Market Analysis Study

1. Introduction

The Hashemite kingdom of Jordan, in the Middle East is bordered from the north by Syria, the east by Iraq and Saudi Arabia, the south by Saudi Arabia and the Gulf of Aqaba. The area of Jordan is 89,213 sq. km . Amman is the capital and largest city of Jordan. Its population is 5,350,000 with a growth rate of 2.6%.

The principal geographical feature of Jordan is an arid plateau that thrusts abruptly upward from the eastern shores of the River Jordan and the Dead Sea, reaching a height of about 610 to 915 m (2,000 to 3,000 ft), and then sloping gently downward towards the Syrian Desert in the extreme east of the country.

The climate of Jordan is predominantly of the Mediterranean type. It is marked by sharp seasonal variations in both temperature and precipitation: Hot dry summer and cool wet winter. Summer starts around mid of May and winter starts around mid of November, with two short transitional periods in between (autumn and spring).

Jordan's economy is free market oriented Prices (except for a few subsidized goods), interest rates and wages are generally determined by market forces. The main economic indicators in Jordan for the year 2004 are shown in Table (1) below.

Table (1) the main economic indicators of Jordan for the year 2004

Growth rate of GDP at fixed producer prices	7.5%
Growth rate of GDP at current producer prices	12.6%
Per capita GDP	1515.6 JD*
Total export of goods and services	3955.1 MJDs
Total import of goods and services	6518.3 MJDs
Inflation rate	3.4 %

*Jordan Dinar (JD) = $1.4

2. Building and energy data (approx. 2 pages, including graphs & tables)

Jordan is growing fast in terms of population and energy consumption. According to the available figures from the Department of Statistics in 2004, the Number of existing dwellings is 1.204 million and the average annual required

dwellings is around 28,063. For the next twenty years, it is expected that Jordan will need around 500,000 new dwellings. Table (2) shows some figures related to construction sector.

Table 2: Number of permits, area and cost for new buildings (Residential & non- Residential)

Indicator	2002	2003	2004
1. Number of Permits	11601	11829	14248
Residential Buildings	10667	10978	13077
Non-Residential Buildings	934	851	1171
2. Total Area of Buildings (000 m^2)	4693	5283	6829
Residential Buildings	3907	4476	5761
Non-Residential Buildings	786	807	1068
3. Estimated Cost (USD 000)	705711	827138	1092480
Residential Buildings	585224	706944	934530
Non-Residential Buildings	120487	120194	157950
4. number of licensed dwellings	23313	25824	35052

It is clearly seen from the above table that the number of licensed square meters for Residential buildings is 18 times higher than the licensed area for non-residential.

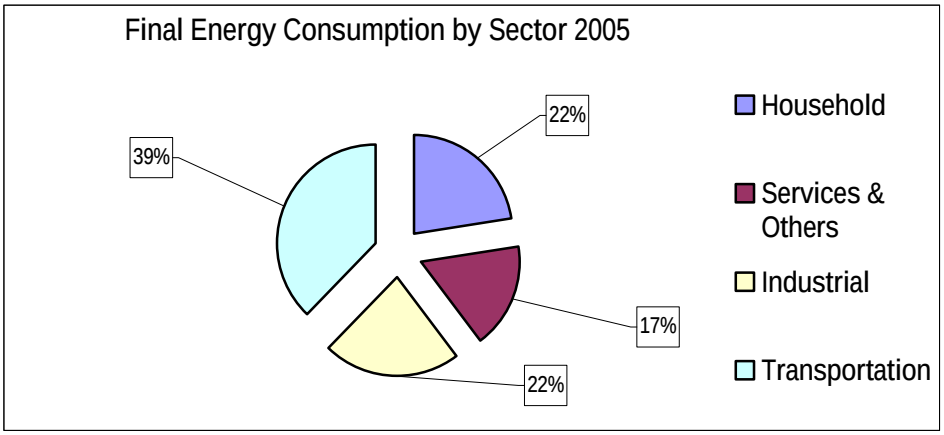
The majority of buildings (Residential and commercial) in Jordan are usually built from white stones. The rest are built from cement bricks and concrete. Building construction in Jordan pays a little attention to energy efficiency and environmental protection measures through design or construction. Very few architects are concerned with passive design or building envelopes in the building design. In the upscale areas central heating using diesel oil is common for space heating while small stoves using kerosene or LPG is used in lower income areas. Efficient lighting such as CFL or lighting control gear is very common in residential buildings. Solar water heaters is not mandatory (only 14% of buildings have SWH). Of course, this construction of energy-inefficient buildings leads to problems associated with comfort level, over design of buildings' heating/cooling systems, in addition to dampness inside the dwellings accompanied by fungus
growth due to low inside temperatures.

Jordan Engineers Association www.jea.org.jo supervise the designs of the building while the Municipality of Greater Amman www.ammancity.gov.jo is the only authorized body to give building license in Amman the capitol of Jordan. Ministry of Public Works and Housing www.mpwh.gov.jo overlooks public building and public housings.

Energy consumption in construction sector

Most energy used in buildings is in the form of electricity and fuel. Heating, cooling and lighting are major energy consumers in buildings.

The residential and commercial sectors in Jordan consumed 4306 Gwh electricity, and 1864000 tons oil equivalent of fossil fuels, and emitting about 7 million tons of CO_2 into the atmosphere, according to the Ministry of Energy and Mineral Resources brochure (ENERGY 2006 – Facts & Figures) www.memr.gov.jo. The graph below shows the energy pie in Jordan for the year 2005.



The graph shows that construction sector (residential & commercial) consumed 39% of the total Energy consumption in Jordan, while accounting for around 49 % of the total electricity consumption.

In addition to that, building sector consumes a lot of energy (electricity & fuel) during construction activity. Table 3 shows the quantity of consumed energy during construction activity by type of energy, 2004.

Table 3: Consumed Energy during Construction Activity by Kind of Energy in 2004

Number of Enterprises that use energy	Electricity (MWh)	Diesel (M^3)	Gasoline (M^3)	Fuel (000 M.T)	Gas (000kg)	Kerosene (000 M.T)
1038	23267	94401	1652	4.83	53375	6.87

Based on the energy consumption figures and number of dwellings, the estimated Energy consumption in residential sector per dwelling is around 0.88 toe.

3. Overview of supporting policies, targets, support mechanisms and the role of the main players

a. Examine and report the existing i) legislative framework & ii) financial instruments, promoting solar energy technologies in the building sector, at national level.

Building permit procedures for private and public buildings usually goes into several phases. First is the design phase which usually done by one of the Architect Houses. The design house should submit the Blue Print of the building which includes: Civil and Structural work, Electrical and Mechanical works, and of course Architectural and Building Envelopes to the Jordan Engineers Association www.jea.org.jo.

Jordan Engineer Association revises the design and supervises the work done by Architect Houses. Unfortunately this supervision does not emphasise on checking the Energy Efficiency measures in the building or renewable energy applications even though it is mentioned in the Jordanian "Codes of Buildings". Usually the Jordanian Engineer Association revises the design structure and Mechanical and Electrical Works.

The Municipality of Greater Amman www.ammancity.gov.jo is the only authorized body to give building permits in Amman the capitol of Jordan while local Municipalities in different governorates are authorized to give the Building permits. Ministry of Public Works and Housing www.mpwh.gov.jo design and supervise over the public building and public housings.

Jordan involvement in renewable Energy and Energy Efficiency goes back to the early eighties. Unfortunately this early interest and knowledge was not accompanied by solid policy framework and market driven tools.

Serious steps in this regards did not start until recent years. The increase in the price of oil, along with the long work of NERC to pass an energy efficiency law, compelled the Ministry of Energy and Mineral Resources (MEMR) of Jordan (The legitimate entity that is in charge of defining policy, fixes energy tariffs and regulates activities linked to energy) to issue "The National Energy Efficiency Strategy" in September 2004 which was approved by the prime minister. The strategy has focused on the following policies to achieve its goals:

1. Tariff policy.

2. Legislations.

* Taxation policies.
* Technical standards.
* Thermal insulation.
* Building codes.
* Customs Duties.
* Traffic Congestion

In the year 2004 The Government of Jordan has developed an integrated and comprehensive Energy Master Plan for the development of the energy sector over the next 20 years. Under the Energy Master Plan the proportion of energy from renewable resources will increase in order to reach 3% of Jordan’s primary energy. A

number of studies are underway to remove barriers to the exploitation of renewable energy, particularly wind, solar, biomass and also to prepare a draft for Renewable Energy Law.

The Ministry of Environment, which is in charge of designing environmental policies, has a strong trend in increasing environmental standards in order to meet USA or EU requirements. New standard for ambient air quality have been established recently (1140/2006). Maximum limits for air pollutants emitted from stationary sources, written in 1999 (JS1189/1999), have just been revised. A draft is under analysis.

architects design buildings, contractors build them, and building managers operate them (most of buildings owners don't have an adequate knowledge about energy efficiency and how to benefit from the technology in this regard, while designers mostly focus on architectural prospects with out much consideration to energy efficiency and contractors try to build with the least cost them and will refuse for example to insulate the building adequately because that requires more time and effort on his part. Building owners think that adapting energy efficiency measures will increase the cost of their buildings so they tend to cut corners and try to reduce their cost as much as possible).

4. Current status of solar energy technology applications

Jordan has abundant supplies of solar energy, with relatively high average daily solar radiation of 5.6 kWh/m^2 day, since it lies in the ‘‘global Sunbelt’’ between 29° 11´ and 32° 42´ N latitudes. The sunshine's more than 300 days annually, this can be considered sufficient to provide enough energy for solar heating/cooling applications. Nevertheless, solar energy technologies are not extensively used, except for solar water heaters (SWH), which are used for heating of domestic water. and it is economically feasible to use compared to all other conventional water heating systems in Jordan The SWH industry in Jordan is well developed.

The market for Solar Water Heater has been rising around 60% in the year 2006 in comparison to year 2005 that because of the increase in energy prices in Jordan, which is the main barrier to the development of the market. The Solar Water Heaters Market in Jordan can be as follows:

- ***Households Sector****:* is the main player in the market of solar water heating. About 14% of the houses in Jordan own solar family systems for water heating (source : national agenda 2006).

According to the available figures from the Department of Statistics in 2004, the number of existing dwellings is 1.204 million. The total area of installed systems is

about 896,740 m^2. Also it is expected to build 40,000 new dwellings every year for the next 20 years.

* ***Hospitals:*** The total number of hospitals in Jordan is 91 hospitals with 8,982 beds. The total annual demand of hot water is 161,767 m^3 (1.5 m^3 monthly demand per bed). The estimated energy needs for the hospitals in Jordan is about: **25.7 x 10^3 GJ/year.**

* ***Hotels:*** The total number of classified hotels in Jordan is 204 and 124 hotels apartment and suites with 19755 rooms & 37613 beds in total. The estimated energy needs for hotels and hotels apartment in Jordan is about: **171 x 10^3 GJ/year.**

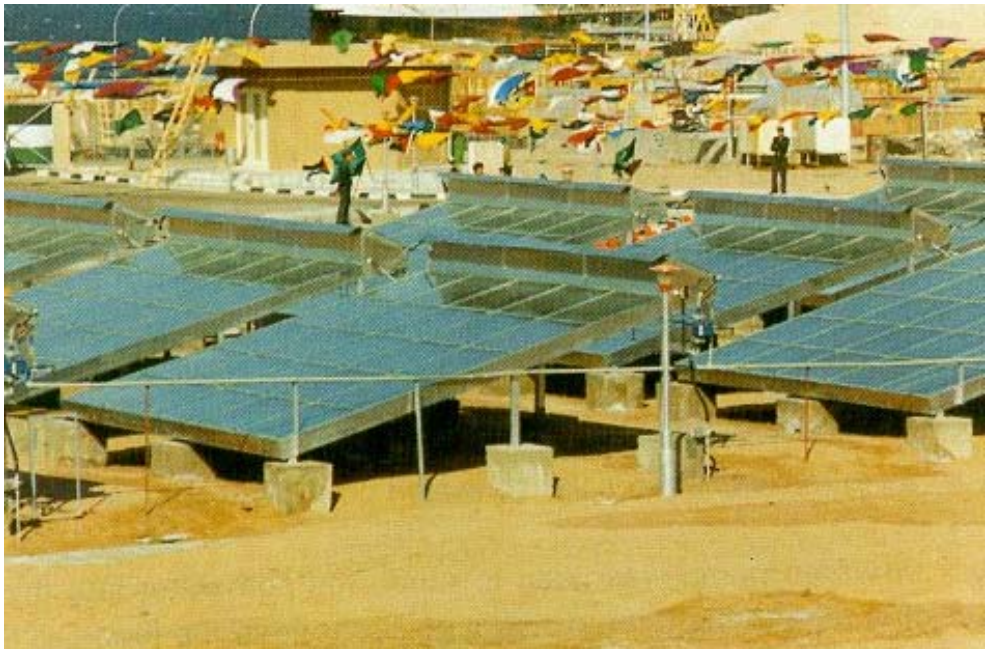
* ***Universities, schools and sports facilities***: Some schools and universities utilize solar heating systems. Unfortunately, detailed information is not available regarding the number of systems available in such facilities.

There are several success stories regarding the use of Solar Thermal Such examples are explained below:

a) Solar desalination using solar heat pipe principle.

The plant which was manufactured by DORNIER SYSTEM GmbH consisted of 15 modules that have a gross area of 375 m^2 with an effective solar collecting surface of 300 m^2. The modules were arranged in a 5-row/3-column matrix pointing to the south in Aqaba experimental station (latitude 29^o 30') with an inclination angle of 15^o so as to maximize solar collection during the summer months.

The distilled water from each individual module drips down into the distillate channel and is collected via a distillate pipe to the storage tank.



Solar desalination using solar heat pipe principle

b) Jordanian solar house.

The Royal Scientific Society (RSS) and the Kuwait Institute for Scientific Research performed a joint project to study the possibilities of solar heating and cooling in buildings, where solar heating should have first priority in Jordan. To meet the objectives of this project, a house was designed and built at an RSS location. Both passive and active design criteria were considered. The house faces the south, with large windows insulated walls.

c) Jordan dairy factory solar water heating system in Russeifa.

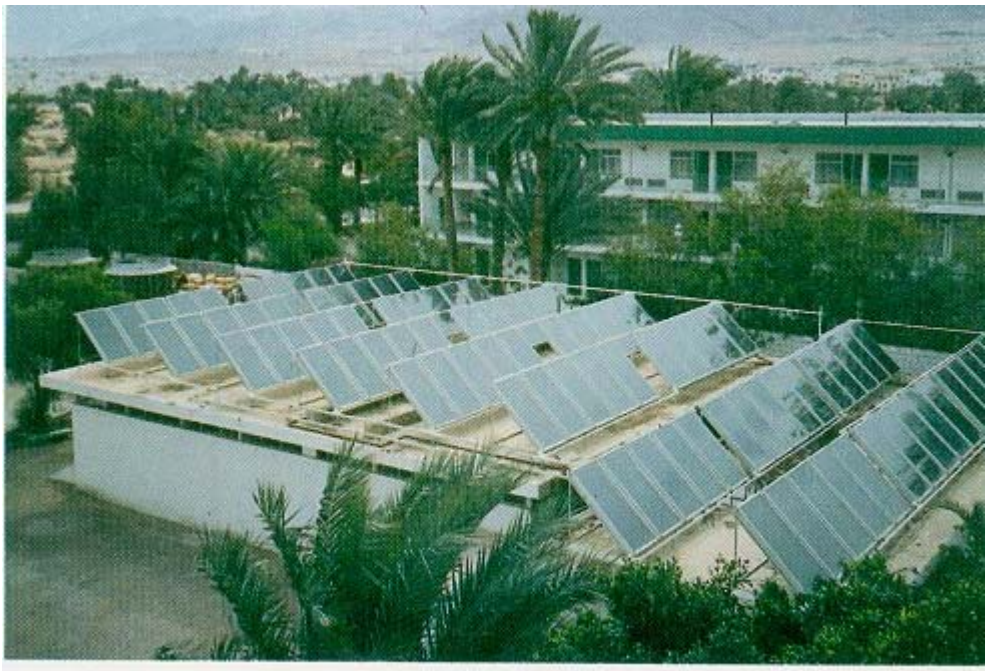
A survey was conducted to identify the possible candidate factory for the first pilot project that will utilize the SWH system for its needs. Jordan Dairy Factory was chosen for various reasons; particularly the required consumption of hot water, the suitable location and the available area for the installation of the flat plate collectors required in the design.

Jordan Dairy Factory in Russeifa

d) Coral Beach Hotel solar water heating system in Aqaba.

The aim of this project was to evaluate the possibility of using large solar water heating systems for industrial applications. For this purpose, a large solar water heating system was installed as a pre-heater to the existing conventional (boiler) heating system in 1987.

The total collecting area installed was 180 m^2 (90 flat plate collectors, 2 m^2 each), with a hot water storage tank of 12 m^3 and the necessary piping and control devices.



Coral Beach Hotel in Aqaba

Feasibility of Solar Water Heaters against Conventional Energy Sources is shown on the following table.

Conventionnel Energy Source	Solar Water Heater payback period (years)
Electricity Heater (Efficiency =90%)	2.1 years
Diesel Oil (Efficiency =59%)	2.8 years
LPG (Efficiency =70%)	4.0 years

5. Barriers impeding building integrated solar technologies

Barriers could be classified according to different factors such as:

Policy

- Absence of regulations, rules and energy provisions to control the quality and the effectiveness of the locally manufactured, imported or used equipment. Only two local manufacturers produce collectors in accordance with Royal Scientific Society's designs, while others do not follow any regulations. They have to face market fluctuations and pressure.

Technical

- Absence of professional calculation tools or technical handbooks for design and sizing of large solar systems.

- Exiguity of professional qualifications and technical skills particularly for the new efficient designs..

- Absence of compulsory testing regulations that forces the manufacturers and importers to test their collectors, although a national testing facility to test solar collectors exist at the Royal Scientific Society.

- High cost of high specification materials/component such as double-glazing, selective coating material, sheet metal, pipes. This results in hindering the development of designs and quality.

- Water contamination or calcification, water freezing in the pipes of collectors in cold regions.

Market

- Lack of incentives & financing offers.
- The majority of manufacturers are located in Amman (the capital) which makes it difficult and more expensive for people living in other cities to install solar collectors and have periodic maintenance.

Social

Recently, most of the buildings are multi-floor within small floor area. The floor area is usually used for many purposes such as, water tanks, dishes ….. etc ,therefore, there is no enough space for installing solar water heating systems for all residence.

6. Future opportunities and plans, most promising market niches

Renewable energy is considered the largest domestic energy source together with oil shale. Technical and market potential exists to increase significantly the contribution of renewable energy sources to Jordan's energy balance, resulting in employment and economic benefits. However, the contribution of such resources in the national energy mix is still minor. For the long-term future, ensuring the security of energy supplies is a highly important issue, but this is regarded as of minor importance relative to the more immediate social and economic problems facing Jordan. Efforts have been made to promote the use of renewable energy, such as wind, solar and biomass, but these are not likely to make more than marginal contributions to the national energy balance during the next 15 years, unless attitudes change and energy unit prices rise significantly. This is because harnessing renewable energy has in general been more expensive per unit of energy than that obtained from conventional energy sources. But it is environmentally beneficial. Nevertheless, renewable energy provides approximately 1% of the total current primary energy demand in Jordan.

Nevertheless, One main result of the EE Strategy that is expected in the very next future is the implementation of the Energy Efficiency Fund, which could grant

studies and audits, training and awareness campaigns, and pilot projects. MEMR has just initiated a call for tenders for recruiting a consultant in charge of elaborating detailed programme and procedures for the EE Fund. More details on the expected actions from the EEF and impact on the EE market are given in the section on "Existing possibilities for institutional support and technical assistance".

General policy Recommendations

Recently, the fossil fuel price was increased for more than 100% as compared with the fuel prices before three years. This rapid increasing of fuel price makes a good opportunity of using the solar thermal technology such as SWH in domestic hot water as well as in space heating. The penetration of solar thermal technology to the market can be achieved by the following:

1) Modifying the existing solar system through transfer of EU technological know-how.

2) Enhancing of awareness of using the solar systems.

3) Incentives for using the solar systems, such as decreasing the taxes and customs on imported solar system and on the materials that are used in local manufacturing of the solar systems.

4) Jordan Engineers Association should Acknowledge the Architect and designers of Building to emphasis on the implementation of energy Efficiency measures and renewable Energy in their design.

5) The Municipality of Amman and other municipalities should increase their supervision on the implementation of the Jordanian Building Codes.