



Prospects of Solar Thermal Investments Case of Al Bashir Hospital & Potential for Other Facilities

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Do we have any solar thermal project done on the basis of Power Purchase or BOT/BOOT etc.... for any facility in Jordan ?

If Yes, which/where?

If No, Why?



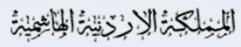

Bashir Hospital Background & Thermal Energy Needs

- Largest Hospital in Jordan established in 1954 located in East Amman.
- 49 Buildings containing approx. 1000 beds
- 7000 Patients Daily or approx. 1,500,000 Annually (850 Doctors)
- Burns diesel fuel or/and LPG for its hot water needs by steam boilers
- Approx. 2,000,000 Liters of diesel recorded in year 2014 at a cost of approx. 1,250,000 JD



Bashir Hospital – Emergency Bldg.

Bashir Hospital Solar Thermal Project – Stake Holders

Name	Scope
Ministry of Energy and Mineral Resources 	Contracting Authority
The European Commission 	Grant Providers (80%)
Ministry of Health 	Final Beneficiary
Bashir Hospital – Amman, Jordan 	Affiliated Entity
Millennium Energy Industries (MEI) - Jordan 	Implementation Party
National Energy Research Center 	Third Party Energy Consultant

Bashir Hospital Solar Thermal Project

- Actual demand was measured and then confirmed by NERC and accordingly Solar Thermal System was sized.
- Fixed type solar flat plate collectors (Large Scale) were selected along with auxiliary items and seemingly connected to existing heating system.
- The system includes large storage for night time usage for more fuel savings.



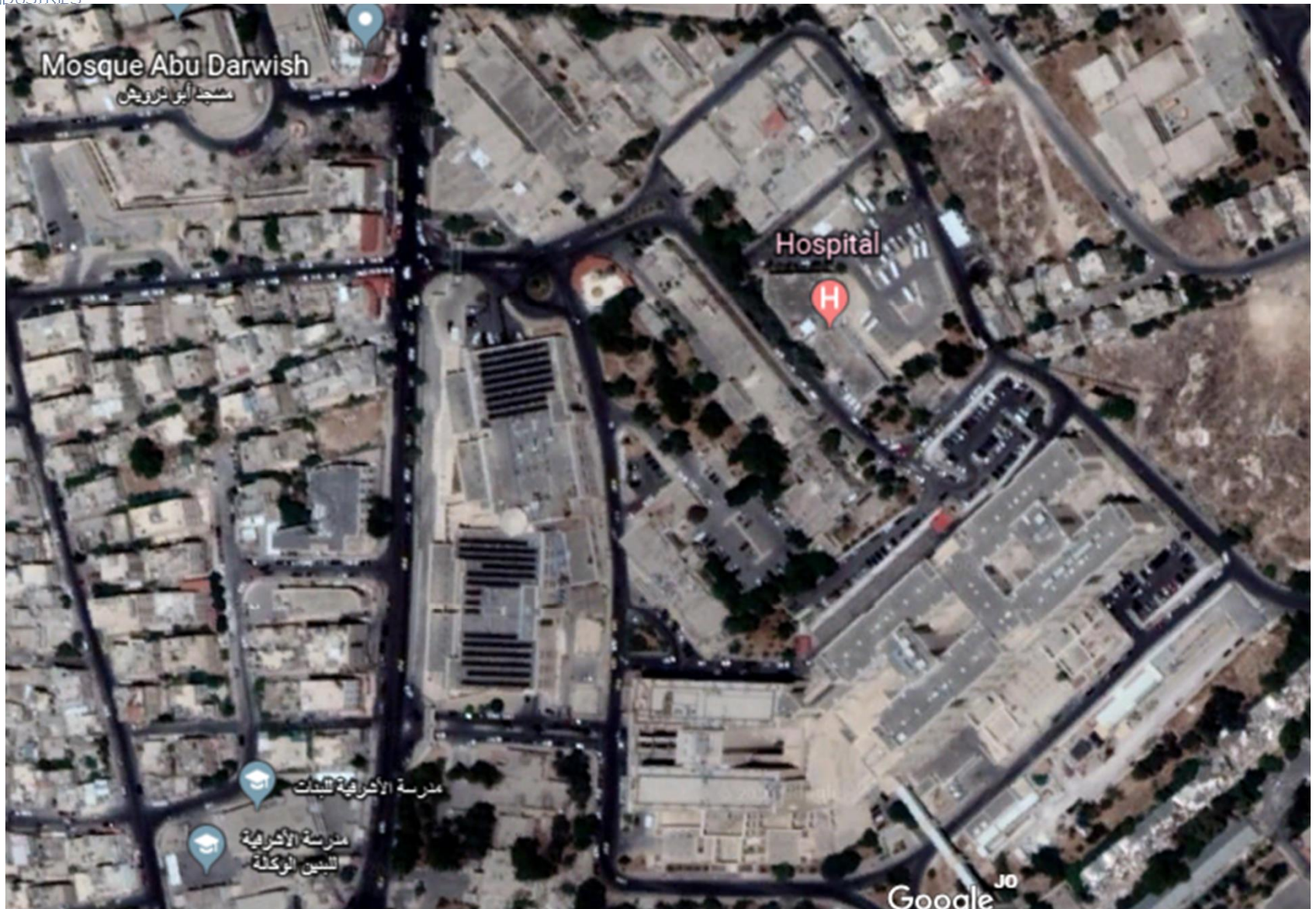


Bashir Hospital Solar Thermal Project Summary

Al Bashir Hospital - Utility Building & Main Hospital

Application	Domestic Hot Water Supply
Solar Collectors Effective Area (m ²)	1,133
Used Roof Space on Utility Building Roof (m ²)	2200 m ²
Estimated Energy Savings (KWht/year)	1,000,000
Average Daily DHWS production @ 60 Deg. C. (Liters/Day)	60,000
System Annual Diesel Fuel Savings (liters/year)	176,000
System Annual savings (JD/year) @ 0.65 JD/Ltr	114,000
System 25 Years Lifetime Savings (JD)	2,350,000
Project Estimated Budget (DJ)	500,000
Project Payback (Years)	4.4

Bashir Hospital Solar Thermal Project Pictures





Bashir Hospital Solar Thermal Project Actual Output

- System was commissioned in June 2018 and running smoothly ever since with minimal O&M needs.
- Savings of Approx. 40,000 JD is recorded so far (Approx. 35% of expected annual savings)
- Measurement of system actual output was carried out and confirmed by NERC
- System is unmanned and remotely monitored and optimized.



Prospect for Solar Thermal Investments into Jordan other Hospitals

- Part of the Bashir grant budget was dedicated into preparation of feasibility studies and preliminary designs of similar thermal systems to other large hospitals in Jordan.
- Three hospitals were selected (HRH Prince Hamza Hospital/ HRH Prince Faisal/ Zarqa New Hospital.
- The studies were carried out by AEE Intec of Austria and verified & confirmed by NERC.
- Studies for these hospitals along with many others in Jordan are ready and can be implemented pending financing

Implementation of Mafrag Hospital Solar Thermal Project and Boiler Upgrades

- Funded by the UK government after Bashir hospital
- Solar thermal system, boiler replacement and upgrade completed in 6 months
- JD 30,000/ Year will be the diesel fuel savings (Payback less than 4 years)



Prospect for Solar Thermal Investments into Jordan other Hospitals

Hospital Name	Location	No. of Bed	Estimated Demand (kWh/day)	Estimated Cost (\$)	Fuel Saving (Liter/year)	Saving (USD/year)	Payback Period (Year)
Prince Hamzah Hospital	Amman -Marka	434	2,115.00	323,000	85,400	69,763	4.6
Prince Faisal Hospital	Amman - Al Rusayfa	195	1,512.00	256,000	58,600	47,870	5.3
Zarqa New Govermental Hospital	Zarqa	493	1,100.00	276,000	74,000	60,451	4.6
Princess Basma Hospital	Irbid	230	969	138,000	48,000	39,211	3.5
Dr. Jameel Totanji Hospital	Amman - Sahab	200	843	117,000	33,000	26,958	4.3
Al Karak Hospital	Karak	310	1,306	180,000	65,000	53,099	3.4
National Center for Mental Health	Blaqa - Fuhais	256	1,079	160,000	44,000	35,944	4.5
TOTAL				1,450,000	408,000	334,000	

Possibility of Solar Thermal with 100% Fuel Savings Through Seasonal Storage



Solar District Heating with Seasonal Storage Pit in Gram - Denmark



70,000 m² Solar District Heating field with Seasonal Storage Pit of 200,000 m³ in Marstal - Denmark

Advantages of Solar Thermal

- 1- Varied client base such as Hospitals, Commercial, industrial, and residential, etc...
- 2- Mature technology – Retrofitting or new constructions
- 3- Comparatively cheap storage with possibility to reach 100% SF with seasonal storage
- 4- Does not need authorities approval, grid impact, etc...
- 5- Short payback of approx. 2 to 5 years in Jordan for most cases

Challenges Facing Solar Thermal Investments

- 1- Needs for technical knowledge by potential lenders
- 2- Establishment of thermal unit cost (KWht) derived from fuel prices
- 3- O&M needs and interrelation with client heating infrastructure
- 4- Fluctuations of fuel prices affecting solar thermal energy unit cost and payback.



Thank You