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Spreading the use of solar energy applications in the new lands of Egypt to achieve sustainable development

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Abstract: Despite the abundance of renewable energy sources in the Arab countries, especially solar energy, the income of the projects of this kind started late compared to the most important global producers of solar energy and states that do not have such resources. And in recent years, it has become a pressing need for solar energy, which was the reason for the low percentage of the renewable energy of the total energy sources available and which does not exceed an average of about 6% for Arab Countries, mostly from hydroelectric power for more than 20% global average. Something that would necessitate the Arab countries, especially Egypt, to study and determine the use of solar energy applications for the deployment of use in severe arid areas, which requires raising the awareness of the residents of the new lands with this use and make them aware of sustainable practices, in order to invest in and implement development projects to raise integrated agriculturally, industrially and service using those applications. Therefore, the research targeted the determination of the possibilities of achieving sustainable development in extremely arid areas in the Arab countries and particularly Egypt using solar energy applications. so the research reached the possibility of creating sustainable cities in the severe arid areas to be able to feed itself through various farming systems that use all solar energy applications in all sectors, whether agricultural, industrial or service sectors as it moved and directed senior Arab investors to The allocation of their capital to invest in solar energy cooperation with renewable energy funds in the direct financing of investments.
Key words: Renewable energies - Solar energy - Solar systems - New lands -Sustainable Development.

Introduction:

Global energy systems undergoing a major turning point in the light of the continued uncertainty about the future of the climate and the future prices of carbon dioxide and high energy prices and uncertainty in the investment and the volatility of the global recession. As the understanding of local variables, regional and global in the energy sector of the basic necessities for the welfare of nations and affects the sustainable decisions[1]. Because of the energy crisis suffered by some of the cities and countries of the Arab world and others depending on non-renewable energy like oil and coal sources for power generation, which drew the attention of the world's environmental problems caused by these means as well as the fate of the expected depletion of these resources after not too long ago of time and so these countries have invested in the research and experimentation in the field of power generation using renewable means and it was topped by solar energy[2].

Egypt is considered one of the Sunbelt states the most suitable area for the deployment of solar energy applications because it's ranging sunshine rate is among 9:11 hour/day which means the availability of

investment opportunities in various fields of solar energy. The energy strategy currently in Egypt aims to the contribution of renewable energy sources including comprehensive water resources by up to about 20% of the total energy produced by the year 2020 with depending on the sun's energy in particular, which contributes by about 2% of the energy produced in addition to the multiple contributions of Renewable Energy in other applications, chiefly the generation of electricity using solar thermal , solar thermal heating to the purposes of service, pumping and desalination of water and lighting of remote areas using solar cell systems which the cabinet had agreed in July 2012 on the implementation of the Egyptian solar plan and aimed at generating electricity of solar energy through the establishment of the composite capabilities which was estimated at 3,500 MW by 2027, of which 2800 MW of solar thermal concentrates and 700 MW of Photovoltaic cells with the participation of the private sector at a rate of about 67% of these projects[3].

Solar technology witnesses marked improvement every year with the knowledge that their costs are not greater than the cost of power generated by coal plants and natural gas. According to the best expectations, the solar energy will become within 5 years less expensive than fossil fuels and the German Fraunhofer Institute predicts that by 2050 the cost of solar power will amount to between two and four cents per kilowatt/hour. This will be a pivotal turning point in the economics of power generation[4, 5]. Not to mention the possibility of spreading solar energy applications in all fields of life, and especially in the areas of severe aridity[6].

So if want to achieve sustainable development to change the current situation after the decrease in agricultural land resulting from violations that followed the revolution of January 25th and what came before in all the governorates of Egypt space, then we must establish national projects for the reclamation of the severe land aridity as compensation for the land that has been built upon and bring about rural development integrated. Egypt has all the ingredients that make you promote farming in terms of the vast spaces of severe arid land, manpower, the big companies that can reclaim millions of acres and banks that can finance these projects[7].But it provided the use of solar energy applications in integrated rural development for these projects. This is because the success of any project depends on the provision of the means of stability through service complexes that facilitate ways of subsistence, entertainment, health, education and all the integrated rural development factors. Water scarcity in severe arid areas leads to difficult living conditions which causes poverty and then food insecurity, prompting the residents of those areas to the over-exploitation of the fragile resources available to meet their basic needs next to overgrazing mobile and unsustainable harvesting of firewood, which changes the land use from forest to pasture land to increase the unity of land degradation and then the poverty and lack of sustainable food security.

The research problem:

Despite the abundance of renewable energy sources in the Arab countries, especially solar energy, its entry into the projects of this kind started late compared to the most important global producers of solar energy and states that do not have such resources.

In recent years, the need for renewable energy sources has become more pressing than ever before have become that's in light of the continuing decline of the cost of production and the development of technology in this area, which was the reason for the low percentage of renewable energy of the total energy sources available and which does not exceed an average of 6% for Arab countries, most of them of hydroelectric power for more than 20% global average, according to the international renewable energy agency, and this figure does not reflect what is enjoyed by the region's natural potential in this area, which is one of the most important regions of the world in which solar energy is available, in particular that many Arab countries within the so-called countries of the sun belt, which have approximately thirty cloudy day or less per year, but scarce in rainfall as it does not exceed the annual average of 100 millimeters only rarely that it does so also fall times are low and irregular, this as well as the advantage of avoiding environmental hazards and health problems resulting from the use of fossil energy[5].

Something like that would necessitate the Arab countries and especially Egypt to study and determine the use of solar energy applications for the deployment of use in severe arid areas (desert), Which requires raising the awareness of the residents of the new uses of these areas and that's through informing and guiding them towards sustainable practices, in order to raise investment and implementation of integrated development projects agriculturally and industrially and service using those applications.

The research aims to determine:

The possibilities of achieving sustainable development in the new land in Arab countries and in particular Egypt using solar energy applications through the study of the following sub-goals: The development of solar energy production in the main producing countries in the world, Determine solar features, to discuss the reasons for non-proliferation in the Arab countries, Determine the benefits of solar thermal energy in very arid areas, and then specify the generated solar electricity systems applications, The experiences of using solar energy in the Arab countries, Solar Egyptian plan and the challenges of using solar energy in Egypt, Spread the use of solar energy applications and Future investment Middle East and Africa in the renewable energy.

Materials and Methods

Statistical Analysis:

The use of descriptive statistical analysis to show the various theoretical aspects and some of the technical aspects of the applications of the use of solar energy in making sustainable development in arid areas, also the use of quantitative statistical analysis for the study of the evolution of the solar energy production in the main producing countries in the world. The appreciation using a single equation models and the models were evaluated in the appropriate picture of the developments of time.

Data Sources:

The research relied on several sources of data represented in secondary data from international sources of energy, and some of the annual reports of the Ministry of Electricity, research and economic studies and electronic Internet sites relevant to the subject of the research.

Results and Discussion

The development of solar energy production in the main producing countries in the world:

Germany, China, Japan, the United States, France and Australia's are considered the most important producing countries for more than two-thirds of global production with a rate of approximately 70.7% of the total global production of solar energy. Despite the enjoyment of the Arab countries with high rates of the total solar radiation, which ranges from 4 to 8 kWh m / day and direct solar radiation intensity ranging from 1700 to 2800 kWh m / year with low cloud cover between 10% to 20% over the year and they are excellent rates and usable effectively with solar technologies currently available. The use of solar energy has spread in the domestic water heating, and some of the leading models for the desalination of water in some areas of the Arab states. There are also several factories that produce solar water heating systems in many of them, also the initiation of using solar energy in the production of electricity by using concentrator solar energy technology in Algeria, Egypt and Morocco began with establishing three solar thermal plants integrated with combined cycle with capabilities of 150.140, 470 MW, respectively, participated in the solar field of both Egypt and Morocco with the ability of 20 MW and in Algeria with the ability of 25 MW. As well as the remarkable progress in the field of direct use of solar energy in the Arab countries which is about 32 megawatts only in 2011[6].

The development of solar energy production in Germany:

Germany has a current ability to generate solar electricity equivalent to that generated by the rest of the world, and gets about 4% of its total annual electricity needs from solar energy alone, and the reason may be that it aims to reduce carbon emissions by about 40 % of 1990 levels by 2020[8]. It has reached its capacity of about 1.3 million solar energy systems, which was estimated at approximately 22.68 gig watts in 2013[3].

It can be seen from Table (1) that Germany tops the countries producing Solar energy during the period (2004-2013) with the relative importance of approximately 33%, with a ranging production that reached a minimum of about 1105 MW in 2004 and reached a maximum of about 36 GW in 2013 and an annual average of about 13.8 gig watts and on studying the annual growth rate for the production of solar energy from Germany during the period in question turns out that it was about 40.2% and the rate is statistically significant at the 0.05 level of probability, Table (2).

It may be because Germany produces the equivalent of about 20% of their need of daily electrical energy through the development of solar energy in order to planning to cover all the needs for electrical power and shut down all its nuclear plants in 2022 and for the sake of planning it has developed a strategy to replace the glass facades of buildings with insulating glass that is specially made for generating solar power to meet the needs of these buildings of electrical energy and at the same time it maintains the architectural beauty, making it one of the largest exporters of electricity in the world as ranked by the international energy agency. Despite the few days when the sun sufficiently shows for energy production in Germany compared to Arab countries or the southern hemisphere in general[9]. So it is expected to double the number of jobs in the solar energy sector in Germany to around 90 thousand in the next five years to reach nearly 200 thousand by the year 2020 and thus Germany was able to save about 13.5 billion US dollars of imports of fossil fuels in 2012[10].

The development of solar energy production in China:

China's electric power generation relies on solar panels, and produce about 5.2 GW during the study period, as well as fossil fuel and it takes serious steps to reduce the use of non-renewable energy, which is a source of pollution to the environment[11]. It turned from Table (1) that China occupies second place for the relative importance of the main producing countries of solar energy during the period (2004-2013) with the relative importance of approximately 12.4%, with a ranging production that reached a minimum of about 31 megawatts in 2004 and reached a maximum of about 17.6 gig watts in 2013 and an annual average of about 5.2 gig watts and may be because most of the Chinese territory enjoys a sun radiance estimated at about 65% of its territory for periods of up to 25% of the times of the year, which animates and promotes the use of solar energy in these areas for the purpose of heating water and direct generation of electricity, as china has 97 million square meters of compounds used in heating water by solar energy that represents 65% of the world's total, in addition to the use of solar energy in the direct generation of electricity (solar cells / photovoltaic) as there's 70 megawatts as compound ability that is mainly used to provide energy to remote areas and some rural areas[12]. On studying the rate of increase for the production of China's solar energy during the period in question turns out that it was about 83.8% and the rate is statistically significant at the 0.05 level of probability, Table (2).

It can be justified by the increasing energy demand associated with the preservation of the environment. Due to the increase of investments in the manufacturing sector, which represents 71% of total energy demand to exceed that of Europe combined, and America, according to data in 2005 and China is regarded as alternative energy and including solar power as a unique option from the perspective of sustainable development because it enables them to generate large amounts of energy without carbon dioxide emissions and at the same time meet the demands of the market[12].

The development of solar energy production in Japan:

Japan tended to reduce its reliance on nuclear power after the Fukushima disaster and is now seeking to increase its production of solar energy since they are safe[11], so solar energy represents more than 80% of electricity generation from renewable sources tripled to reach a production of 25 gig watts[13]. It was clear from Table (1) that Japan occupies third place for of the main producing countries of solar energy during the period (2004-2013) with the relative importance of approximately 9.5%, with a ranging production that reached a minimum of about 1.13 gig watts in 2004 and reached a maximum of about 13.64 gig watts in 2013, with an annual average of about 4 gig watt and on studying the rate of increase for the production of Japan's solar energy during the period in question turns out that it was about 24.7% and the rate is statistically significant at the 0.05 level of probability, Table (2).

Japan investing billions of dollars in clean energy after the launch of the program in 2012 that aims to help the third largest economy in the world to shift away from the reliance on nuclear power after the Fukushima disaster in March 2011. The advantage of solar energy from the program and reached more than 24 gig watts by the end of April instead of about 5 gig watts before the start of the program[14].

The development of solar energy production in the United States:

As found in table (1) that the United States occupies the fourth place for the relative importance of the main producing countries of solar energy during the period (2004-2013) with the relative importance of approximately 6.7%, with a ranging production that reached a minimum of about131 megawatts in 2004 and reached a maximum of about 12.02 gig watts in 2013 and an annual average of about 2.8 gig watts and solar

energy is considered the second largest source of electricity in the United States after the natural gas, as estimated (GTM) that with the end of last year there will be more than 400 thousand new solar projects working across the country, because a new solar project is being installed every four minutes across the country. California takes the lead when it comes to solar energy, followed by Arizona, North Carolina, Massachusetts and Nevada. And it's because of the progress in solar technology that reduces the cost, as well as new forms of innovative financing, which make solar energy more available for consumers with acceptable prices. Companies like (Vevent) and (Solar City) and (Sun rang) collected about $ 500 million to finance solar energy projects for residential purposes, which covers the country[15].

On studying the rate of increase for the production of the United States' solar energy during the period in question turns out that it was about 51.7% and the rate is statistically significant at the 0.05 level of probability, Table (2).

The development of solar energy production in Spain:

As shown in Table (1) that Spain occupies fifth place for the relative importance of the main producing countries, solar energy during the period (2004-2013) with the relative importance of approximately 6.3%, with a ranging production that reached a minimum of about 24 megawatts in 2004 and reached a maximum of about 4.83 gig watts in 2013 and an annual average of about 2.64 gig watts and On studying the rate of increase for the production of Spain's solar energy during the period in question turns out that it was about 61.5% and the rate is statistically significant at the 0.05 level of probability, Table (2).

Spain is already one of the leading renewable energy states by providing $ 30 billion for government support in the field of clean energy, as the US administration considered that an example of the composition of a green economy. Note that Spain generates about 24.5% of its electricity through renewable sources compared to seven percent in the United States. That's because the government had introduced attractive incentives recently to encourage the development of solar photovoltaic (a technology that uses cells heated by sunlight in the generation of electricity) [16]. Which resulted in the adoption of Spain on renewable energy sources provide about 2.8 billion US dollars of imports of fossil fuels in 2010.

The development of solar energy production in France:

As shown in Table (1) that France occupies sixth place for the relative importance of the main producing countries of solar energy during the period (2004-2013) with the relative importance of approximately 3.2%, with a ranging production that reached a minimum of about 26 megawatts in 2004 and reached a maximum of about 4.63 gig watts in 2013 and an annual average of about 1.36 gig watts and on studying the rate of increase for the production of France's solar energy during the period in question turns out that it was about 66.7% and the rate is statistically significant at the 0.05 level of probability, Table (2).

The development of solar energy production in Australia:

As shown in Table (1) that Australia occupies seventh place for the relative importance of the main producing countries of solar energy during the period (2004-2013) with the relative importance of approximately 1.9%, with a ranging production that reached a minimum of about 52 megawatts in 2004 and reached a maximum of about 3.26 gig watts in 2013 and an annual average of about 817 megawatts, and On studying the rate of increase for the production of Australia's solar energy during the period in question turns out that it was about 51% and the rate is statistically significant at the 0.05 level of probability, Table (2).

The increase may be due to doubling of production from 2012 to the imposition of Australia in July 1, 2012 the pricing of carbon to be the cheapest and the most effective way to reduce pollution and build an economy that works on clean energy for the future, the carbon price is not a tax on the population, but that mechanism impose on the 300 largest polluter in Australia to pay for the pollution that they produce[17].

The development of solar energy production to other countries on the international level:

The rest of the countries on the international level producing solar power (Table 1) during the period (2004-2013) with a ranging production that reached a minimum of about 1.13 gig watts in 2004 and reached a maximum of about 29.41 gig watts in 2013 and an annual average of about 8.3 gig watts and on studying the

rate of increase for the production of other countries on the international level producing solar power during the period in question turns out that it was about 40% and the rate is statistically significant at the 0.05 level of probability, Table (2).

Table 1: The evolution of solar energy in the main producing countries of the world per Megawatts during the period of (2004-2013).

Year	Germany	China	Japan	United States	Spain	France	Australia	Others	World
2004	1105	31	1132	131	24	26	52	1133	3698
2005	2056	38	1422	172	50	33	61	1149	5048
2006	2899	50	1709	275	145	44	70	1338	6619
2oo7	4170	128	1919	427	739	82	83	1652	9291
2008	6120	458	2144	738	3635	186	105	2537	16063
2009	1o566	1181	2627	1172	3698	377	188	4156	24265
2010	17554	3502	3618	2022	4110	1194	571	7959	41330
2011	25039	12803	4914	3910	4472	2953	1377	12450	71218
2012	32643	16139	6743	7271	4685	4019	2407	21169	102076
2013	35948	17600	13643	12022	4828	4632	3255	29409	139637
Average	13810	5192	3987	2814	2639	1355	817	8295	41924
%	32.9	12.4	9.5	6.7	6.3	3.2	1.9	19.8	100

Source: Statistical Review of world Energy June 2014 (London: 2014).

Table 2: Estimated functions growth for the evolution of solar energy in the main producing countries of the world per Megawatts during the period of (2004-2013).

Statement	Equation	Value (F)	R^2	The annual growth rate %	Average of annual values of variables
Germany	Ln Y = 862.8+0.402X1 (23.85)**	569	0.99	40.2	13810
China	Ln Y = 7.4 + 0.838 X2 (14.90)**	222	0.97	83.8	5192
Japan	Ln Y = 758.1+0.247 X3 (10.52)**	111	0.93	24.7	3987
United States	Ln Y = 61.0+0.517 X4 (34.09)**	1162	0.99	51.7	2814
Spain	Ln Y = 33.0 +0.615 X5 (5.69)**	32	0.80	61.5	2639
France	Ln Y = 8.4+0.667 X6 (16.36)**	267	0.97	66.6	1355
Australia	Ln Y = 16.4+0.510 X7 (9.60)**	92	0.92	50.0	817
Others	Ln Y = 468.6+0.400 X8 (13.33)**	178	0.96	40.0	8295
World	Ln Y = 2026.0+0.427 X9 (32.14)**	1033	0.99	42.7	41924

The number in brackets refers to the calculated value of T. T: Indicates the order of time. ** Significant at 0.01.
Source: Collected and calculated from Table 1.

The development of solar energy production on the international level:

Solar energy production on the international level during the period (2004-2013), with a ranging production that reached a minimum of about 3.7 gig watts in 2004 and reached a maximum of about 139.63 gig watts a year 2013 and an annual average of about 41.92 gig watts (Table 1) and on studying the rate of increase for the production of solar energy at the international level during the period in question turns out that it was about 42.7% and the rate is statistically significant at the 0.05 level of probability, Table (2).

Some of the Arab countries set their eyes on overall targets for renewable energy by 2020, including Morocco, who aspired to achieve 42% of the diversified renewable wind, solar and water energy, followed by Egypt, Jordan 20% and 10%. While it identified Tunisia 30%, Algeria 40% of renewable energy in 2030. As for Saudi Arabia it aspires to achieve 44% of renewable energy in 2032 and that's according to figures released by the Energy Department of the Secretariat of the Ministerial Council of the electricity in the Arab League, and also the Secretary-General of the Arab organization of Renewable Energy is expecting that the volume of investments in the renewable energy sector in the Arab world will reach up to $ 300 billion by 2030. But these goals, even if all of them have been achieved, and this is not certain, do not seem enough for the Arab countries to reach the global proportion of energy generated from renewable sources to be achieved by 2020 which was announced by the International Energy Agency, that it will be in the range of 26%[5].

Solar energy features[18, 19]:

The use of solar energy applications have important advantages cannot be ignored or overlooked, the most important are the following:

- It provides renewable, sustainable and clean energy which participates in the diversification of energy sources and achieves saving of conventional energy sources, and provides the possibility of achieving a surplus in the future of electricity produced from renewable sources to export to the outside in case of sustainability.
- The solar energy technologies are known, not complicated, can be developed and used to develop other technologies also its use will provide plenty of job opportunities.
- Its physical and environmental accessories are available in most Arab countries significantly.
- It may need a big capital at the beginning, but it won't need to be provided with raw materials as it already exists in nature, plus it doesn't require constant maintenance.
- Integrated agricultural development in extremely arid regions occurs, and then we achieve sustainable development in those areas.
- The solar industry can contribute in economic diversification and provide many jobs, compared to the oil and gas sector that produces about half of the total GDP in the Arab Gulf states only, for example, and does not achieve more than 1% of its jobs.
- Reduction of the quantities of oil and gas used in the production of electricity locally in the Arab countries, which achieves better use of these quantities in fields that makes greater profit. As in the case of replacing gas and oil energy, which is currently used for power generation, with solar energy, this command would make the surplus quantities available for export and use in applications with highest economic return.

Reasons of not spreading of solar power in the Arab countries:

It may be due to several reasons; the most important are the following[5, 20, 21]:

- The abundance of conventional energy from oil and gas in many countries in the region, as countries of the Arabian Gulf, Iraq, Algeria and Libya, has played an important role in not searching for new sources of energy such as solar energy, while the rest of the countries, most of them, suffer from the lack of financial resources due to the high cost for the establishment of clean energy stations as well as technological barriers.

- The low efficiency of solar energy conversion, as the efficiency of photovoltaic cells to convert solar energy into electrical energy approximately approaches 24% at its best and does not exceed 30%.

- There are a lot of dust in the severe arid areas as the ongoing researches have shown that more than 50% of the solar energy efficiency is lost if the receiving device of sunlight is not cleaned for a period of one month.

- The lack of this solar energy viability throughout the day or throughout the year to meet the continuing needs of energy so to achieve that it has to be stored, which is reflected on the cost of production. For example, the cost of producing 1 kW / h of electricity from solar energy through solar concentrators to 25 cents, while the cost of production of the same amount from traditional plants that use gas and oil are in the range of 6 cents.

- Occurrence of corrosion in the solar complexes in extremely arid areas because of salts in the water used in heating cycles and the cycles are closed so the use of salt-free water courses is the best solution to reduce the problem of corrosion and rust in the solar complexes.

- The low level of public awareness of the possibilities available and solar energy systems that can be used in technical and economical for most Arab countries, synchronous with the lack of joint Arab cooperation in the field of solar energy.

- The spread of some of the policies and wrong practices in the field of solar energy, such as the belief that technological progress is the only way to cut the prices of its components, and to those who want to promote solar energy to wait until the prices of those systems go down due to research and development procedures.

- Omission of the cost of the negative effects on the environment caused by fossil fuel use and the claim that renewable energy is more expensive than their conventional counterparts, while not setting targets to solar power projects which is not putting specific frameworks for development, and the omission of transparent incentives, with overpricing in financial terms to investors.

- lack of marketing plans linked to the deployment of the sale of solar energy equipment outlets, both for domestic use or commercial or industrial applications , during the rise of equipment prices, leading to a decline in the competitiveness of these equipment in addition to the weakness of the sources of funding which weakens the possibility of creating an Arab common market for the deployment of solar energy applications , in spite of the multiplicity of sources of funding in the Arab world.

- The issue of poverty and energy security from their traditional sources in some Arab countries makes a hope for partnerships between the public and private sectors in spreading the use of solar energy applications in extremely arid areas to achieve sustainable development.

The benefits of solar thermal energy in severe arid areas :

In addition to the obvious benefits of solar energy at the macro level Represented in reducing the peak of electricity demand, avoiding emissions of carbon dioxide CO_2 and reducing dependence on fuel imports also solar thermal energy provides other benefits to building owners or residents in severe arid areas including the following[22]:

- **Reducing or eliminating dependence on fuel desired to be transferred to Location:** As one of the solar technologies at the site, where solar thermal energy can replace other fuels typically used for heating purposes, such as oil, natural gas, liquefied petroleum gas, coal, biomass and electricity. Therefore it's of particular importance when it is Burdensome and costly to transfer fuel.

- **The possibility of application everywhere:** Solar thermal energy can be used in areas where there is no electrical currents from conventional sources for electricity, and that's what makes it interesting especially in severe arid regions far from the electric grid, whether rural or Areas where power failure frequently happens. So energy conservation batteries in these systems achieve the security of electricity supply in locations where there is weakness in these supplies.

- **A healthy environment:** Local air pollutants resulting from water heating systems form a significant threat to health in many countries, so to avoid or reduce the need for burning fossil fuels, solar thermal energy could be used to help create a healthy environment.

- **Public support:** Governments in many countries support the installation of solar thermal systems, as they are offering financial incentives (direct grants, interest-free loans, tax incentives, and others). House owners and developers can benefit from the financial support by the installation of solar thermal energy systems.

- **Costs and benefits:** Without financial incentives, the solar thermal energy, in many cases, competes with other water heating techniques.

- **Stable Cost:** The cost of oil, gas or electricity could change dramatically, however, solar thermal energy costs remain constant for a period of 25 years because it's purchased and installed once so solar thermal energy systems will generate free energy for a period of 25 years to come.

- **Green image:** Solar thermal systems enable several commercial companies; especially they have a very clear statement about their interest to achieve a more sustainable business, as many governments require using solar energy in their own buildings.

- **The added value of the real estate sector:** The solar thermal energy often raises the building value, the increase in value is due to the estimated savings provided by the system, as it has similar effect of energy efficiency measures, such as double glazing in states that give energy performance certificates in buildings and thus contribute to energy solar thermal highest classification of the building.

The architects and technicians can have an important role in spreading the use of solar thermal energy applications for owners of small houses in isolated and remote areas because the lack of technicians and users of solar thermal energy is one of the most significant obstacles to the deployment of its uses Although it is a relatively simple technique, the technicians often refrain from widespread use of solar energy applications that they are not familiar with, so instead they recommend the traditional alternatives, which often rely on fossil fuels or electricity. Especially when the cost of installations of solar thermal power plants is high, it is also important to distinguish between financial constraints (a given solar system is unable to compete with non-traditional solutions) as the necessary funding for constituent expenses is not available enough, so financial incentives can become decisive, which it is often provided by public or private bodies (such as energy institutions).

The use of solar energy applications in the very arid areas to achieve sustainable development[23]:

The agriculture in fact is only a method of integrated life linked to nature organically, it's a way of life to the rural community and then the whole community rural and urban as it's a source of continuance existence in the universe for providing the community with all its requirements of food, clothing, drink, decorations, the medical and pharmaceutical products, air, human energy and other requirements in all fields of life that is associated with simple life dominated by the primary social relations and is also linked to the organizations , traditional and rural systems , habits and heritage[24].

There is an urgent need in Egypt for the development of new lands to draw people away from the cities and regions that are packed with people. The government has been trying for decades to reclaim desert land for agriculture and to create viable agricultural communities[25].

The use of solar energy applications in sustainable development vary from Architectural applications in housing and agricultural uses and services. Also that includes the direct use of solar energy in water heaters, heating facilities and thermal storage, as well as solar homes. Or the indirect usage of solar energy using heat pumps and connecting them to solar collectors, air conditioning and refrigeration. Or agricultural applications presented in the solar dryers or protected agriculture and groundwater desalination in extremely arid areas for agriculture, solar cooker[23].

Agricultural development is part of the integrated development and is not an ancillary term as agricultural development focuses on all that is important about the agricultural sector only, while integrated

rural development is caring about all aspects of life in rural areas[26]. Energy, waste management and buildings sectors are considered as ways that can solve the issue of resource depletion[27].

Solar systems applications generating electricity:

Electricity generated from solar energy is the ideal solution for energy in places not accessible by the electricity supply network[28]; also it could be used later in the operation of water pumps or could be stored in batteries for later use[29]:

- **Economical photovoltaic cells in remote areas:** PV systems are very economical in providing electricity for remote areas as remote farms and orchards, rather than the installation of power lines and transformers to illuminate the walls, simple buildings and agricultural water pumping process for livestock usage and watering crops.

- **Water pumping:** To irrigate crops or livestock usage and household uses. The pumping systems operating by solar energy meet the needs of a wide range of water and most of these systems have the additional advantage of storing water when the sun is not shining, which eliminates the need for the use of costly batteries and achieves simplicity and reduce overhead costs.

- **Distillation of saline water [28]:** The simple solar distillate is a good way, also it's cheap at cost, yield acceptable, needs little maintenance to get the distilled water from salty water, the safest of all energy available all over the world, its intensity of solar radiation varies and without pollution, and so that those distillates could be economic, their daily output should be of more than 200 m^3.

- **solar electrical energy for various household uses[28]:** Domestic Photovoltaic cell systems is available in the form of fully integrated compact units and it could be adapted to the system power and capacity depending on the specific needs of the home , also Photovoltaic cells are easily operated and installed and the limited number of times of maintenance also all the needs of the home of the electric power could be obtained by using solar energy, as the estimated energy required to meet the needs of the home of the electricity used in lighting , operation of solar pumps and air blowers in addition to the refrigerator, television and radio, and other uses of energy at home is about 2000 kW / h / year.

- **Electricity production and crop of agricultural land:** On creating rows of solar cells in cultivated land with crops, vegetables and fruits with suitable dimensions and heights to provide a shadow over the plants, the study concluded that it is possible to cover up to 32% of the cultivated land area of plants[30].

It also includes other uses of PV systems on farms and orchards the feeding energy , milling products, cooling products, battery chargers, in fish farms to operate the compressors and pumps for aquaculture, crushed ice manufacturing to save the fish caught until marketed using dual systems of solar cells and diesel to supply electrical energy[28], in the livestock farms to feed livestock , spray motors , controls , the electric fence to contain cattle and pasteurization of milk, egg collection at chicken farms electrically and dealing with machines.

Heat-generating solar systems applications[29]:

- **Solar drying of agricultural crops:** The use of solar dryers a proper application of the development of economic , social and cultural scales in the Arab countries and the West others, such as the use of solar energy to dry some agricultural products such as grapes, coffee, pepper, fish, natural plants and production of tomato paste with a concentration of (26% - 20%) by exposing tomato juice to direct sunlight or using by a simple solar dryer, milk could also be dried by solar energy, and from the prospects of using solar dryers that they could be used in drying the seeds and drying plants and medicinal herbs, as well as dates.

- **Water heating:** Another use of solar power to increase agricultural productivity is water heating, especially in raising livestock and chicken and machines that need to be cleaned periodically. Mini Solar water heaters can provide hot water varying from low to medium for this purpose. These systems need a solar collector, storage tank, water heaters and pipes. These commercial systems are available on a large scale and simple to install.

- **Hot water for cleaning:** Cleanliness is a very important process in poultry processing so the use of solar water heaters can provide us with water at a temperature of 60 degrees Celsius that is valid for this purpose, also currently available solar heaters could be used commercially and at a reasonable price on the farms, in the livestock and poultry slaughterhouses and in fish processing. Also domestic water could be heated by solar energy with the need for some technical workshops in the manufacture or more precisely in the installation of solar heaters which function by fluid flow system as a natural result of the difference in density resulting from temperature rise.

- **The use of solarization in the fight against agricultural pests:** Numerous studies have been prepared on the thermal effect of this process on the structure of soil, its nutrients , the microbes of soil , agricultural pests and soil gases , volatile gases and other materials. And new horizons or more have opened of which two or more layers of polyethylene could be used For coverage as the temperature reached 125 degrees Celsius and higher, compared to using a single layer and as well as the use of some pest control materials besides solarization process.

- **Greenhouses:** plastic houses have spread, it's a cover of a single layer with the use of galvanized iron frame and all of them are Greenhouses (mostly resistant to UV-rays) and of sizes ranging from (6 × 54 m) to (9 × 60 m), and these are used for the cultivation of flowers, crops and others that need a warm moderate atmosphere.

- **Solar water pumps:** Some water pumps that run on photovoltaic solar cells were used over the past ten years and recently began the increased use of this type of motor powered by solar energy and its important took off by the basic degree to provide water in some rural areas and its estimated energy is around 30 kW and is expected to expand in this application ,even with the complexities of the expansion of the electricity network and cons of diesel pumps, solar water pumps remain one of the most promising options if their prices were told.

- Creating integrated fish farms its mechanism of action relies on well water desalination using solar energy and through which it could contributed to the production of agricultural crops and animal production[31].

It's also possible to use the solar cooker system and convert it to desalination, as well as in the sterilization of drinking water, distilled water production and hot water preparation as it's now possible to sterilize 30 liters of water and prepare 45 liters of hot water at a temperature of between 50-60 degrees Celsius during 6 hours, also 70 liters of hot water were prepared in some sunny states.

The limited experiments of uses of solar energy in the Arab countries[32, 33]:

Solar energy falling on the Arabian Desert is able to produce times the consumption of the entire world and the use of a small desert area is sufficient to meet the requirements of human need of energy, and those experiences are as follows:

- Heating, water heaters and heating swimming pools by solar energy has become an economical way in the Arab countries, provided that the solar panels are manufactured locally.
- The solar energy is the best way to cool, as the more solar radiation the more it gets cool the more the solar cooling devices were more efficient, but solar cooling cost is higher than the current price of the current cooling by three to five times the normal cost and that's due to the high cost of materials of solar cooling and heat collectors and power generation equipment.

Egypt's solar plan[34, 35]:

In light of the depletion of fossil energy sources and the growing demand for energy to fulfill the needs of economic and social development plans, the Egyptian solar plan targeted the following:

- Increase the contribution of solar energy to provide Egypt's needs of clean electricity and thus reduce the growing dependence on traditional fuels to generate electricity.
- Investment and deepen the gained national experience in the exploitation of the natural richness of Egypt from solar energy sources for expansion in the implementation of thermal generation of electricity projects by a technically and environmentally friendly mature technology.

- Development of a national industry for solar equipment in addition to some of the traditional components of the plants so as to contribute in the economic development and provide employment opportunities in the manufacturing processes , the operating, maintenance, and marketing of this type of equipment stations.
- Reduce emissions of polluting gases harmful to the environment by about 7.7 million tons of carbon dioxide per year, in synchronization with saving about 3 million tons of oil equivalents annually.
- Electric power generation from solar energy through the creation of compound capabilities about 3,500 megawatts by the year 2027 (2800 MW of solar thermal concentrates +700 MW of photovoltaic cells). Produces about 14 billion kWh per year, (of which about 5 billion kWh a year by 2020).

The Challenges of using solar energy in Egypt[35]:

- Financial and financing challenges , and of the raise of initial investment cost, concurrent with the state supporting the traditional energy sources such as electricity and gas in the absence of appropriate funding mechanisms for the residents of the new areas.
- Institutional challenges which require the efforts of a large number of partners united, including manufacturers , users and legislative and executive powers related for technical assistance of project preparation as well as the support for the adoption of appropriate organizational frameworks, moreover should these organizational frameworks are crucial to attract investments in the solar energy sector. It may be due to the absence of organization and institutional coordination at the national and regional levels.
- Technical challenges whether it's the dust effect on solar devices, the research demonstrated that more than 32% of the solar energy efficiency is lost if they do not clean up the device receiving sun rays for a month. Or corrosion in solar complexes because of salts in the water used in the heating cycles and it is considered closed cycles so the use of salts free water is the best solution to reduce the problem of corrosion and rust in the solar complexes. In addition to that the subject of solar energy storage is one of the topics that need to be more scientifically researched and new discoveries that are not economically expensive. Not to mention the absence of cognitive and informational side related to the manufacturing of the components of solar energy systems, which is considered one of the most important technical obstacles to the deployment of solar energy applications.
- Lack of awareness of the importance of using solar energy applications in extremely arid areas for household, industrial and agricultural uses and here the economic media role is highlighted.
- Non-Proliferation of the tools and solar energy equipment companies and its branches at local and rural levels.

In light of the high density of solar radiation in the Arab countries which is proper to produce electricity in some locations as the severe arid areas are vast, semi-flat and uninhabited for the most part. As well as the growing interest in the development of national energy plans including renewable energy, taking into account the environmental dimension, especially solar energy and its increasing inevitability when the availability of the cheap hands of labor , human expertise and industrial capabilities in some Arab countries, achieving regional integration , low-carbon production , green energy, green industries which contribute in the deepening of regional cooperation on the basis of win-win situation[36]. Solar energy should not only be accessible to rich countries and oil-producing Arab countries, but it is important that the non-oil producing Arab countries start to seriously consider to progress in developing the production of this energy. Egypt and Jordan have a few experimental areas for the use of solar energy and there are few experiments in Lebanon, but the suns enjoyed by these countries deserve much attention to the provision of electric power in the future due to the low cost of technology[37].

Which is why we must take advantage of the possibility of deploying the use of solar energy applications until Egypt becomes one of the first exporters states of clean energy of the sun to take advantage of Egypt's global relationships to establish a giant industry of the requirements of clean energy production, and in particular solar cells to create an optical and heat solar power stations and shallow Solar Ponds. As well as creating new urban communities in sustainable cities by providing essential services and creating jobs in the following fields[38]: **1.**The generation of electricity needed for buildings. **2.** Streets and roads lighting. **3.** Water heating. **4.** Heating.**5.** Operation of telecommunication devices. **6.** Water pump. **7.** Houses conditioning (air

heating and cooling, and changing it). **8.** The use of solar cooling technology in the food and agricultural industry[39]. **9.** Solar drying of agricultural crops.

Especially in light of the decrease of photovoltaic solar energy prices by 80% since 2008 and it is expected to continue to decline in the future. In 2013, the Commercial solar energy has succeeded in matching public power grids in Italy, Germany, Spain and soon in Mexico and France, as the solar energy potential to compete without support is increasing gradually, to the part where it is expected that for example that the solar power generation field ,which is being created in Chile with an energy of 70 MW, will sell its production in the instant national market and to enter directly in a competition with the electricity generated from fossil fuels[40].

Spreading the use of solar energy applications[41]:

The economic and social characteristics have a significant impact in spreading the use of solar energy applications and accepting it as something new by identifying, knowing it and giving information about it. Therefore, the education and knowledge of Spreading the use of solar energy applications have the greatest impact in terms of their use which its use is reflected on the social, economic, and environmental aspects of life of the population achieving sustainable development. Through analyzing the characteristics of the family head, whether that was in terms of their social status, their educational level, their profession, the average per capita income, the family head possession of durable goods, and is the degree of education affecting their acceptation of the new ideas and their adoption and use? As very arid areas do not have uses for solar energy applications, we will limit ourselves to the knowledge of the determinants of spread the use of those applications and that is presented in the following factors:

- Marital status of the family head: Marital status plays a big role in energy consumption as married couples who have families and sons and consume energy more intensively than those who do not have families.
- Educational level of the family head: The educational level of the family head is the scale of the development and welfare of the individual so whenever the level of education of the family head increases, his perception and consciousness in the use of solar energy applications increases. As the use of solar energy reduces the working hours, that gives the opportunity to be educated in the case of the existence of free time especially for children so they can go to school.
- Main Profession of family head: whether the work was in agriculture, education, trade or other fields note that the type of profession plays a big role in the use of solar energy applications as Most who use solar energy are the literacy because of their high degree of awareness. Also to identify the use of solar energy and its importance as a modern and cheap energy application besides there is another factor that plays a big role in the use of solar energy that is the level of income.
- Average per capita income for family head: The average per capita income plays a large role in the different directions of use of solar energy applications because they require large sums of money when used for the first time
- the family head's possession of durable goods: durable goods play an important role in the social and economic life of the population especially television and radio broadcasts to see the outside world and what's going on in it and to know of the new things that are newly emerged such as identifying the solar power, for example, and its benefits.

It is expected that the spread of the use of solar energy applications will have a positive impact on the social aspects as the increase of education rates, increasing the number of schools and learners, developing health aspects and providing water by solar pumps, also the individuals possess durable goods ,as for the economic terms, that it may affect the increase of the income by increasing production rates, particularly in the industrial production of goods areas, leading to market expansion and high commercial traffic areas, which contributes to raising the standards of life and improve all aspects of life, not to mention the environmental perspective achieving sustainable development.

The Future of Middle East and Africa Investments in the renewable energy:

Governments in the Middle East and Africa made big promises for investments in renewable energy, the most important was the following[42, 43]:

- Saudi Arabia stated to make the participation of solar energy reach up to about 41 GW by 2032, including 15 GW Photoelectric cells and the rest are solar concentrators to represent the percentage share of electricity produced from solar energy to about 16-22% in that year. The Kingdom's commitment to inject 109 billion US dollars in the development of the 41 gig watts of solar power is a part of a wide-ranging plan to deploy 54 gig watts of clean energy by the year 2032.
- the city of Dubai announced in July 2012, the Dubai Sustainable City project, which aims to provide 50% of electricity consumption, 50% of water consumption, waste treatment by 100%, the deployment of green spaces by 75% of the total area of the city, the production of 50% of the electricity needs from renewable sources, and also to transform transportation to sustainable means by 100%.
- Start work on the solar energy project in Morocco with a worth of 9 billion US dollars which will be responsible for 38% of power generation in the country by 2020 and it has begun working right now, and it targeted 42% of the power supply internally of the total aspects of renewable energy by 2020.
- Jordan announced the first phase of the project to produce electricity from solar energy at an investment cost of about 400 million US dollars and Jordan also targeted 10% of energy from renewable energy sources and expects to invest in it up to about 2.1 US dollars billion by 2020 by Motivating the private sector to work on spreading its uses, and create a fund to finance renewable energy and energy efficiency projects.
- The Egyptian government will invest one billion US dollars in the field of solar energy since they consider increasing the share of the country's renewable energy sources to about 20% by 2020.
- It is expected that the renewable energy investments in African countries south of the Sahara, and in particular, South Africa, Kenya and Ethiopia will grow for more than US $ 7 billion by 2016.

Recommendations:

1. Authority of Renewable Energy in Egypt should seek promoting the spread of uses of solar energy in a sustainable manner on a wide scale , provided that the prices are affordable, taking into account local priorities to increase the solar energy contribution to the energy mix to preserve the environment to deploy their applications on the ground, in order to secure further contribution to achieve economic growth and sustainable development for the possibility of securing access to energy supplies on an ongoing basis. Provided that an information bank of solar radiation and the temperature and the amount of dust and other information is established.
2. Senior Arab investors should head towards encouraging the private sector to move and customize their Capital funds to invest in the establishment of an integrated development projects in the Arab world in the manufacture of systems and solar energy equipment and other work of installation and replacement, with the possibility of granting interest-free loans with concessional procedures for young people, leading to the availability of equipment and resettlement to achieve Arab integration by attracting and steering investors and other least in wealth size partners of the Arabs to start a small business for the promotion and dissemination of solar energy that can stimulate the development of new territory, given their role in achieving sustainable development applications[44].
3. Development of Arab specialized centers for training in manufacturing technology and the installation of solar cells to have the house expertise and supporter and benefactor, to Generalize awareness of the technical and applied potential for solar systems to accommodate the technologies, deploy and adapt according to local requirements, in order to spread the use of solar power applications.
4. The necessity for every Arab country to determine the percentage of solar energy contribution in advance in Qatar's energy mix, which holds a strategic and sustainable dimensions in integrated development projects severe arid areas, under the legislation and incentives to encourage investment and expanding Qatar's isolated networks also working on creating an energy market in those areas makes the government obligate electricity companies to buy quantities of electricity derived from the sun's energy for 25 years with prices up to more than three times the market price, which provides a financially rich source of private sector institutions working in the field of solar energy on the grounds that it is a contribution in the fight against climate changes in those countries.
5. Apply awareness programs aimed at spreading all ways of rationalizing energy conservation and to gain access to the best ways to the generalization in addition to the support of the citizens who use solar energy in their homes.
6. Study the possibility of creating sustainable cities in extremely arid areas to be able to feed themselves through different agricultural systems such as agricultural schemes within the city with relying a little on

old rural land surrounding the solar energy applications that are used in all sectors, whether agricultural, industrial or service in order to create a the smallest possible ecological footprint and produce the least possible amount of pollution, in light of the use of land and fertilizer materials efficiently and recycling or waste diversion and thus, the overall contribution of the city in climate change will be at a minimum, if these practices were organized, Simultaneously with the improvement of public transport and the increase in pedestrian ways to reduce emissions of cars.

7. Create Solar shallow ponds[28]: characterized by the possibility of their use in winter and summer, day and night as those ponds collect solar radiation, regardless of the intensity of this radiation and air temperature to store heat during the day and its use at night, therefore, the solar ponds operate as a large thermal reservoir that reaches a temperature at its bottom up to 90 degrees Celsius, the North Lakes, Lake Bardawil, Lake el Marah and Qattara Depression are considered suitable for establishing those ponds and can be utilized in the production of electric power for the villages, the tourist resorts near the solar ponds, heating and central air conditioning for some recreational shops and commercial malls built on the lakes land or Depressions, and drying lakes' products like fish , medicinal and aromatic plants and crops if it was so necessary and one of the most outstanding applications is the possibility of water desalination for drinking , household uses or in the agricultural and industrial uses.
8. The severe arid areas are suitable for the establishment of solar thermal power plants, provided the proximity of the source of water (for cooling station) or the presence of underground water in the region, also the availability of electricity or gas networks near the station. And a solar thermal plant can be created in Farafra oasis to serve 1.5 million acres that are reclaimed in it, also optical solar power plant can be created to produce electricity all over the Flat of Lake Nasser to be fully bi purpose to produce electric power and to prevent evaporation of lake water. This ensures the future of energy required for integrated agricultural development in various parts of Egypt to achieve sustainable food security[36]. And the station relies on replacing fuel sources used in conventional thermal stations to produce electricity from thermal energy generated from the solar radiation concentration at high temperatures (400 - 1500 m e) and is characterized by solar thermal systems which have the potential of integration with traditional electricity production systems and ensures the Electricity regular supply, it also does not cause problems for the operation of the electric grid[35].
9. The need for optimal exploitation and sustainable solar energy in Egypt, which achieves the lowest economic and social cost possible from the use of solar energy with staying on a specific level of its output, in order to bring about a leap in spreading the use of solar energy applications in a severe arid areas to enhance the opportunities for international and regional cooperation levels.
10. The use of renewable energies in Egypt Fund in the direct financing of investments or providing zero-interest loans (Revolving loan) to buy electricity from micro-enterprises to pay half the amount at least in advance to the age of the default of the project taken into account the inflation rates on this amount covers half of the contracted electricity price for the project for 25 years.
11. Taxing Fossil Fuel in the form of taxes on carbon emissions or taxes on other contaminants such as sulfur oxides of nitrogen oxides resulting from the use of petroleum fuel, and it benefits indirectly the solar energy in lowering its cost compared to petroleum fuel.
12. It must be taken into account in the countries' solar energy projects that the planning of integrated rural development cannot achieve its objectives in isolation from the city, its Influence and being influenced by the surrounding region and thus the public interest is through a balanced goals between the city and the rural region affiliate plans, as the integrated rural development based on a true integrated planning based on a comprehensive national scale.
13. The expansion of the isolated local networks and work to create a market for solar energy in the new territory to accelerate the electrification of isolated solar areas and deployment of applications in the areas of development of agricultural irrigation techniques and water desalination and all walks of life to take advantage of successful practices in the Arab countries[45].
14. The need to take advantage of the expertise available in the Arab areas in the fields of spreading the use of solar energy applications in Egypt.

References:

1. www.worldenergy.org.
2. http://www.sasapost.com/top-countries-using-renewable-energy.
3. http://cleantechnica.com/2013/04/16/solar-power-record-in-germany-22-68-gw-infographic.

4. http://expo2020dubai.ae/ar/hello_2020/article/going_solar_can_desert_sun_power_the_world.
5. http://www.aljazeera.net/news/scienceandtechnology/2015/12/23.
6. http://www.lasportal.org/ar/summits/Documents/ p. 64, p. 65.
7. http://www.algomhuria.net.eg/it/tahkik132.html.
8. Berlin: the Middle East, Germany: a record levels in the generation of solar electricity, the International Al-Arab newspaper, in May 2012 the number 12235.
9. http://www.alyaum.com/article/3080967 and http://www.noonpost.net/content/4729.
10. Http: //www.alhayat.com/Articles/10202847.
11. http://www.akhbarak.net/articles/18359746.
12. Mohammed Mustafa Khayat, China and alternative energy, international politics magazine, Volume 43, No. 173, July 2008, p. 3.
13. http://www.skynewsarabia.com/web/article/740918.
14. http://www.alriyadh.com/1079119.
15. London: the Middle East, America is heading to overcome Germany toward first place in the use of solar energy, the International Al-Arab newspaper, in January 2014 the number 12828.
16. http://www.alittihad.ae/details.php?id=31626&y=2009&article=full.
17. http://environmentvictoria.org.au/newsite/sites/default/files/useruploads/Clean_energy_fact_sheet_new _SUAR.pdf.
18. http://www.philadelphia.edu.jo/philadreview/issue7/no7/11.pdf.
19. http://weather.pme.gov.sa/applied-studies/dirasa5.pdf.
20. http://files.books.elebda3.net/elebda3.net-3355.pdf.
21. www.energyandeconomy.com/.../1079147225_Sucsessful_Markets.doc.
22. http://www.solarthermalworld.org/sites/gstec/files/story/2015-11-04/ arabic.pdf.
23. https://portail.cder.dz/ar/IMG/pdf/PV20package_29cc.pdf.
24. http://arbsustainabledevelopment.blogspot.com.eg/2011/05/blog-post_5838.html.
25. http://www.ifad.org/media/press/2015/14_a.pdf.
26. BMZ-GTZ: Reainal rural development, Germany, 1984, P.18.
27. .http://unctad.org/meetings/en/SessionalDocuments/ecosoc_res_2015.
28. www.arabgeographers.net/vb/attachments/attachments/arab3337.
29. http://noa.bh/niadar/wp-content/uploads/2015/01/solar-energy.pdf.
30. https://sites.google.com/site/e4poor/solar/agrelictricity.
31. http://www.masress.com/ona/1959575.
32. http://eco.univ-setif.dz/seminars/ddurable/56.pdf.
33. http://www.terracuranda.net/altaka_almia/arab_future_energy.pdf.
34. Ministry of Electricity, the new and renewable energy agency, the annual report 2012/2013.
35. Study the future of solar energy in Egypt, see the website: http://www.capmas.gov.eg/Pages/Publications.aspx?page_id=5104.
36. http://css.escwa.org.lb/sdpd/1582/d2s42.pdf.
37. http://www.alarabiya.net/ar/politics/2014/.htm.
38. http://www.alwatan-libya.com/more.
39. http://www.arsco.org/detailed/19d38af5-32bd-4b1c-8549-e5de2ec344ad.
40. www.irena.org.
41. http://khartoumspace.uofk.edu/jspui/bitstream/123456789/10812/1.pdf.
42. http://www.solargcc.com/renewable-energy-investment-opportunities-in-middle-east-africa-focus-at-world-future-energy-summit-2015/?lang=ar.
43. http://www.lasportal.org/ar/councils/ministerialcouncil/Documents/.pdf.
44. Sohier M.A. EL-Surety and Mohamed Hany M.2014. Inter-Arab Investments and Necessary Trends of the Senior Arab Investor in the Light of the Current Global Economic Situation, World Applied Sciences Journal, Vol. 31, No (7): 1287.
45. http://www.escwa.org.lb/information/publications/edit/upload/E_ESCWA_SDPD_13_WG 5_Report_ A.pdf.