Solar Energy in Oman

Need of an integrated approach to renewable energy solutions

By

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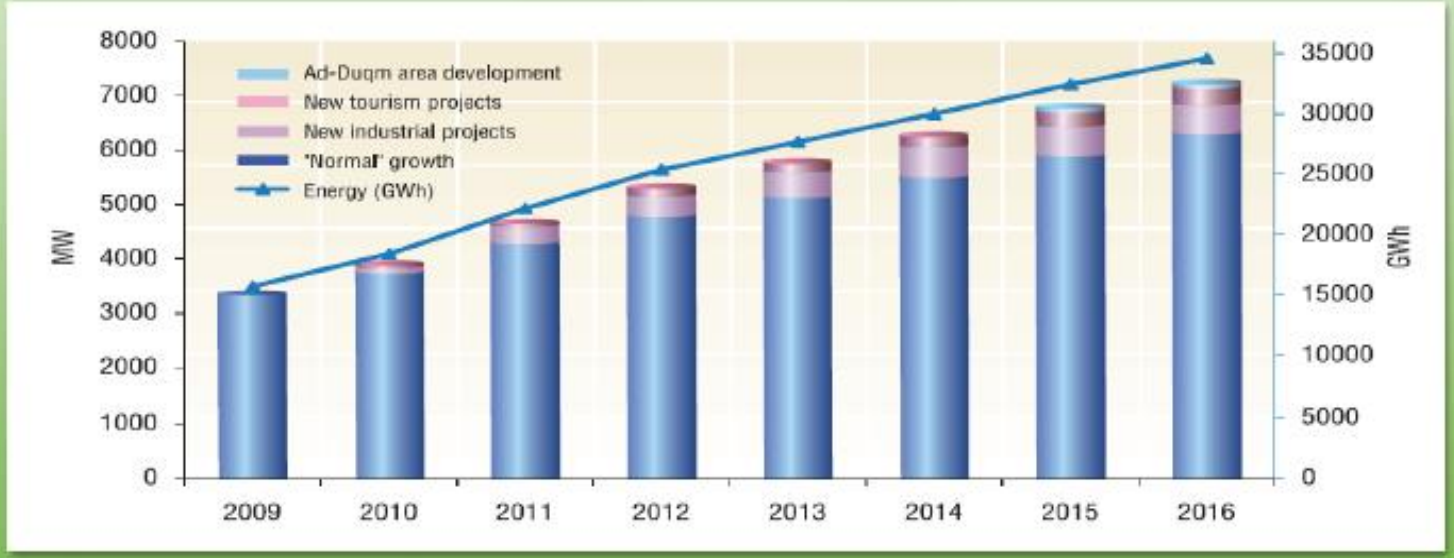
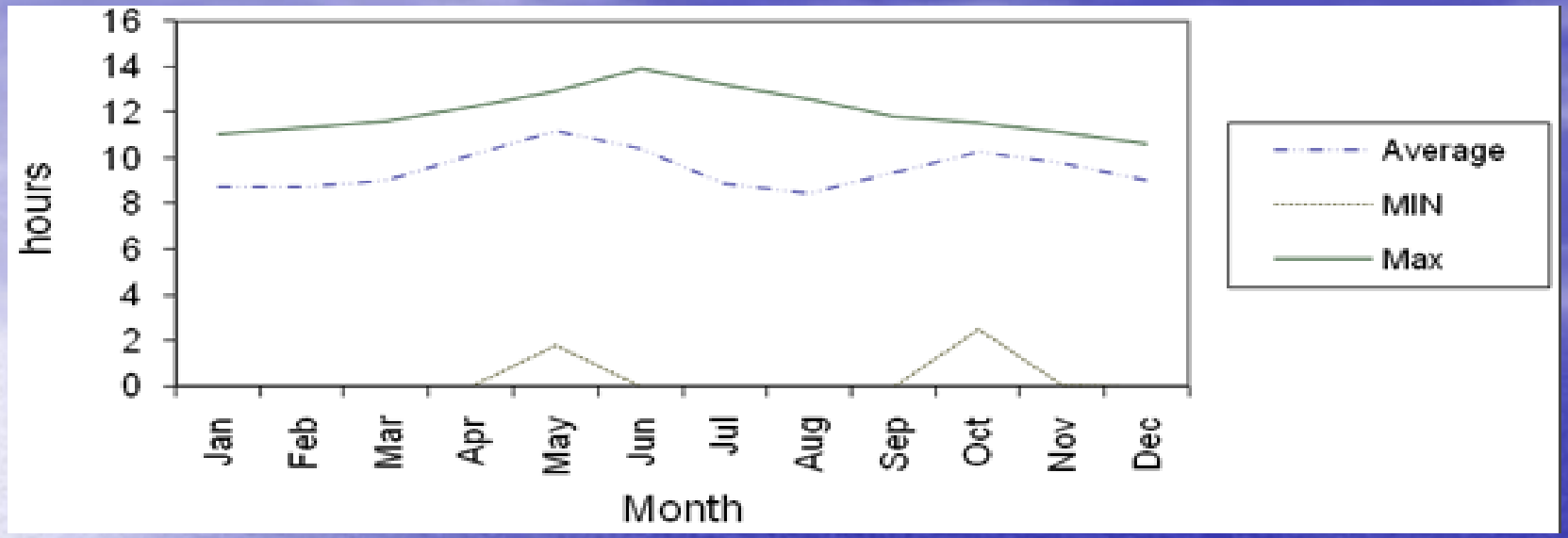
Trend of Future Demand

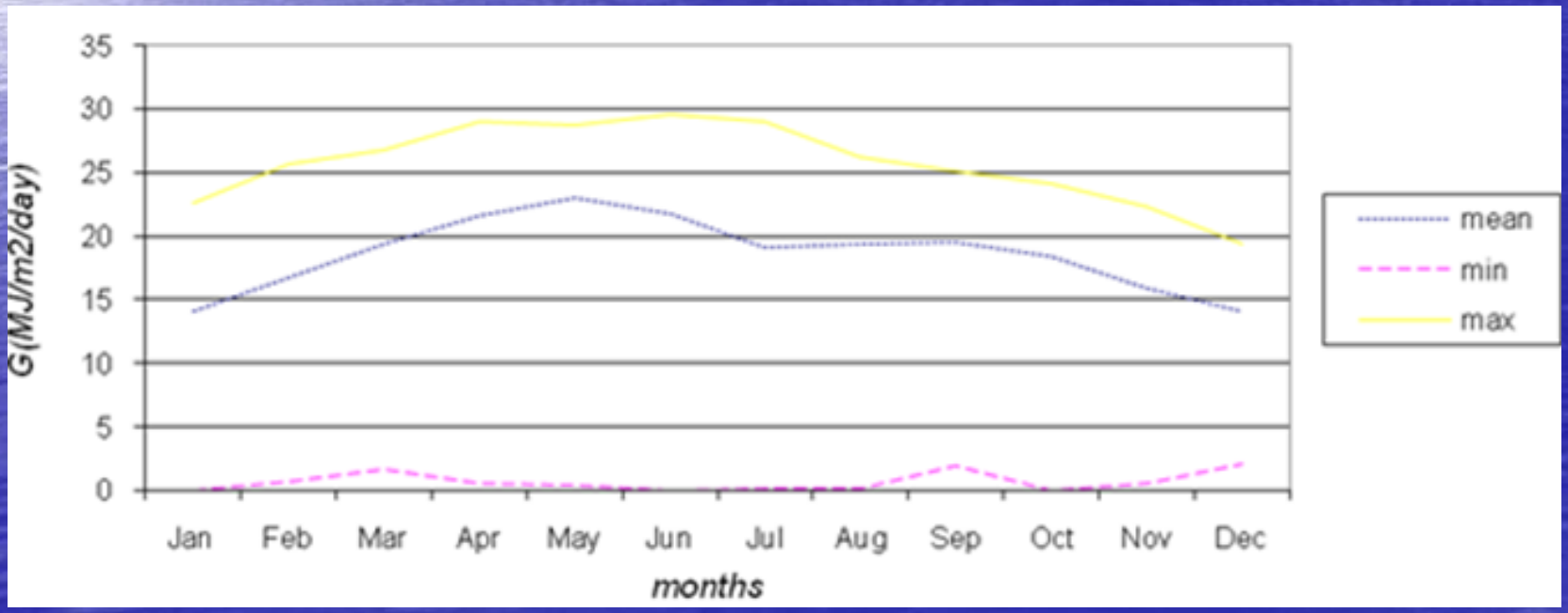


Source: OPWPC

Annual Sunshine Hours



Annual Solar Radiation



Why Solar Energy in Oman

- Oman enjoys a climate with many hours of continuous sunshine and receives substantial amounts of solar radiation, which can be converted to solar energy .
- The average solar radiation is 216 W/m2.
- The average sunshine duration in Oman is 9.49 hours with little seasonal variation.
- Oman has a great potential for solar energy harnessing because of the long daily duration of sunshine and high levels of solar radiation.
- Researchers from SQU have carried out a detail study to use renewable energy in rural sectors of Oman and concluded that there is a good potential to use solar energy in rural areas.
- Solar energy is free from any pollution, does not provide any toxic by-products and no nation can put an embargo on its supply.
- A reduction of greenhouse gases throughout the world of about 50 % is required in the next 50-100 years.

Feasibility Studies Carried out in Hospital in Oman

- Hot Water Application
- Vaccine Refrigerator
- Pumping Water
- Air Conditioning

HOT WATER SYSTEM

- Two years study.
- Fund from SQU.
- Final Report submitted recently.
- Collected data reported in graphical format.

At present Oil-fired Boilers generates steam and using calorifier at which hot water is produced and used for various applications.

S.No	Description	Details
1	Boiler Specification	Make: York Shipley, Model: 460 SPHV–125– 2 Pressure rating: 150 psig, Capacity: 4313 lbs/hour Year of Installation: 1993
2	Hot Water Consumption per day	Winter: 13800-litres/day approximately Summer: 12840 liters/day approximately
3	Average Diesel Consumption per day	1084 liters/day
4	Operating Cost of System	$3900 per month (approximately)
5	Maximum required temperature of hot water	Kitchen/Laundry: 80°C to 85°C Other areas: 60°C to 70°C
6	Main usage of hot water	Kitchen, Laundry, OPD & other areas of the hospital
7	No of beds in the Hospital & % of Occupancy	240 beds & 70% to 80% of Occupancy

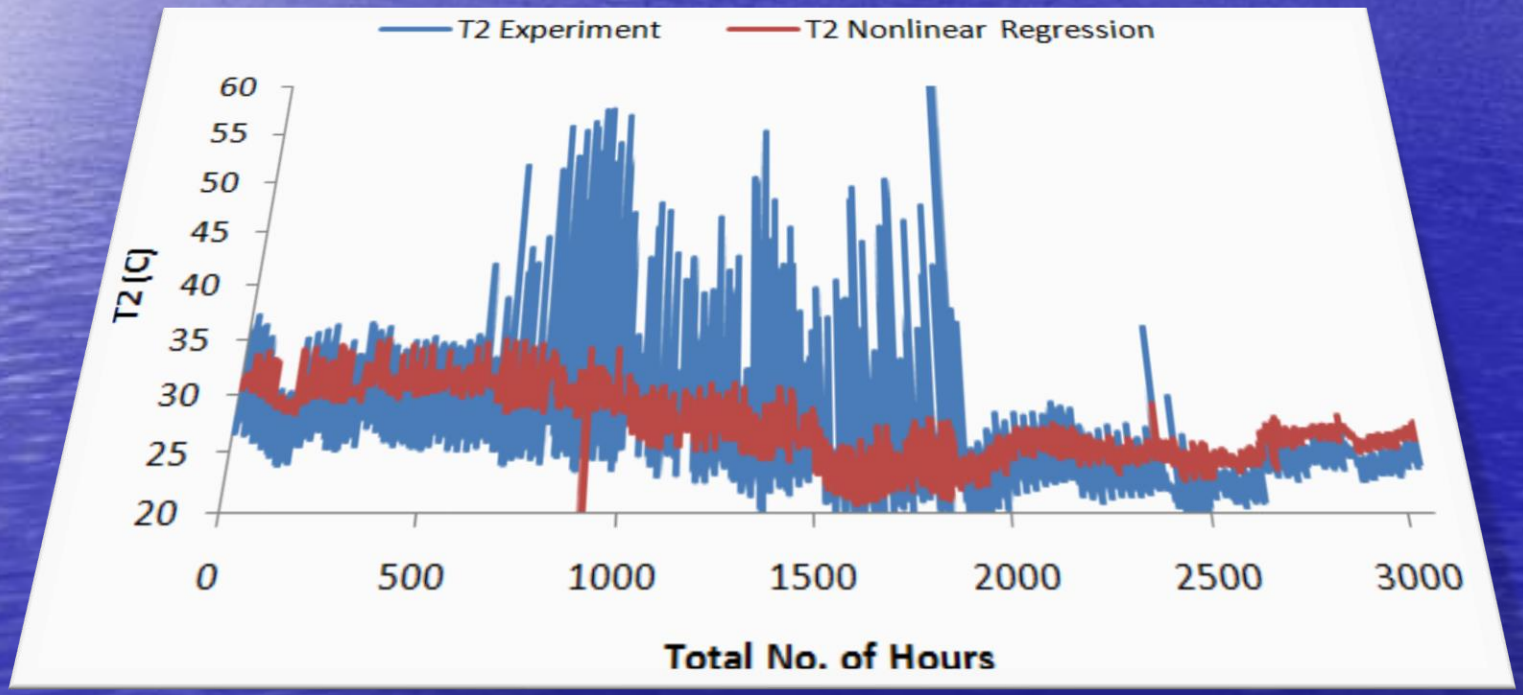

04/11/2007

Savings Details of the Proposed Project

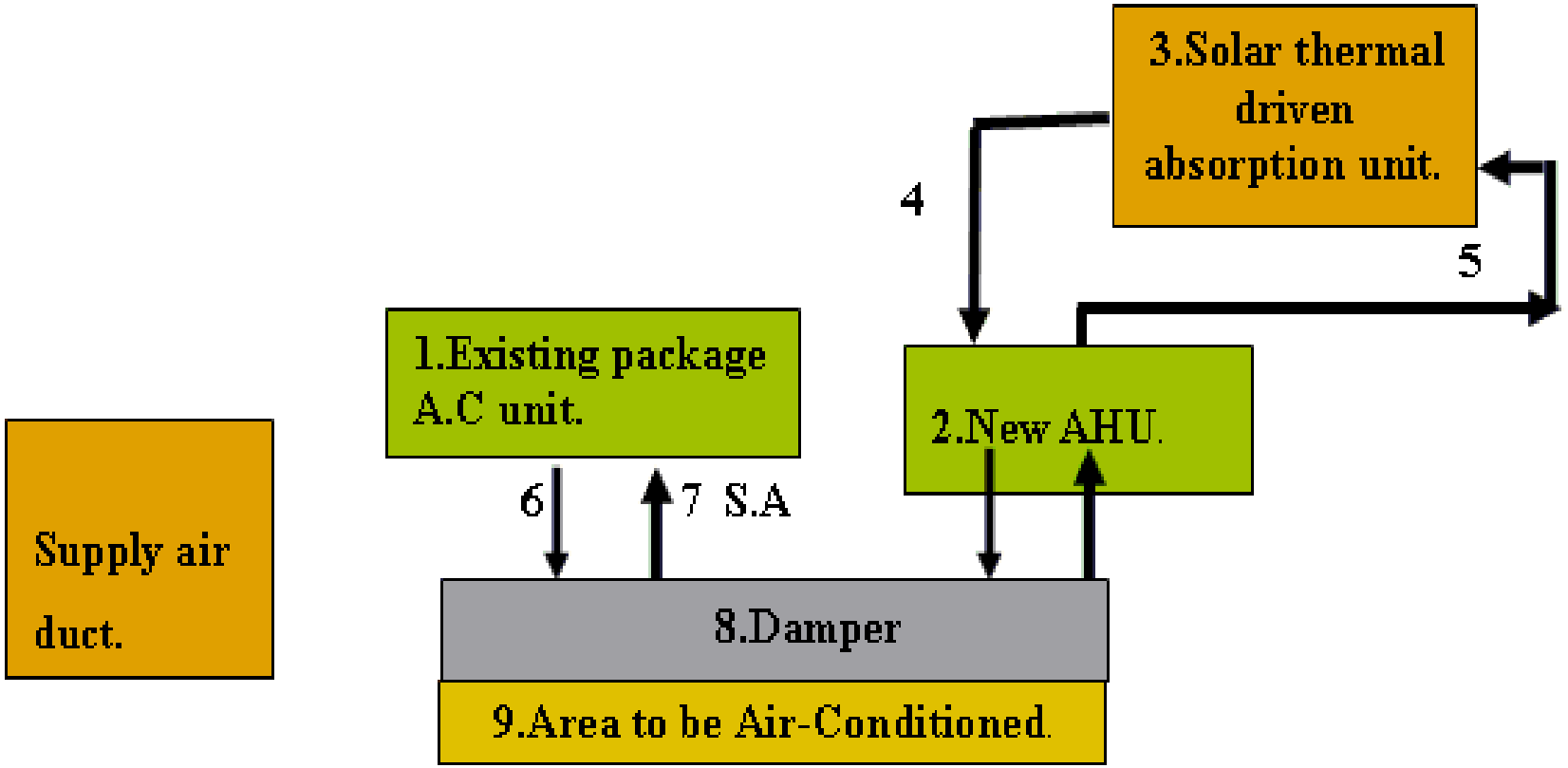
S.N.	Description	Total Amount
1	Average Diesel Consumption/Month	30,000 Liters/Month
2	Assuming 90% is used for Boilers	27,000 Liters/Month
3	App. Diesel Consumption/Calorifier (We have total eight calorifiers and for approximation we divide the total consumption by 8)	3375 Liters/Month
4	Price of Diesel Saving/Month (Assuming 0.140 Baisa/liter)	US$ 1250
5	Annual Saving from Diesel Budget	US$ 15000
6	Capital Cost to install the proposed solar system as per the report	US$ 21000
7	Pay back period	Approximately 18 months
8	Operating Cost	Negligible
9	Amount of CO_2 Emission Saving	10125 Kg/Month

Regression analysis was used to analyze the recorded data to develop the following correlation which correlates T2 (hot water supply by the system) to T3 (cold water supply to the system), NT (noon temperature) and NH (noon humidity) .

$$T2\,(T3, NT, NH) = 0.87*T3 + 0.264*NT - 0.063*NH$$



The Schematic Diagram of the Proposed Scheme.

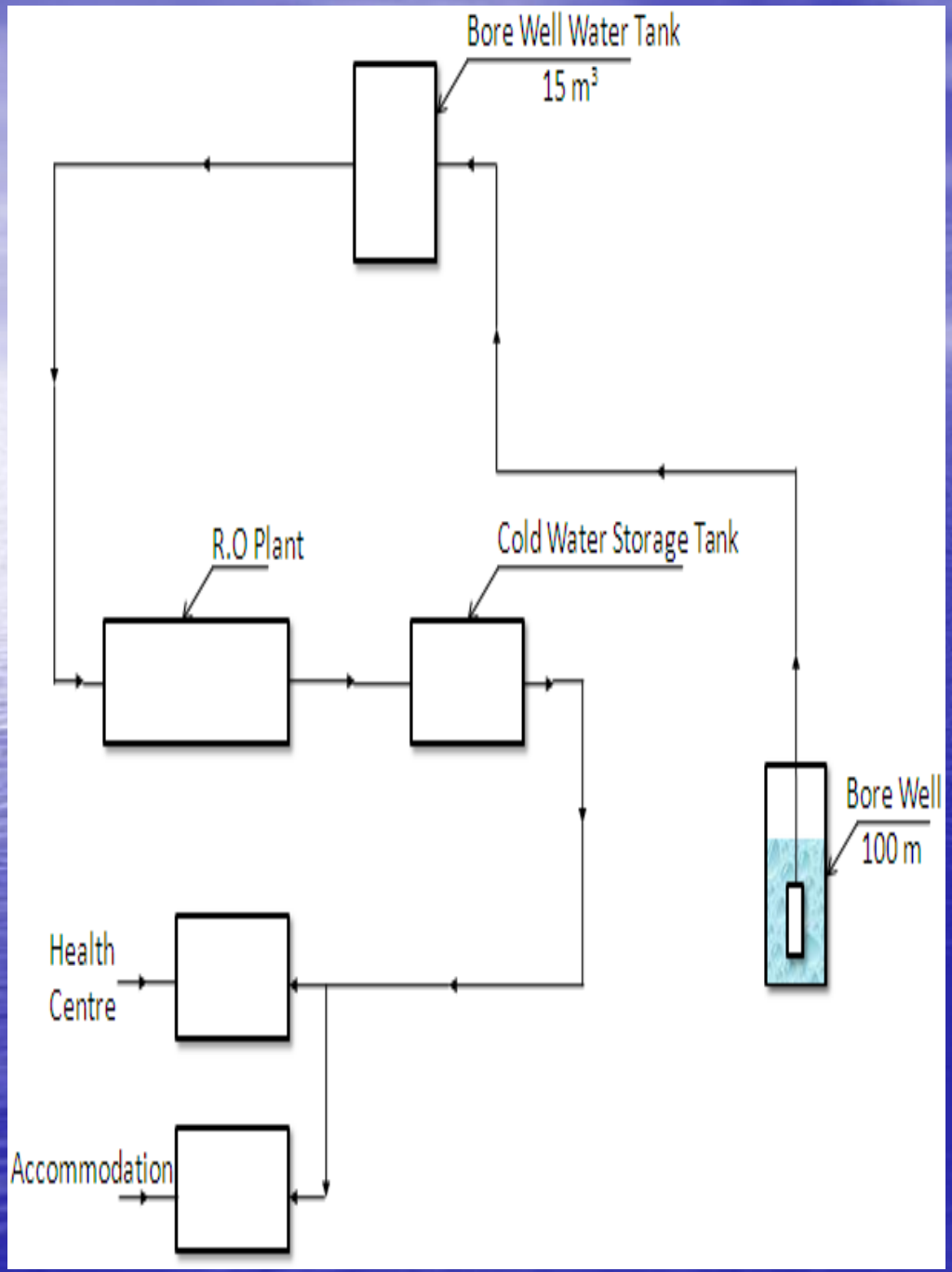


4.Chilled Water supply line to AHU, 5. Chilled water return line from AHU, 6. Supply air duc tand 7.Return air duct

The Assembled System

PV Cells at the Assembly Location

The Control Unit Box



The Existing System

S. No.	Description	Details
1	Bore well Depth	100 M
2	Pump Details	GRUNDFOS submersible Pump Model No SP 5A-21N
3	Pump Output	4 m^3/hr
4	Power requirement	2.5 kW
5	Pipe Size and type	Stainless Steel 25 mm dia

The Proposed System ... continue

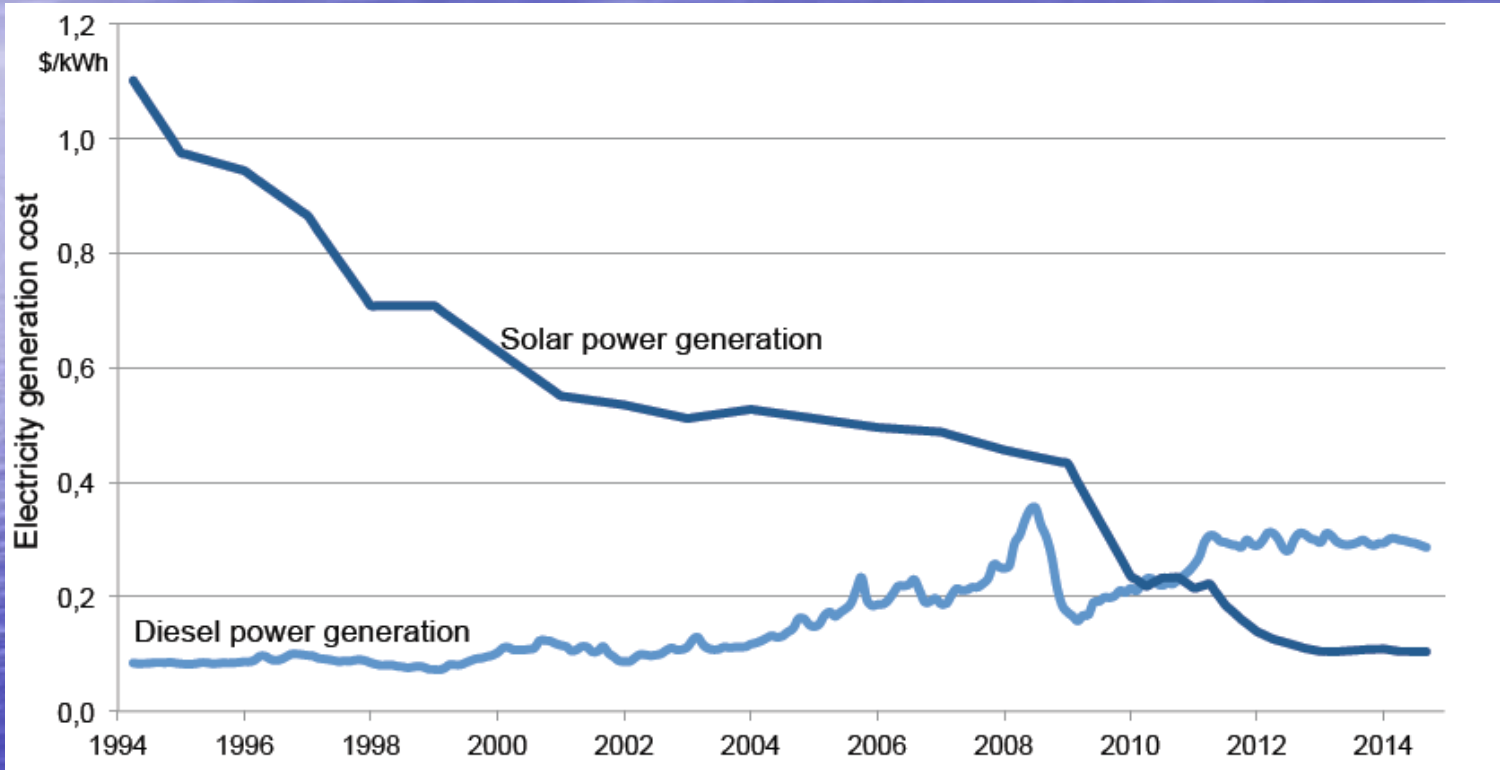
- If the pump run for 7 to 8 hours during the daytime, when solar energy is available in plenty, and store the water in the raw water tank then the system will be more economical.
- When there is a problem in the solar system automatically power supply is switched over to the existing MEW power supply.
- The power supply for the pump motor comprises a photovoltaic array and a battery for storage.
- The PV array charges the battery via a charge regulator, to prevent the batteries from overloading and under loading.

Proposed System

- It is envisaged to replace the existing air-conditioners with the solar thermal-driven absorption unit of capacity 525 KW.
- Proposed absorption unit will be used to produce chilled water at a temperature of 7°C to 9°C.
- This water will be circulated to wall mounted fan coil units (FCUs) of different capacities through insulated piping.
- Each room will be provided with FCU along with individual controls.

- Electricity tariffs in Oman are identical in all parts of the country, heavily subsidised. (App 42%).
- A comparison of the costs of producing thermal electricity with the costs of solar photovoltaic (PV) or wind energy shows viable business cases for solar PV and wind power in Oman. These renewable sources are cost-competitive, in particular in rural areas, with thermal power generation.
- National Energy Strategy to 2040:: The study was completed in 2015 and recommended that around 10% of Oman's generation mix should come from renewable energy sources (RES)—primarily onshore wind and solar—by 2025.
- http://www.aer-oman.org/aer/RenewableEnergy.jsp?heading=0
- Public Consultation on the Regulatory Framework for Small Scale Grid Connected Solar PV Systems Standards -Technical Standards Issued 2017 (http://www.aer-oman.org/pdfs/TechnicalStandards.pdf).
- The abundance of solar resource potential and the falling cost of associated technologies, mainly photovoltaic (PV) modules are major factors influencing the attractiveness of solar energy in the region.

Compared to diesel power generators, PV-systems are increasingly competitive and therefore a viable alternative



Assumptions:

Genset efficiency 3.5 kWh/l (net electricity production) @ 1 USD/l; Capex and maintenance cost for Diesel not included (incumbent system)

PV power cost based on 1500 kWh/kWp at EU market system price (EPC cost base), 30% equity, 3.6% interest rate, 20 years period, 5% IRR

Sources: EIA, DOE NREL Solar Technologies Market Report Jan 2010, BSW, ECB, EXXERGY own estimates and calculations

Short listed pilot projects

Project Description	Location	Installed Capacity	Technology
2*250 Wind turbine	Masirah - Sharqiah	500 kW	wind
100 KW Solar	Hij – AL Wusta	100 kW PV	(50KW thin film& 50 KW mono crystalline)
2*2.1 MW turbines	Saih Al Khairat	4,200 kW	wind
292 kw Solar	Al Mazyonah- Dhofar	292 kW	solar
1000 Kw Solar	Haima – Al Wusta	1000 kW	Solar (PV-mono crystalline)
28k W PV and storage system.	Al Mathfa- Dhofar	28 kW	solar

Enhanced Oil Recovery- (EOR) – Solar Energy use -Oman's oilfields account for more than 20% of the country's total gas use to produce steam for EOR process. GlassPoint partnered with PDO built Middle East's first solar EOR project. The pilot was commissioned in 2013 and proved the cost effectiveness . 1,021MW solar thermal project now under construction.

Oman floats tender for 500MW solar project - June 2018

- 12 companies invited by the Omani - solar PV Independent Power Project (IPP).
- The **Oman Power and Water Procurement Company (OPWP),** the sole procurer of new capacity. The RfP was issued on June 4, 2018.
- The proposed commercial scale renewable energy project — dubbed Ibri II Solar IPP — is a 500 MW capacity solar photovoltaic (PV) based scheme to be set up in Wilayat Ibri in Dhahirah Governorate.
- Among the contenders for this maiden investment in large-scale renewables are energy giants like BP, EDF and Total, many of which are competing as consortiums or joint ventures. Prequalified to participate in the tender are: (1) Abu Dhabi Future Energy Company PJSC (Masdar) and Total Solar (2) BP Alternative Energy Investments Limited, Lightsource BP Renewable Energy Investments Limited and China New Energy Development (Zhejiang) Co (3) EDF Energies Nouvelles and Korea Electric Power Corporation (KEPCO) (4) International Company for Water and Power Projects (ACWA Power) (5) International Power SA (IPSA) (6) GCL New Energy International Limited and Alfanar Company. Included in the list are (7) Hanwha Energy Corporation and Hanwha Q CELLS Corporation (8) Marubeni Corporation (9) Mitsui & Co, Ltd (10) Sumitomo Corporation (11) X-ELIO Energy, SL, and (12) Zorlu Enerji Elektrik Uretim A.and Abengoa Energa SA.
- The deadline for submission of bids is October 22, 2018 with the project scheduled to be operational by June 2021.
- The successful bidder will secure the government's mandate to design, build, finance, own, operate and maintain the Solar IPP —government's strategy to secure a minimum 10 per cent contribution from renewables by the year 2025.

Regulatory framework for solar PV systems

- The Authority for Electricity Regulation has announced during January 2017 the completion of the final draft of the Standards for small scale Grid-Connected Solar PV Systems.
- The new standards define the requirements to be fulfilled by solar PV generating plants which intend to operate in parallel with the distribution networks.
- In addition, connection guidelines have also been developed to provide information for customers, consultants and contractors on the essential aspects which have to be taken into consideration in order to connect a solar PV system to the Distribution Networks.
- All future small scale Grid-Connected Solar PV Systems would have to go through relevant distribution companies. Therefore, a typical connection process has been established which provides general procedures to be followed by distribution companies when allowing the connection of a solar PV system to the distribution network, from the application stage up to the operation stage.
- The study also made recommendations on the experience, competence, training and certification required for installers to qualify to undertake any work related to Grid- Connected Solar PV Systems.
- The Authority has already written to the Distribution Code Review Panel (DCRP) to adhere to these requirements when certifying solar PV systems installers and contractors.
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