-110.43
Refinery Capacity	(1980-2012)	90	7,245	88,097	78	90
Proved Reserves (Billion Barrels)	(1988-2014)	0.00	802	1,646	88	0.00

Sources: EIA. International Energy Statistics, 2013.

With regard to the production and consumption of oil in Jordan considering proved reserves, the country is at high energy deficit regarding primary energy, is only able to generate a 0.16% energy required.

In the case of natural gas taking into account the reserves and production, this is at a 67% deficit, but note that has been reduced by 42% imports for the last year.

Natural Gas (Billion Cubic Feet)		Previous Year				Latest Year
	History	Jordan	Middle East	World	Rank	Jordan
Production	(1980-2012)	8.12	18,332	116,255	74	7.95
Consumption	(1980-2012)	37.43	14,089	116,395	86	25.04
Net Export/Imports(-)	(1990-2012)	-29.31	4,243	--	52	-17.09
Proved Reserves (Trillion Cubic Feet)	(1988-2014)	0.21	2,823	6,846	81	0.21

Coal (Million Short Tons)		Previous Year				Latest Year
	History	Jordan	Middle East	World	Rank	Jordan
Production	(1980-2012)	0.000	1	8,444	68	0.000
Consumption	(1980-2012)	0.000	19	8,285	115	0.000
Net Export/Imports(-)	(1980-2012)	0.000	-17	--	87	0.000

Sources: EIA. International Energy Statistics, 2013.

Coal has no interest in Jordan energy, and its production and consumption 0%.
In terms of electricity the country is able to generate a surplus of 3.6% highlighting the increase in installed capacity of up to 7.1% in response to increased consumption in two decades of 5.6% of the country's energy having a drop of up to 0.9% of electricity production in these decades.

Electricity (Billion Kilowatthours)		Previous Year				Latest Year
	History	Jordan	Middle East	World	Rank	Jordan
Net Generation	(1980-2011)	13.89	830	20,254	84	13.77
Net Consumption	(1980-2011)	12.52	718	18,501	80	13.27
Installed Capacity (GWe)	(1980-2011)	3.14	207	5,086	87	3.38

Total Primary Energy (Quadrillion Btu)		Previous Year				Latest Year
	History	Jordan	Middle East	World	Rank	Jordan
Production	(1980-2011)	.009	72	505	136	0.009
Consumption	(1980-2011)	0.323	29	507	82	0.276
Energy Intensity (Btu per 2005 U.S. Dollars)	(1980-2011)	10,653	10,989	7,401	30	8,920

Sources: EIA. International Energy Statistics, 2013.

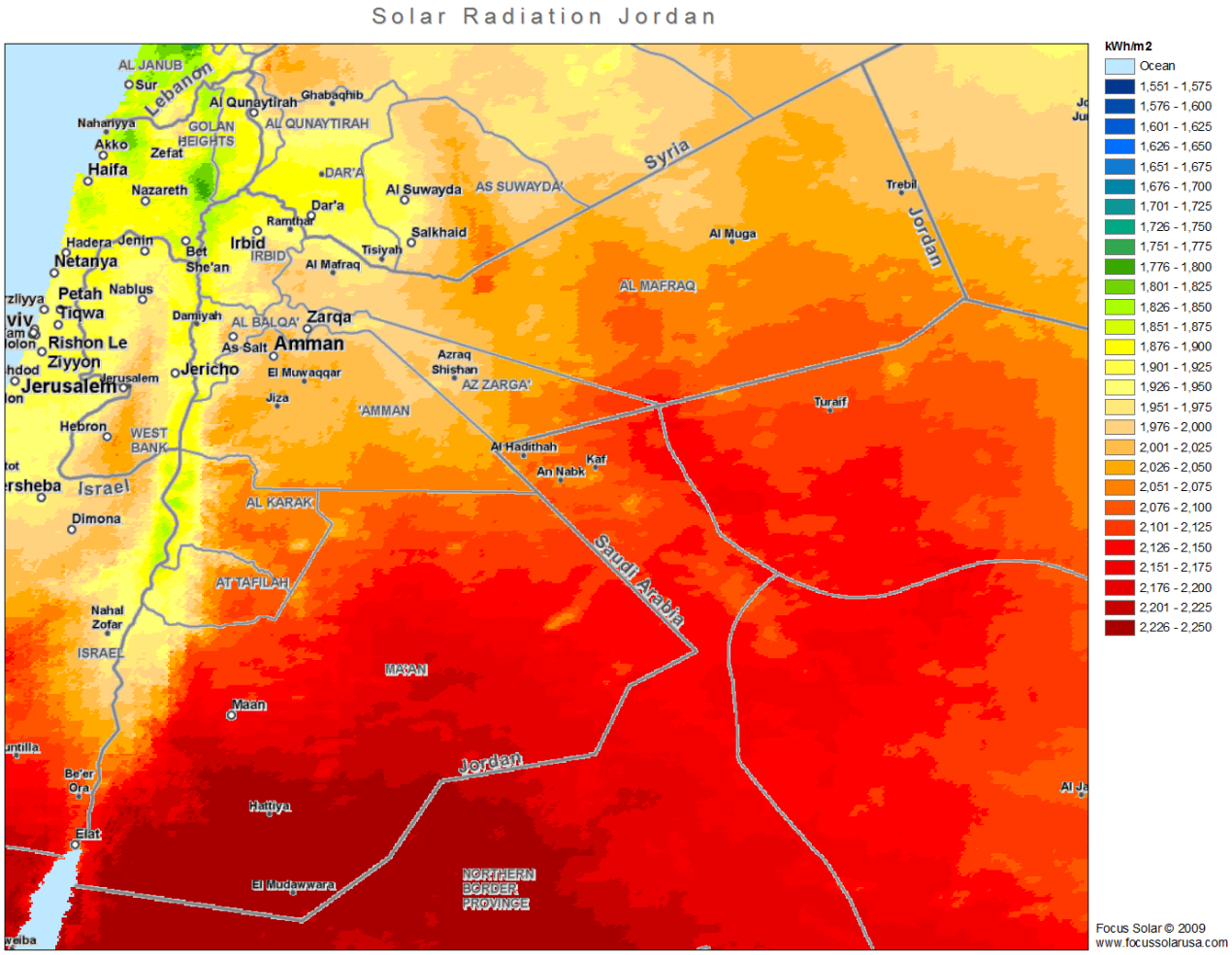
Moreover Jordan has significant deposits of phosphorite, which will be used to provide electricity to the country through nuclear energy by 30% by 2030 and to exports. The country has uranium resources inexpensive plus another 140,000 tU 59,000 tU in phosphate deposits, to recover uranium as a by-product of phosphate and subsequent energy production. Until 2011 Jordan is only capable of generating 3.2% of the energy consumed in the country.

3.1.2 Renewable sources

The renewable energy sector in the Middle East is in a rapid and strong growth, but nowadays the participation of outside countries in the market of renewable energy in Jordan is only 5%. The Jordanian government is focused on projects related to wind energy, but the estimated growth of interest in solar energy when costs become cheaper and greater availability of study and implementation in the country.

The Middle East has a high solar and wind resource due to its geographical and climatic characteristics. The Arab countries receive an average solar radiation of 2000 kWh/m^2 with 330 days of sunshine a year with temperatures of 40 ° C, low levels of dust and moisture and to be able to generate up to 630 million solar MW and 75 MW of wind energy. Major emerging technologies in this sector are solar photovoltaic, wind and solar concentration.

Specifically Jordan has a high average annual solar radiation on a horizontal surface that ranges from 5 to 7 kWh/m^2, one of the highest figures in the world daily. The country currently has a total capacity of 1,000 kW peak for cities and remote areas who consume daily electricity and water pumping and social services. Around 15% of households have solar hot water contributing 1% of total energy consumption in the present.



Sources: Focus Solar, 2009.

Since early 1990, wind power in Jordan is exploited by up to 1.5 MW projects, since the country has in some regions like northern and western wind speeds exceeding 7.5 m/s especially in the north and west and go up to 11.5 m/s in mountain areas, making it a country with significant potential for exploitation of this energy resource.
Biogas in Jordan generates up to 4 MW from municipal solid waste (MSW) through systems landfill systems, remain a viable resource for the country since 2001.
Hydropower is very limited, have a unique power plant 7 MW of installed capacity that is capable of generating 25 GWh/year of electricity. Along with hydroelectric turbines installed with nominal capacities up to 6 MW.
To date and geothermal after recent research has not enough energy potential to economically profitable operation in order to ensure technical feasibility.

3.2 Energy plans

The increase in energy demand due to population growth and rising import costs and the price of fossil fuels, they pose to Jordan changing its energy strategy to export energy from various sectors and be self-sufficient in the near future. Therefore enacted in 2010 the renewable energy law and background for the same in energy efficiency by providing the incentives country, access secured network, some tax exemptions and customs, in addition to favorable treatment to leased lands use of renewable energy and guidelines for net metering.

This country committed to nuclear power and renewable energy and oil shale, to increase the share of renewable energies of 2 to 7% in 2015 and 20% in 2020. It proposes to increase electricity production from 600 MW to 1,200 MW of generation by 2020 and 50 MW from biogas as a resource from municipal solid waste (MSW).

The Jordanian government is taking part in a major change in terms of implementing energy plans based on natural energy sector, gas distribution and oil refining, with budgets of up to $18 billion in public and private sectors.

Among its objectives is to increase the percentage of energy coming from the country, from 4 to 25% in 2015 and 39% in 2020 of which a production of 100 MW for wind and 600 will go MW for solar. With emphasis on renewable energy to reach 9% in 2020 and reducing oil consumption by 18%. The country also advocates the use of fuel-efficient vehicles.

Jordan is currently implementing two solar plants, both of 100 MW each, one of Concentrated Solar Power type (CSP) and photovoltaic another of the same capacity, financed by the Trade and Development Agency United States (USTDA).

- A solar power plant will be implemented in Al Qweira in South Jordan, with a total capacity of 65 MW. The plant, which will be financed by the Fund in Abu Dhabi, connect to the network in late 2015.
- The first solar power plant located in Mafraq Jordan 1700 hours of radiation per year, is estimated to be operational in mid-2015 with an output of 10 MW / h. The plant is being developed by the local company of Philadelphia Solar in collaboration with some of the leading renewable energy companies in the world.
- Pending approval a project in which an electrical substation will be connected to a solar PV plant Arabia One of 10 MW located in the Ma'an Development Area (MDA) and will be sold to National Electric Power Company of Jordan (NEPCO). Saudi One is co-owned by a consortium including Korean company Hanwha, Ennera Spanish company and Saudi Trading and Consulting (part of Arabia Group), the local partner. Project location was chosen by the government as it generates up to 2,200 kWh/m^2, one of the places with the largest radiation.
- It is conducting a photovoltaic project will be the largest in the Middle East of 52.5 MW, estimated to occur in 2016 up to 160 million kW / h of electricity per year, be self-sufficient for 35,000 households, or is the same 1% of the total energy of the country. It is located 220 km south of Amman Ma'an Development Area (MDA) conducted by a solar companies Ventures, Kawar Group and First Solar and its affiliate Shams Ma'an Power Generation. The project already has secured a power purchase agreement for 20 years (PPA) with the National Electric Power Company (NEPCO), which acts as the main authority generation and power distribution Jordan.
- Adenium comprises 3 plants of 10 MW solar PV each (Zahrat Al Salam, Al Ward Al Khoury and Al Zanbaq) and Falcon Ma'an is a power plant of 21 MW solar PV, located in Ma'an Development Area (MDA). The power output generated by the project will be connected to a substation of new construction in MDA and will be sold to National Electric Power Company of Jordan (NEPCO).
- Banks, hotels and hospitals in Jordan have petitioned the government for permission to build renewable energy power plants to reduce costs and cover between 80 and 100% of these sectors:
    - ✓ The Jordan Hotel Association is planning to build a power plant of 30 MW of renewable energy in the Dead Sea area.
    - ✓ The Association of Banks of Jordan intends to build a plant of 40 MW.
    - ✓ The Association of Private Hospitals proposes the construction of a plant of 15 MW.
- The proposed 1,000 MW of a solar and wind power held by the company Masdar, renewable energy company in Abu Dhabi, to implement a major power in the country.

Are planned several wind projects such as:

- They are in the process of implementing two other wind projects, one of 30-40 MW conducted by a Greek company Terna Energy in Al Kamshah north of Amman and a 89-90 MW by the Ministry of Energy and Mineral Resources (MEMR) in Fujij near Wadi Musa, along with a series of turbines in Al Harir, Wadi Araba and Maan in order to produce up to 300-400 MW of energy.

- By the end of 2015 The start of the operation of a wind power plant of 33 wind turbines with a rated power of 2 MW each, of 65-75 MW of total power in Maan is estimated with an output of over 150 MW / h year. Installation carried out by the Spanish company Gamesa and funded with a grant from the Kuwait Fund for Arab Economic Development.
- It is undertaking a project to build a 117 MW wind farm located in Tafileh, 180 km southwest of Amman end of 2015. The plant will be connected directly to the network of the National Electric Power Company to provide 400 GWh per year, enough to meet the energy needs of more than 150,000 Jordanians. The energy plan is being developed by Jordan Wind Project Company (JWPC), an investment InfraMed, Masdar and EP Global Energy Ltd and funded by the International Finance Corporation, the European Investment Bank, Eksport Kredit Fonden, the OPEC Fund for International Development, FMO, Europe Arab Bank and Capital Bank of Jordan (ANSAmed).

As an additional contribution has made a projection desire to increase the hydroelectric potential to 800 MW by the elevation difference between the Red Sea and the Dead Sea.
The government also wants to introduce between 40 and 50 MW biogas from waste.

3.3 RE situation and future expectations

Some of the most important companies in Jordan are displayed with respect to their energy concern and its impact on environmental quality through public awareness and education each year more sectors of the population.

Jordan Society Enviroment

Established in 1988 as a non-governmental non-profit organization with 15 branches spread across the country, is the largest NGO in Jordan in their field.
Among its objectives are:

- The protection of the environment and its basic elements (water, air, soil and wildlife) with the motivation that the environment is everyone's responsibility, encouraging public and private interaction for the resolution of environmental problems such as pollution within the framework of the National Strategy.
- Among its goals is to balance economic development with sustainable development, creating a pervasive culture in which the environment is a priority for the current situation and future generations.
- At the same time promotes the participation of experts and learning from people interested in the field of environmental protection, social awareness among all sectors of society and the creation of individual and collective commitment.

This association carries out activities and projects in collaboration with other companies and organizations concerned with the environment such as the public and private sectors in Jordan, USAID, WEPIA, UNDP, GTZ, the Arab Fund for Economic and Social Development (FADES), Fridrich Naumann Foundation, the International Cooperation Agency of Canada (CIDA), OMS, and the French and Swedish governments:

- Training courses on traditional sources of renewable energy, environmental audit, the state of environmental reporting, environmental legislation, environmental awareness, specialized courses in the Environmental Impact Assessment (EIA), and participatory evaluation regardless of their training including academic students, economists, environmentalists, engineers and investors.
- Some of their projects are: awareness on water and the environment, eco-media, integrated pest management, biogas, recycling, medical waste management, management of household hazardous waste management solid waste in Arab countries, the comic theater of the environment and a network of eco-student.
- Environmental Publications such as the quarterly journal "Environment", newspapers "The message of average daily environment."

JHA: Jordan Hotel Association

The Jordan Hotel Association is a nonprofit association founded in 1969 and is registered with the Ministry of Tourism and Antiquities of Jordan to establish an association for the protection of the hotels to conduct joint marketing activities and training in various aspects and one of the most important environmental training.

Among its objectives are:

- ✓ The protection of the interests of the association and its members.
- ✓ Coordination with tourism authorities to develop this sector.
- ✓ Data collection and statistics.
- ✓ Coordination of Arab and international associations of tourism.
- ✓ The meetings and conferences on behalf of tourism hospitality sector in Jordan and abroad.
- ✓ Contribution to the training of technical personnel in the industry.
- ✓ Participation in determining tourism terminology for various fields.
- ✓ The resolution of disputes between members.
- ✓ The issue of professional journals and periodicals.
- ✓ Coordination with government and private authorities for environmental protection.

Jordan GBC

Non-governmental group of passionate professionals, academics, government officials and entrepreneurs in growth that established the Green Building Council of Jordan (Jordan GBC) to build a more sustainable future for Jordan.

Its mission is to promote and implement sustainable building practices in all phases of the construction process at regional and global levels. AAK Jordan hosted a group of dedicated professionals, academics and business people to start working on the establishment of the Jordan Green Building Council (GBC Jordan) was born in 2010 and global recognition.

Whose main objective is the development and expansion as a leader in the development and implementation of innovative green building practices in every possible way in order to introduce, promote and advocate for sustainable building concepts.

- Promoting a culture of workplace professionalism.
- Compliance with global responsibilities across local concerns.
- Develop and maintain an independent entity based on ethical standards with an ultimate goal of contributing to a sustainable way of life.
- Follow a transparent approach to ensure the participation and involvement of all our stakeholders.
- To maximize the potential of all members through recognizing the value of diversity and special abilities.
- Commit to serve the common cause, avoiding conflicts of interest.

This association carries out activities in order to develop a high quality education in practice to train professionals to develop, manage and implement successful sustainable projects, such as:

- Green Building Basics and LEED
- Basic Concepts and Strategies
- Understanding Design Building Construction LEED Rating System
- Execution System Building Design + Construction LEED Rating
- Passive Design in warm climates
- Energy Modelling and Monitoring
- Energy efficient building envelope - Basic
- Energy efficient building envelope - Intermediate

EDAMA (Energy, Water and Enviroment Productivity)

It is a Jordanian Business Association seeking innovative solutions for energy, water and productivity while respecting the environment and providing a platform for a large number of representatives from

the public, private and NGO sectors to wean the country's energy. EDAMA comes from an Arabic word meaning "sustainability" and strives to move towards a sustainable economy through the creation of a new economic sector energy companies.

This association specializes in:
- Network Development and Business
- Business Opportunities.
- Create networking events, workshops, conferences, etc.
- Provide Value Added Services.
- Academic participation and promotion of R & D.
- Awareness and Education
- Establish quality standards.
- Increased social awareness.

Among its main objectives are:
to maximize renewable energy generation Jordan, fostering research, development and commercialization of technologies in Jordan, social awareness and create policies that make Jordan a model of energy efficiency, water conservation and environmental stewardship.
Reduce reliance on imported fuel and increase renewable energy and energy and water efficiency by 7% by the solar energy on a large scale (600 MW) and wind (300 MW) in 2015 and to 20% in the 2020 and reduced contamination transport action.
Eight working groups have been established to address the key issues of energy and the proposals made by EDAMA:
- SME Innovation: entrepreneurship.
- Carbon Markets: increasing participation in global markets for greenhouse gases.
- International Partners: attracting investment in manufacturing engineering and abroad.
- Jordan Capital Network: formation of a coalition of Jordanian investors focused on SMEs.
- Jordan EWE system: development of local energy, water and system model environment by qualified professionals.
- Infrastructure EWE: establishing necessary to implement renewable energy and increase energy and water efficiency infrastructure.
- Awareness SHEEP: Building public awareness and encourage public participation in the EWE solutions.
- EWE Advocacy: advocating for legislation, policies and regulations.

General Federation of Jordanian farmers
Popular nongovernmental organization founded in 1932 that represents farmers across Jordan has no-profit that aims to serve farmers and help them develop their standard of living, to improve the development of the sector and its national contribution.
The estimated number of Jordanian labor in this sector is 150,000 thousand workers, 28% of the value of GDP. The lack of agriculture inevitably lead to environmental degradation, vegetation and land by preventing desertification risk, given that Jordan is suffering from a shortage of agricultural and water resources.
The Executive Board of the International Federation of Agricultural Producers Member (FIPA) has 114 organizations in 66 countries and EU member Association regional marketing (Ovemanina).
Among its objectives are:
- Allow more participation of farmers at work, meet their needs and provide services.
- Sustainable agriculture, conservation of natural resources and the environment.
- Gender Equality.
- Promote community awareness about the importance of agriculture and the need to preserve farmland.
- Study and analysis and development of appropriate treatment and rehabilitation of agricultural areas solutions.

- Training and education of young people and inclusion of this group in the research.
- Definition of comparative advantage of the Jordanian culture and its promotion in countries around the world to increase horticultural exports.
- Strengthen the confidence of citizens and local agricultural production
- Promotion of agricultural products in foreign markets through the establishment of agricultural fairs.
- Launch an awareness campaign in collaboration with the Ministry of Education and lecturing on farms.
- Establish and support unions quality and support independent associations of organic agriculture.

The Federation maintains relationships with many of the organizations, institutions and associations that carry out a number of projects including:
- Project Horticultural Export Development
- Project of the National Biosafety Framework
- Management of private negotiations with GM foods
- International Union Relations

3.4 Environmental aspects of the energy sector in Jordan

Since 1994, Jordan began work to meet the environmental objectives of the UNFCCC convention. These objectives are that Jordan should have organizational resources, institutional and financial to perform tasks in environmental material.

The Jordanian government has given an assessment to determine potential climate change and has also identified the necessary measures to address these challenges. But the implementation of these studies has been delayed due to lack of financial resources, technical capacity and poor relationship with national plans.

As part of its commitment to international environmental conventions, Jordan Initiated With The support of UNFCCC. A National Economic and Environmental Development Study (NEEDS) for Climate Change. The main objective of the initiative is to identify needs, which adapt and mitigation of adverse environmental effects.

This studio was carried out in two stages, which were carried inventoried resolution adaptation and mitigation works, national strategies and institutional frameworks; and consultation with the participation of experts from the sector level. There are two main areas in the plan, energy and waste were adaptation for water resources and agriculture.

It is estimated that by 2020 on implementation of environmental solutions, an investment of up to 3.345 billion dollars in mitigation and 1.564 million US dollars will be required for adaptation required. 2050 are estimated 4,500 million US dollars for mitigation and 5,000 million US dollars for adaptation projects.

In 1991 the first environmental strategy in Jordan, prepared by The National Environmental Strategy (NES) by which various environmental policies were formulated arises. Jordan from this decade is prepared to undertake environmental planning at on the eve of the Earth Summit (the UN Conference on Environment and Development) in Rio de Janeiro in 1992 nationwide.

This convention was signed by Jordan in 1992 and entered into force in 1994, to date the country had to rely on the laws of different sectors, regions, services and activities. The number of environmental laws doubled.

Notably Law 12/1995 aimed at regulating national activities in a sustainable manner; the creation of a central authority (General Corporation for Environmental Protection) to manage Jordan's environment and in Place the new environmental legislation; the National Environmental Action Plan (NEAP) which makes a number of projects in material of sustainable development; in 1996 launched the Agenda 21 where they are collected up to 70 projects nationwide in material water resources, agriculture, environmental management, protection of biodiversity and eco-tourism. The Law Environmental Law 1/2001 protection laying took a role of regulation and supervision of environmental aspects.

Among the environmental projects undertaken by the country are:

- In 1996 Capacity Building for GHG Inventory and Action Plans in the Hashemite Kingdom of Jordan in Response to UNFCCC Communications Obligations, with an investment of 240,000.
- Study of water resources, with an investment of $ 100,000.
- In 2003 accession to the Kyoto protocol.

Other activities implemented by UNFCCC, are the regionals workshops to raise awareness about climate change, increasing public participation and environmental conservation. But one has been fitted in the energy and environmental sectors but not in agriculture, and this vulnerable sector in the country.

In 2006, proposed the National Energy Strategy aimed to increase the use of alternative energy sources, diversification of local energy sources, increasing the potential contribution of local energy resources, reducing dependence on oil imports and increased environmental protection.

The National Water Strategy Plan for the years 2008-2022, issued in 2009, to supercar water scarcity, but regardless Account potential environmental impacts of extracting it. Jordanian cabinet passed the Renewable Energy and Energy Efficiency Law 3/2010, which promotes investment in renewable energy, improving energy security, attracting international investment and protect the environment.

The Jordan production of greenhouse gases is approximately 20,140 Gg of CO_2 for 2000, 84.6% corresponds to the gas, 13.6% methane with 2,754 Gg; about 74% of total emissions attributable to the energy sector, 14% to the residues sector 8% of the industrial sector and the use of agricultural and forest land with 4%. Organic waste and residuals waters are responsible for 91.6% of the methane produced by the country; And NOx represents only 1.7%.

2050 increased emissions of greenhouse gases to 5%, with 170,000 Gg linked to economic growth is expected. The energy sector will remain the largest emission of greenhouse gases despite the move towards sustainability estimated for the coming years.

A condition for the country's water resources both in quality and quantity is estimated, were detected after study anomalies in highly variable rainfall, mayors during all pluses of the year except for the warmer months and temperatures is inversely proportional increases below 2 ° C, more intense during the warm months of the year. In short an overall increase in temperatures and greater warming in summer along with a decrease in rainfall is estimated.

Local Previous studies investigated the weather records showed an increase in the magnitude and frequency of extreme temperatures. The main results of the climate change Local studies are:

- An increase in annual heating but a significant decrease in daytime temperatures.
- A decrease in annual precipitation.
- Increased relative humidity.
- Decreased sunshine hours.

These climate changes are closely related to changes in surface runoff, increasing by 21%, according to studies conducted in different basins.

The results of the vulnerability assessment for agricultural sector, climate change showed that could have significant impacts, particularly on rain fed agriculture is the most sensitive sector, affecting wheat and barley.

Generally, the increase in rainfall amount would not compensate for errors for the adverse impacts increase of the temperature on barley. The trend for wheat was different from barley, as the Increase of temperature was more 'advantageous for yield if rainfall would increase.

4. RE Sector in Jordan

4.1 RE companies in Jordan

- **Energy Situation in Jordan**

Jordan covers an area of about 89.200km 80% of its population living predominantly in urban centers, particularly in the northwest of the country in areas constituting 10% of the country's total land area, Amman is the capital and the largest city in the country 2.5 million lives in Amman. Jordan is experiencing a high population growth rate. Jordan is highly effected by the cost of energy import, Jordan imports 96% of its energy.

- Energy mix in Jordan

Jordan's electricity is mainly consumed by the residential sector (43% in 2012) followed by the industrial sector (24%) then commercial sector (17% in 2012) and water pumping is consuming a significant percentage of electricity consumption (13% in 2012)
The demand for primary energy is growing at the rate of 3.7% and expected to continue to increase at an average annual rate of 6%.
Energy mix is anticipated to be in 2015 as follows:
Renewable energy 7% and 10% in 2020, 600 to 1000 MW from wind energy, 300 to 600 MW from solar energy and 30 to 50 MW from waste energy. This ambitious energy strategy to boost the use of renewable energy is a key factor of encouraging investors to invest in renewable energy.

Electricity Consumption (GWh), (2012-2008)

	2008	2009	2010	2011	2012
Household	**4459**	**4926**	**5219**	**5548**	**6126**
Industrial	**3128**	**2981**	**3258**	**3445**	**3461**
Commercial	**1925**	**1978**	**2184**	**2269**	**2427**
Water Pumping	**1713**	**1761**	**1867**	**1939**	**1955**
Street Lighting	**284**	**310**	**315**	**334**	**305**
Total	**11509**	**11956**	**12843**	**13535**	**14274**

Figure 1.1 electricity consumption .

- RE Companies in Jordan

In the 1980s private sector invested in renewable energy by investing in solar thermal collectors for water heating this market bloomed for a while then at the end of the 1980s a crises hit Jordan which effected this market but it bloomed again in the 1990s, the main challenge for investors in renewable energy was that there were no legislations, so it was only solar thermal some of the companies imported the systems and worked as installers and distributors and few of them manufactured installed and maintained the systems.
The first relevant legal framework is the Renewable Energy and Energy Efficiency Law (REEE) passed in Feb 2010 and approved in 2012. Approving this law pushed the investment in RE forward,
The strategy of the MEMR helped by lunching direct proposal submission initiative (2011).
Many companies were established and the demand for labor increased significantly.
Solar panels market improved, most of the companies are in the field of sales, import, installation and maintenance.
The number of registered companies since 2009 is 11593 company from that number there are 3642 companies in trade representing 31% of the companies registered and the number is expected to increase due to the strategy of the Jordanian government.

4.2 Technology offer

The field of renewable energy has advanced significantly in a few years, reducing the price of renewable energy systems (as shown in figure 1.2) thus increasing the profit expected from systems in Jordan specifically due to the abundant source of clean energy (photo voltaic for example) and lack of natural resources of traditional energy, this situation with the strategy of the government encouraged investors to invest more in renewable energy.

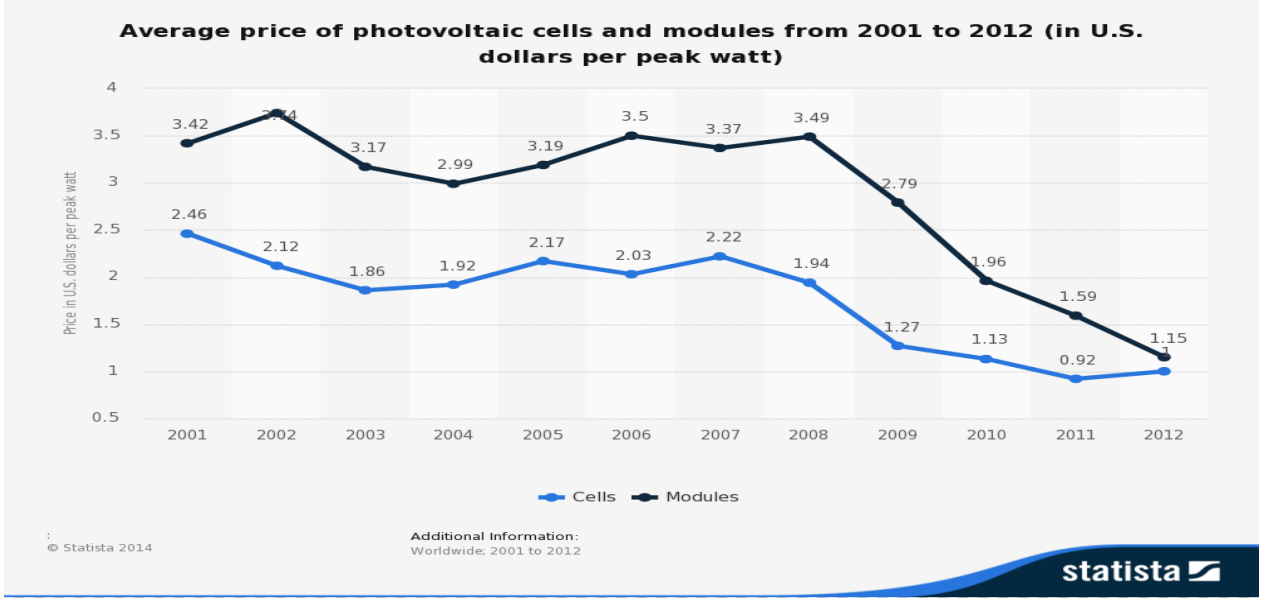


Figure 1.2 prices of photovoltaic

Figure 1.3 shows the increase of investment in renewable energy

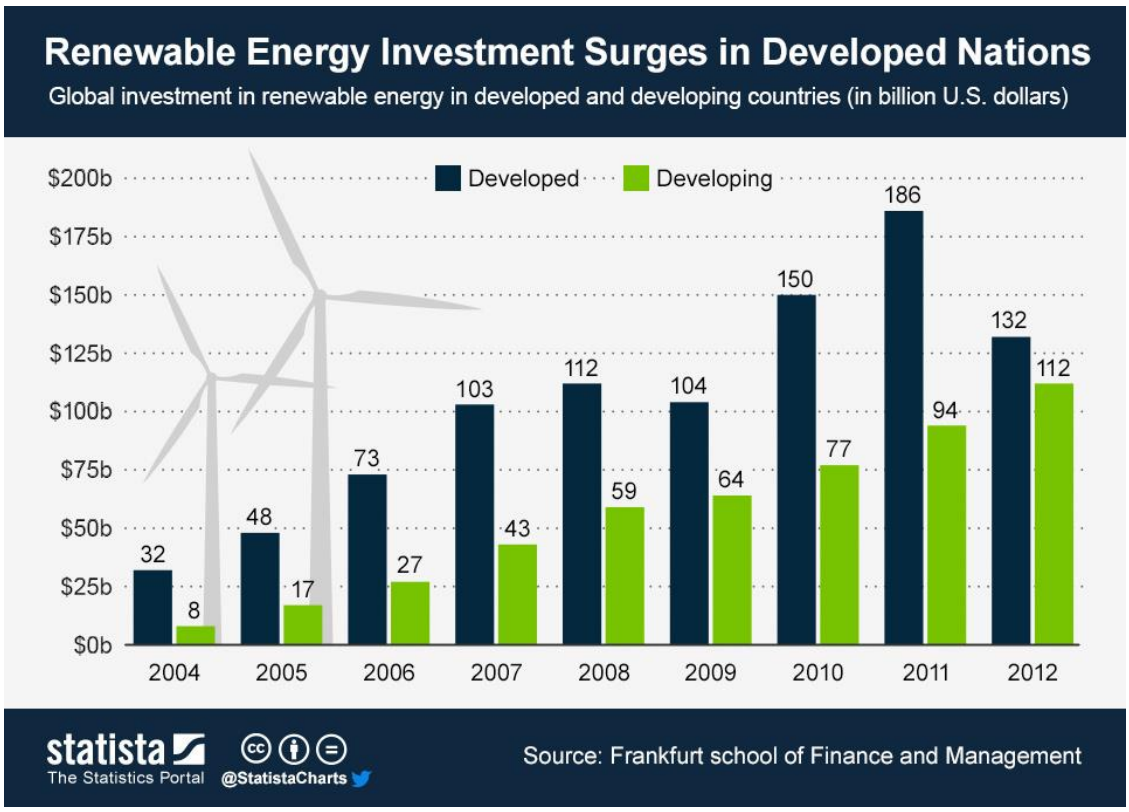


Figure 1.3 RE investment

4.3 Future clients and their profile

Future is promising for renewable energy companies. The clients vary from small houses to large farms (solar, wind) all kind of companies small and large will have business running at least for the seen future.

It is expected to have residential, industrial, and commercial, mosques are taken a good share of photovoltaic market.

The government is requesting a huge amount of energy to be installed 200 MW (photovoltaic) and ordering 117 MW of the first utility scale wind power plant to be built in the Tafilah region. 83 request from investing companies were received.

4.4 Law and support programs

The main relevant legal framework for RE is the 2012 renewable energy and energy efficiency law (passed in FEB 2010 approved in 2012) that covers

Conditions of investment, construction and connection to the grid of electricity generating facilities based on renewable energy.

Establishment of the Jordanian Renewable Energy and Energy Efficiency Fund (JREEEF)

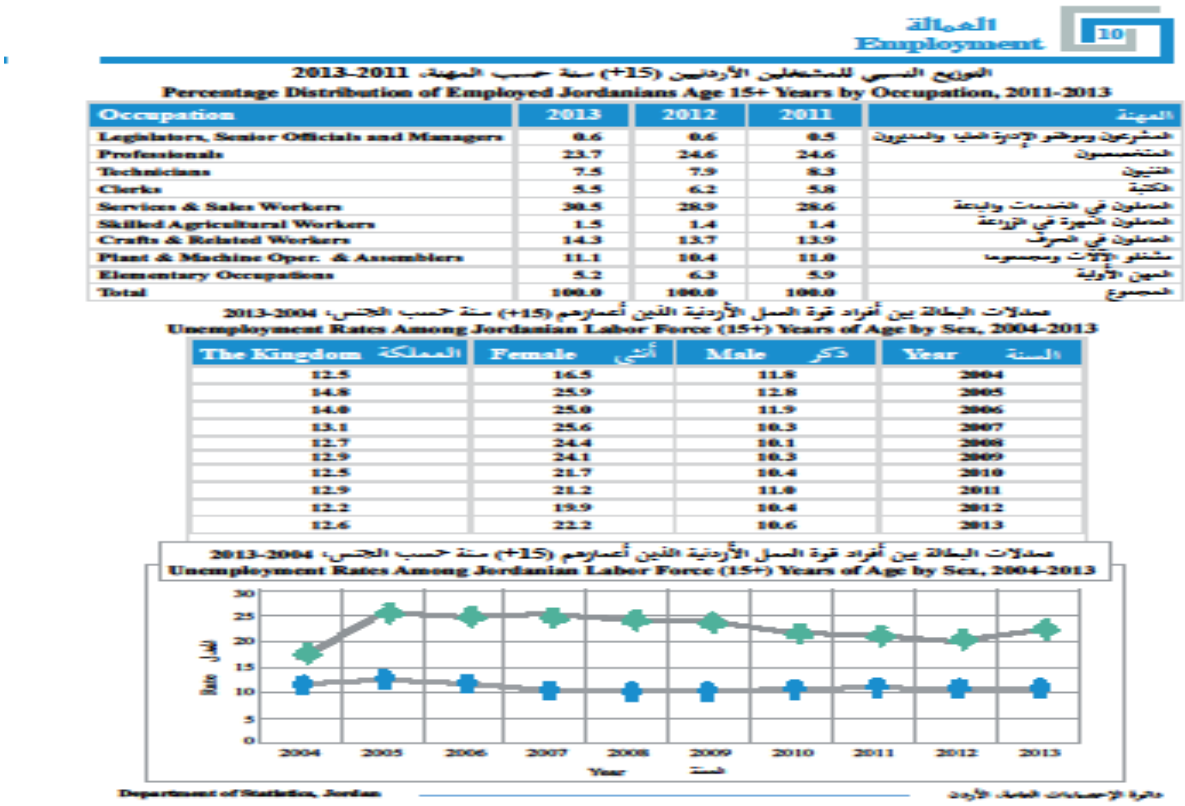
The law sets the principles of RE project selection (competitive bidding for medium and large projects) and financing (PPAs and FIT for small projects) in May 2012 ERC set the following FIT:0.12 JD/kwh (0.1694 $/kwh)for solar and 0.085 JD/kwh (0.12 $/kwh). Also it set for small PV systems the principle of net metering.

In order to align the grid capacities to the RE investment objectives,(NEPCO)has developed a broad investment program to reinforce the grid notably a “green corridor” of 800 MW from Aqaba to Amman from 2016.

About 34 projects proposals for a total of 1000 MW were selected over the past 6 years and the lunch of Direct Proposal Submission Initiative by MEMR (Ministry of Energy and Mineral Resources).

5. RE employment market

5.1 Actual jobs



العمالة Employment 10

التوزيع النسبي للمشتغلين الأردنيين (15+) سنة حسب المهنة، 2011-2013

Percentage Distribution of Employed Jordanians Age 15+ Years by Occupation, 2011-2013

Occupation	2013	2012	2011	المهنة
Legislators, Senior Officials and Managers	8.6	8.6	8.5	المشرعون وموظفو الإدارة العليا والمديرون
Professionals	23.7	24.6	24.6	المتخصصون
Technicians	7.5	7.9	8.3	الفنيون
Clerks	5.5	6.2	5.8	الكتبة
Services & Sales Workers	30.5	28.9	28.6	العاملون في الخدمات والباعة
Skilled Agricultural Workers	1.5	1.4	1.4	العاملون المهرة في الزراعة
Crafts & Related Workers	14.3	13.7	13.9	العاملون في الحرف
Plant & Machine Oper. & Assemblers	11.1	10.4	11.0	مشغلو الآلات ومجمعوها
Elementary Occupations	5.2	6.3	5.9	المهن الأولية
Total	100.0	100.0	100.0	المجموع

معدلات البطالة بين أفراد قوة العمل الأردنية الذين أعمارهم (15+) سنة حسب الجنس، 2004-2013

Unemployment Rates Among Jordanian Labor Force (15+) Years of Age by Sex, 2004-2013

The Kingdom المملكة	Female أنثى	Male ذكر	Year السنة
12.5	16.5	11.8	2004
14.8	25.9	12.8	2005
14.0	25.0	11.9	2006
13.1	25.6	10.3	2007
12.7	24.4	10.1	2008
12.9	24.1	10.3	2009
12.5	21.7	10.4	2010
12.9	21.2	11.0	2011
12.2	19.9	10.4	2012
12.6	22.2	10.6	2013

معدلات البطالة بين أفراد قوة العمل الأردنية الذين أعمارهم (15+) سنة حسب الجنس، 2004-2013

Unemployment Rates Among Jordanian Labor Force (15+) Years of Age by Sex, 2004-2013

Department of Statistics, Jordan دائرة الإحصاءات العامة، الأردن

Figure 5.1 shows the employment percentage 2011 to 2013

Most of the workers in RE field are working in thermal solar this is due to the fact that solar thermal is widely used in Jordan for water heating, the diffusion rate of solar water heating systems in residential buildings is almost 30%according to the estimates from National Energy Research Centre (NERC), the concentration of employees in RE markets fall within sales and installation.

5.2 Future jobs

Due to the nature of RE market the demand will be on sales persons, technicians and engineers mainly.

In Jordan RE is new relatively, for that reason it is difficult to find qualified employees in the field of RE, the skills that are most difficult to find are related to technical aspects and to general knowledge of RE and secondly finding qualified employees with skills in economics and policy of RE as well as general management and finance skills.

The need for territory education is very important to address the lack of qualified employees by providing complementary courses in RE to existing engineering education.

5.3 Workers profile

A study on markets analysis and needs for RE done by the university of science and technology showed that the employment market of RE in Jordan is demanding multi skills employees there for it is needed to train engineers, technicians and sales men more than one skill for example engineers should have some knowledge about economics, finance and marketing.

6. Conclusion

- MENA countries have much interest in improving the studies of renewable energy. The MUREE project is timely to support this interest.
- The technological development of renewable energies requires continuous improvement and updating of universities to train new technicians and experts in each country in the MENA region.
- The energy potential in all countries of the MENA region is very high and appropriate for the development and use of renewable energy.
- For the countries of the MENA area, especially not oil exporters, is particularly interesting implementation of renewable energy to reduce energy dependence, such as Jordan.
- In the countries of the region growing the number of companies in the renewable energy sector. This is necessary to consolidate the energy sector.
- The work of universities must not only be academic but also transfer knowledge to the industrial sector of renewable energy to increase local development of these energies.
- The renewable energy sector offers significant potential for local job creation that requires training and adaptation to new energy technologies.

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