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# The potential of solar energy in Qatar



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# OBJECTIVE

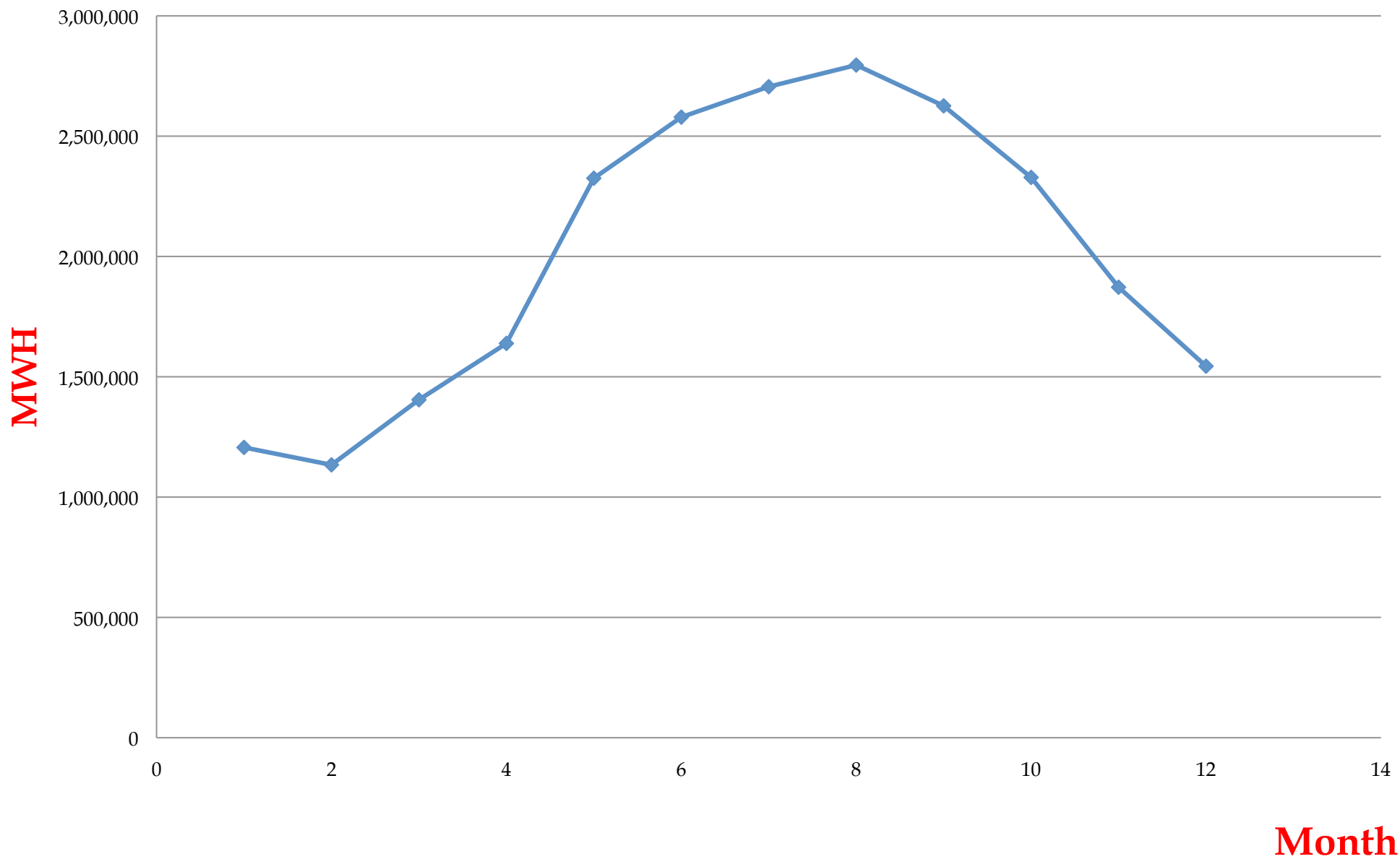
The objective of this research is to assist and lead the authority and government to the:

- Energy roadmap, Energy planning
- Energy forecasting, Energy Balance
- Qatar solar atlas, and
- Solar Energy policy

to secure energy future with minimizing energy demand and presenting the solar energy Potential with controlling air pollution.

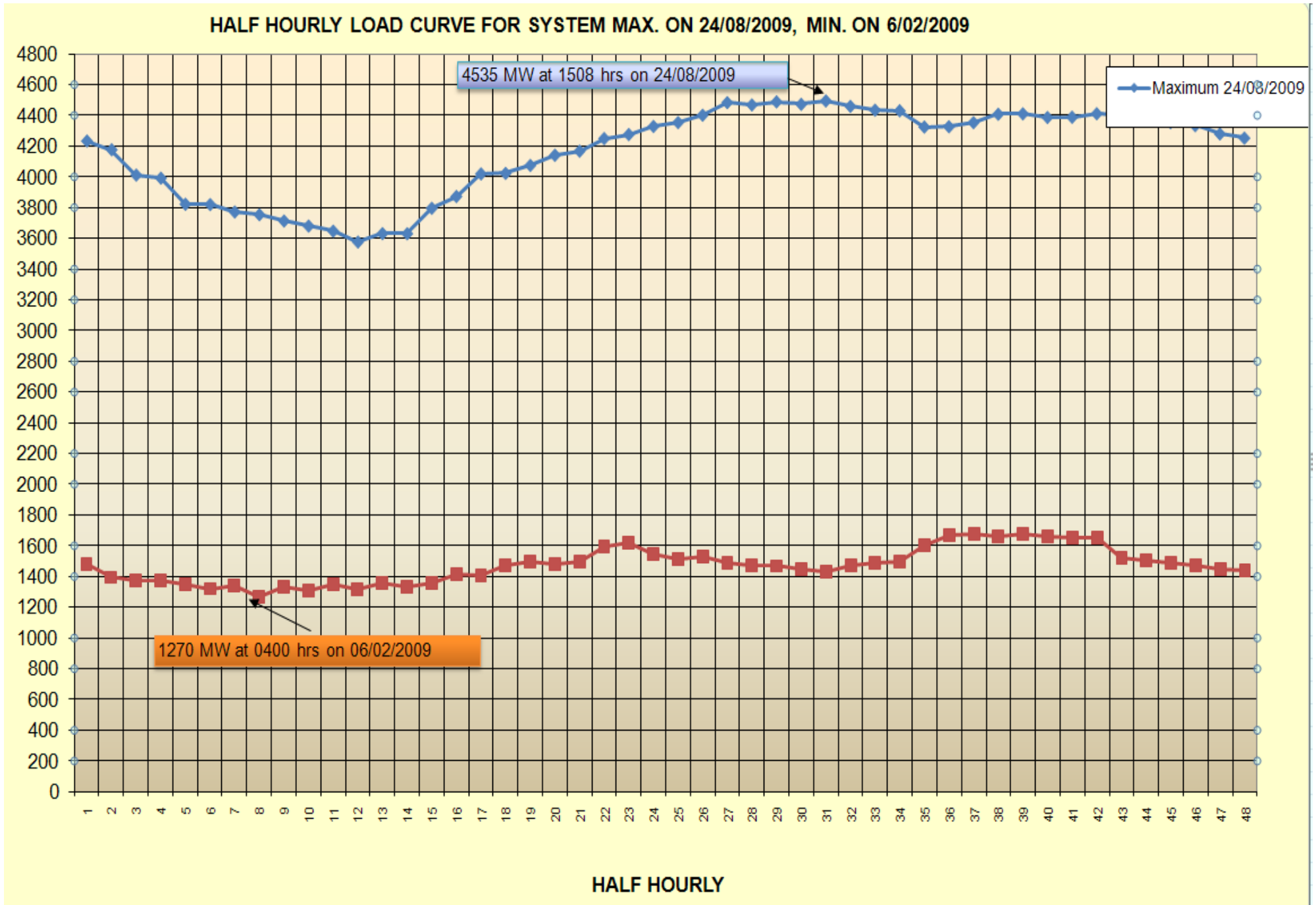


# Electrical generation in 2009



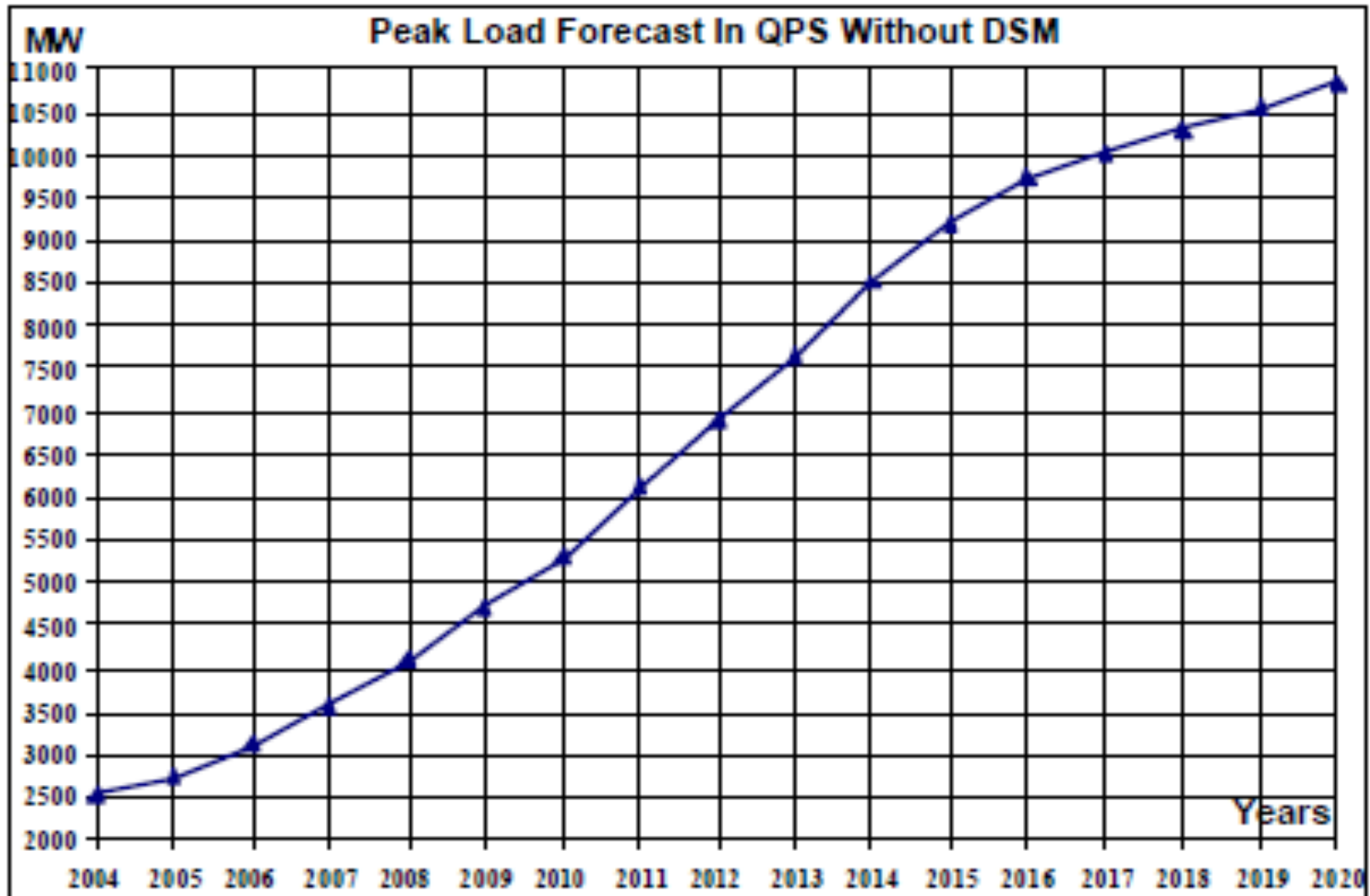
Note: Data Source is NCC; to be updated by NCC.

# Max. & Min electrical load (MW) 2009 Aug.





# Forecast of electrical energy gross demand



DSM== Demand side management

## Average electricity per Capita consumption

Year	2006	2007	2008	2009	2010	Avg Growth
Population	1,041,733	1,226,211	1,553,729	1,631,728	1,699,435	
Population Annual Increase	17.3%	17.7%	26.7%	5.0%	4.1%	14.2%
Electricity Consumption in Qatar, GWh	10,726	12,034	13,524	14,947	16,844	
Electricity Consumption Annual Increase	15.4%	12.2%	12.4%	10.5%	12.7%	12.6%
Electricity Per Capita Consumption	13,874	13,476	11,820	12,727	14,485	
Electricity Per Capita Consumption Year-on-Year Variance	-6.5%	-2.9%	-12.3%	7.7%	13.8%	-0.0%

*counts from Qatar Statistics Authority's web site (<http://www.qsa.gov.qa/eng/index.htm>). Per IEA standard only actual energy consumed (excluding auxiliary and all kinds of losses) are summated and divided into the country's population.*

# Qatar expects

- Qatar expects to add **16,260 MW** of power to the national grid between 2011 to 2036, almost three times current capacity (**5,000 MW**).

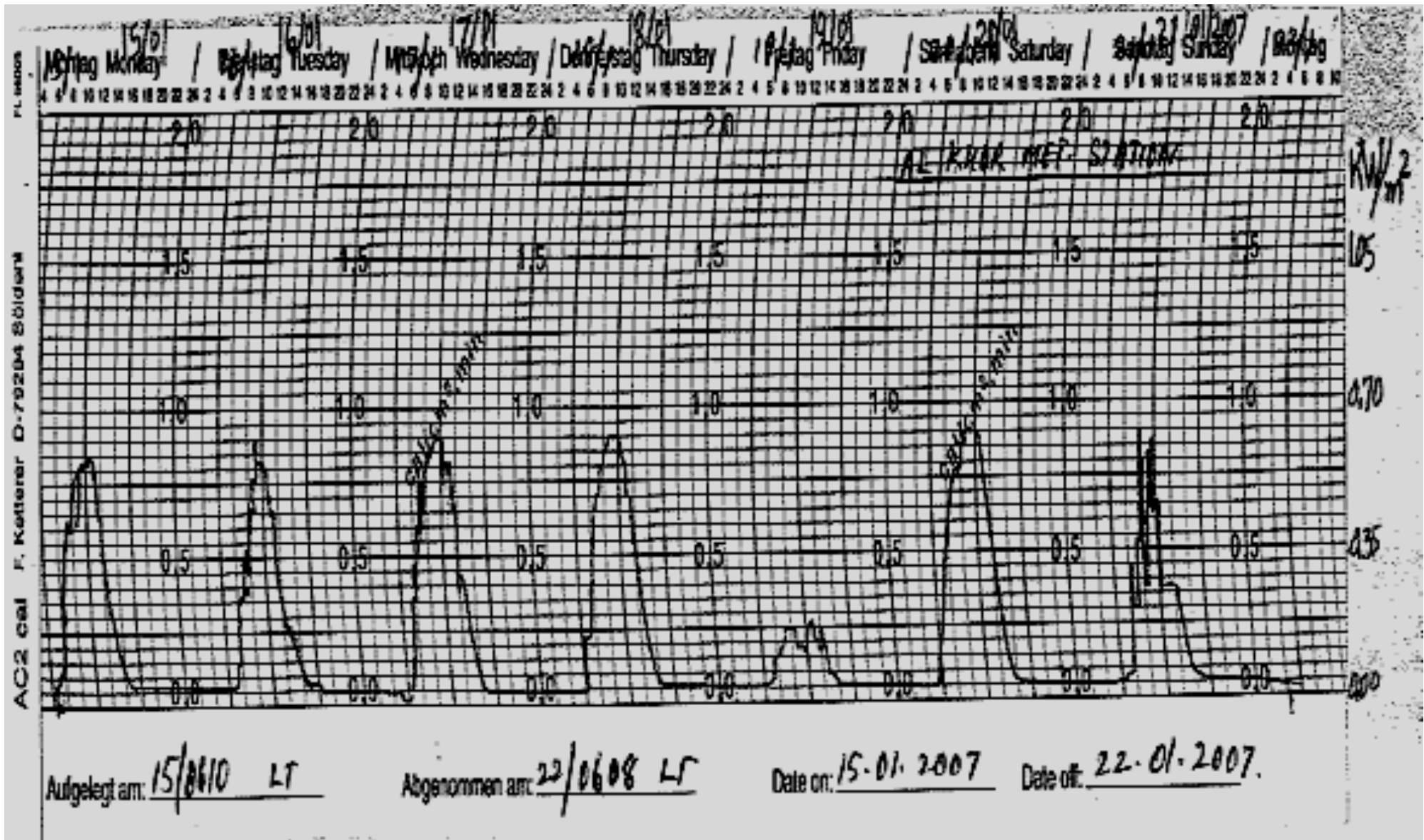
# *Solar Atlas*

*MEAN DAILY GLOBAL RADIATION from*

*Measured Data*

# Solar radiation measured in **Al-Khor**

(kW/m<sup>2</sup>), Jun. 15-22, 2007

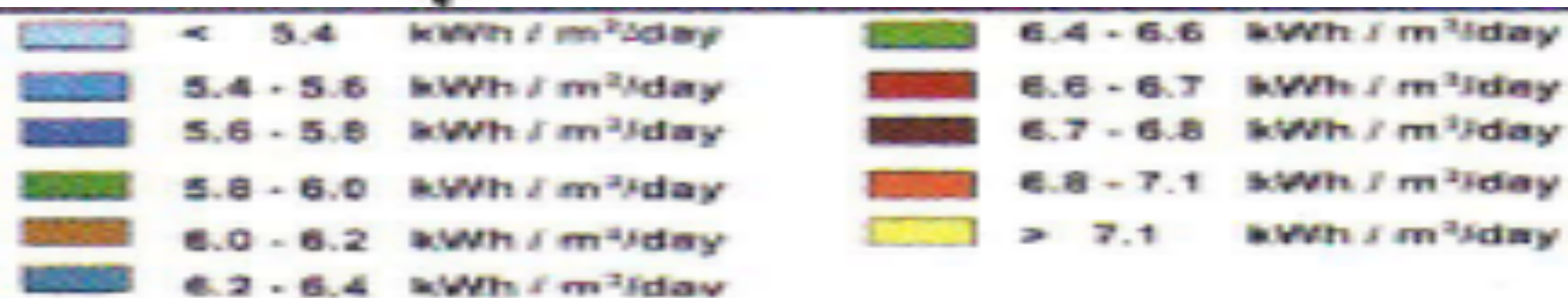
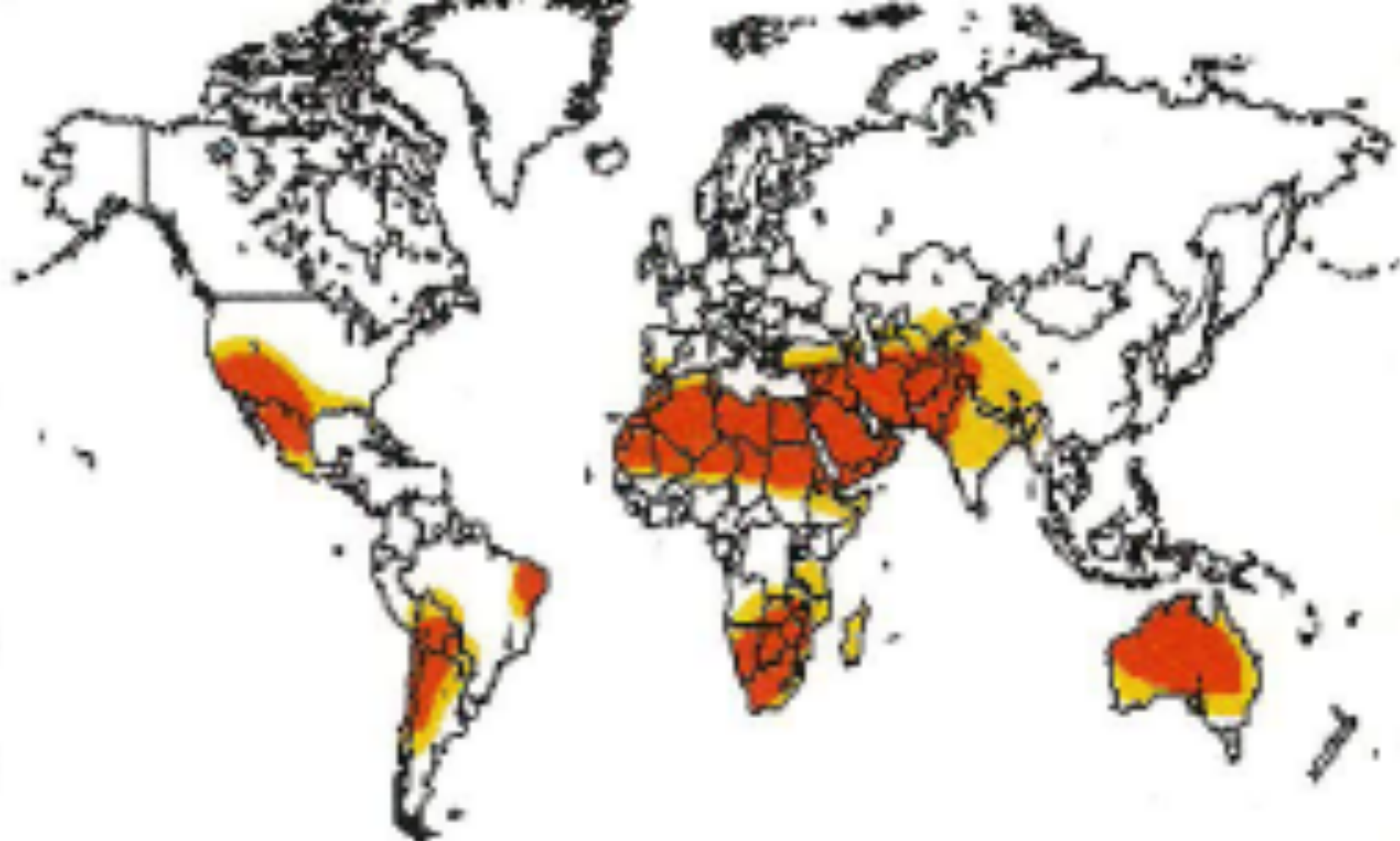


# *Solar Atlas*

*MEAN DAILY GLOBAL RADIATION from*

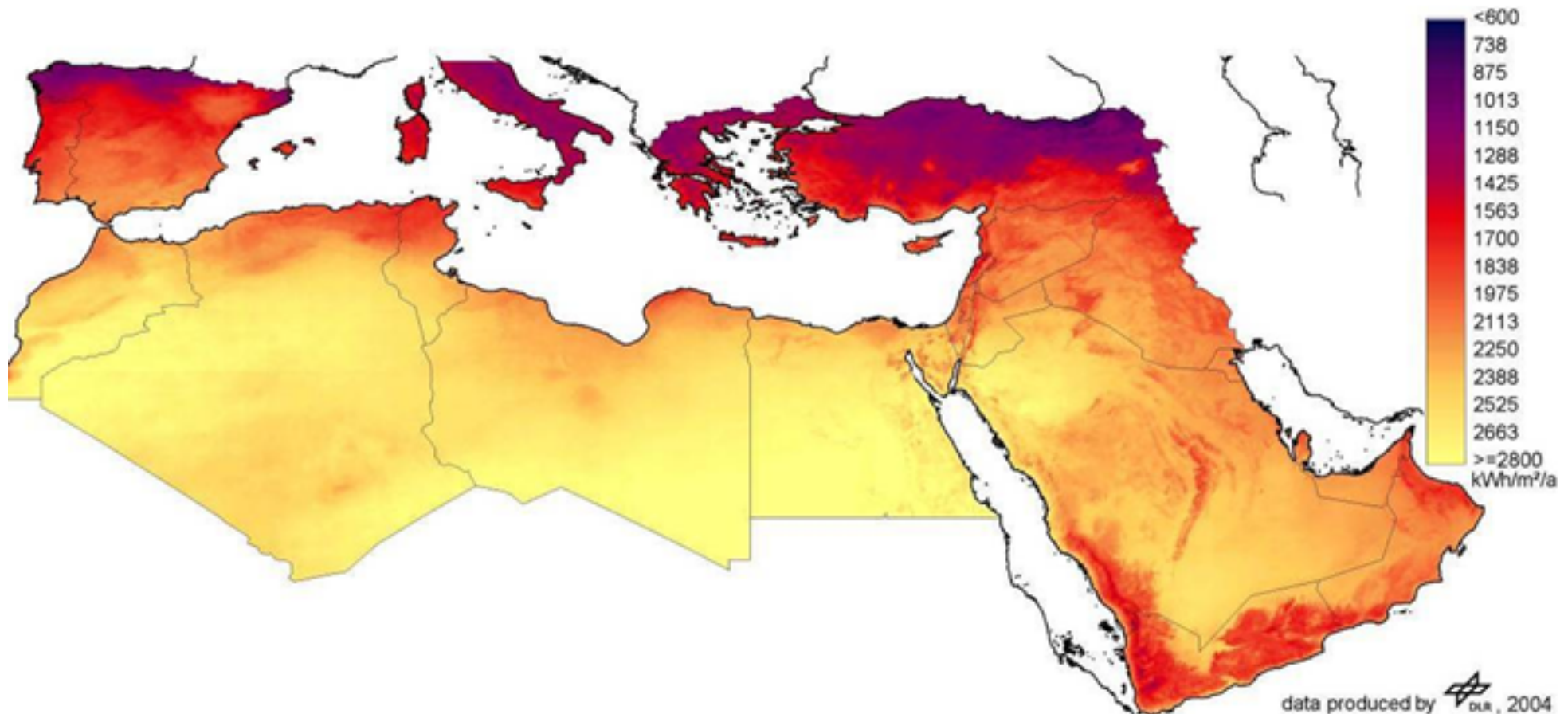
*Satellite*





# Nondepletable Resources

## Atlas of Direct Normal Irradiance from MED-CSP



One can define set of **Bands** – characterized by the same solar irradiance / wind conditions (i.e. described by the full load-hours/year– capacity factor for each technology ) describing the overall mid-term/long-term generation potential for offshore wind, onshore wind, PV technologies, Concentrating solar technologies etc.

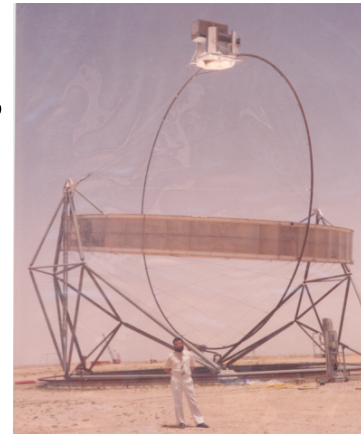


# Solar Energy Technology

# Alternative Solar Energy Technologies for Qatar

- **Solar Energy:**

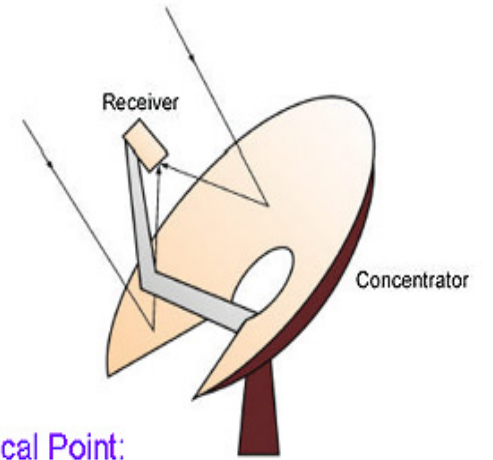
- Concentrator PV Cell,
- Heliostat,
- Solar concentrator, CSP
- Solar-dish advanced heat engines
  - **Ericsson** Heat Engine
  - **Stirling** heat engine
- Mix fuel power stations,
- Solar Domestic & Industrial hot fluid & dryers
- Solar thermal desalination.



# Solar Energy Industrial Applications

- Solar industrial driers,
- Solar industrial hot liquid and gases applications,
- Solar photovoltaic technology applications
- Solar-domestic hot water for:
  - Government,
  - Residential & Commercial buildings, moles,
  - Hospitals, Compounds, fitness centers, ..etc.
- Solar heating and cooling systems.

# Solar Dish Advanced Heat Engine



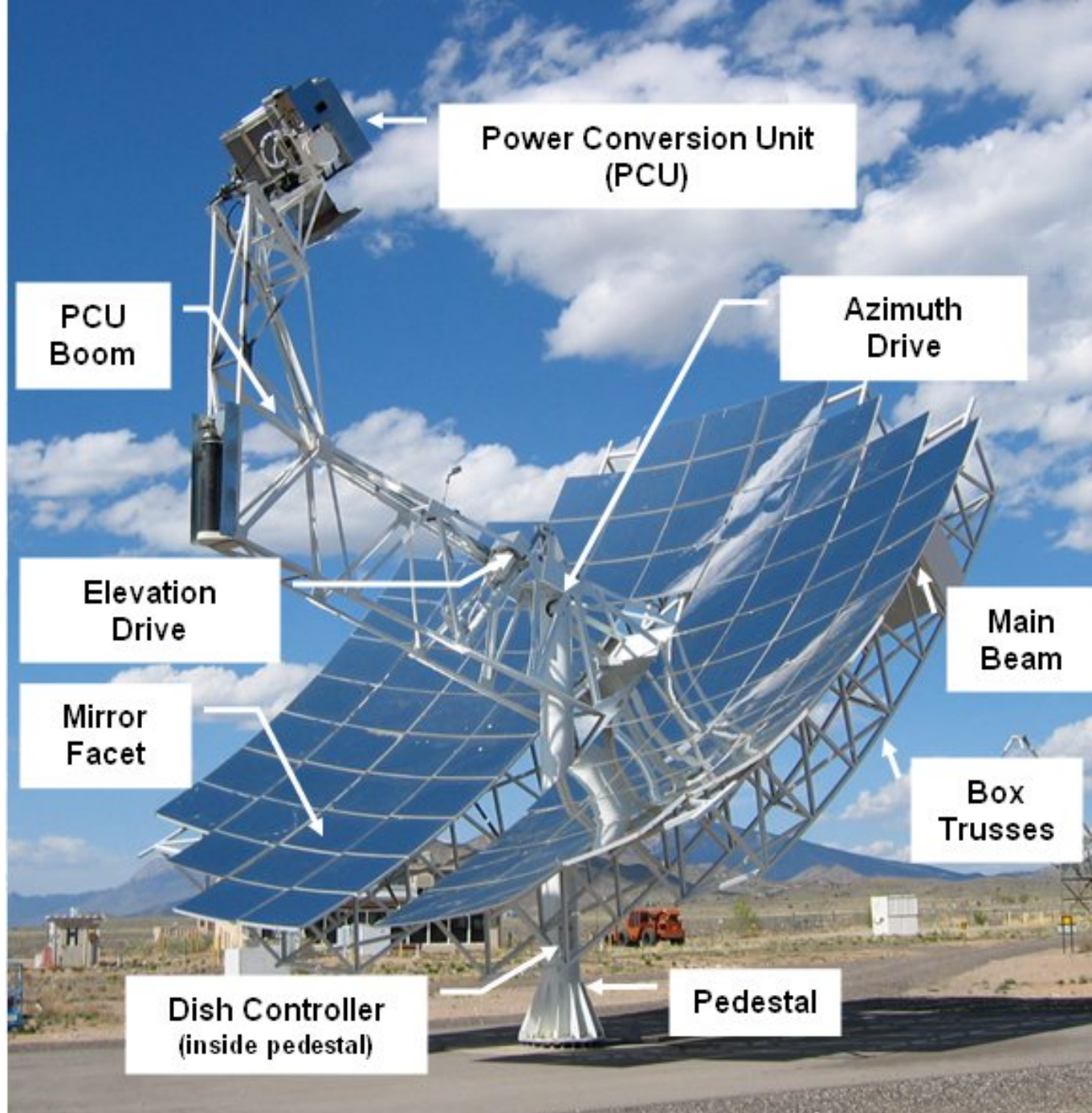
Focal Point:  
(50 - 200 bar / 600 - 1200 °C)

# Estimated Annual Energy from Solar Thermal Concentrating technologies

Solar Technology	Power density (kWH/m <sup>2</sup> )	Power density in Qatar (kWH/m <sup>2</sup> )
Solar Dish-Ericsson engine	800	933
Solar Dish-Stirling engine	629	700
Central Receiver	327	370
Parabolic Trough	260	300
Tracking Photovoltaic	217	250
Flat Plat Photovoltaic	170	219



# Solar Electric Power And Renewable Energy Futures For Colorado

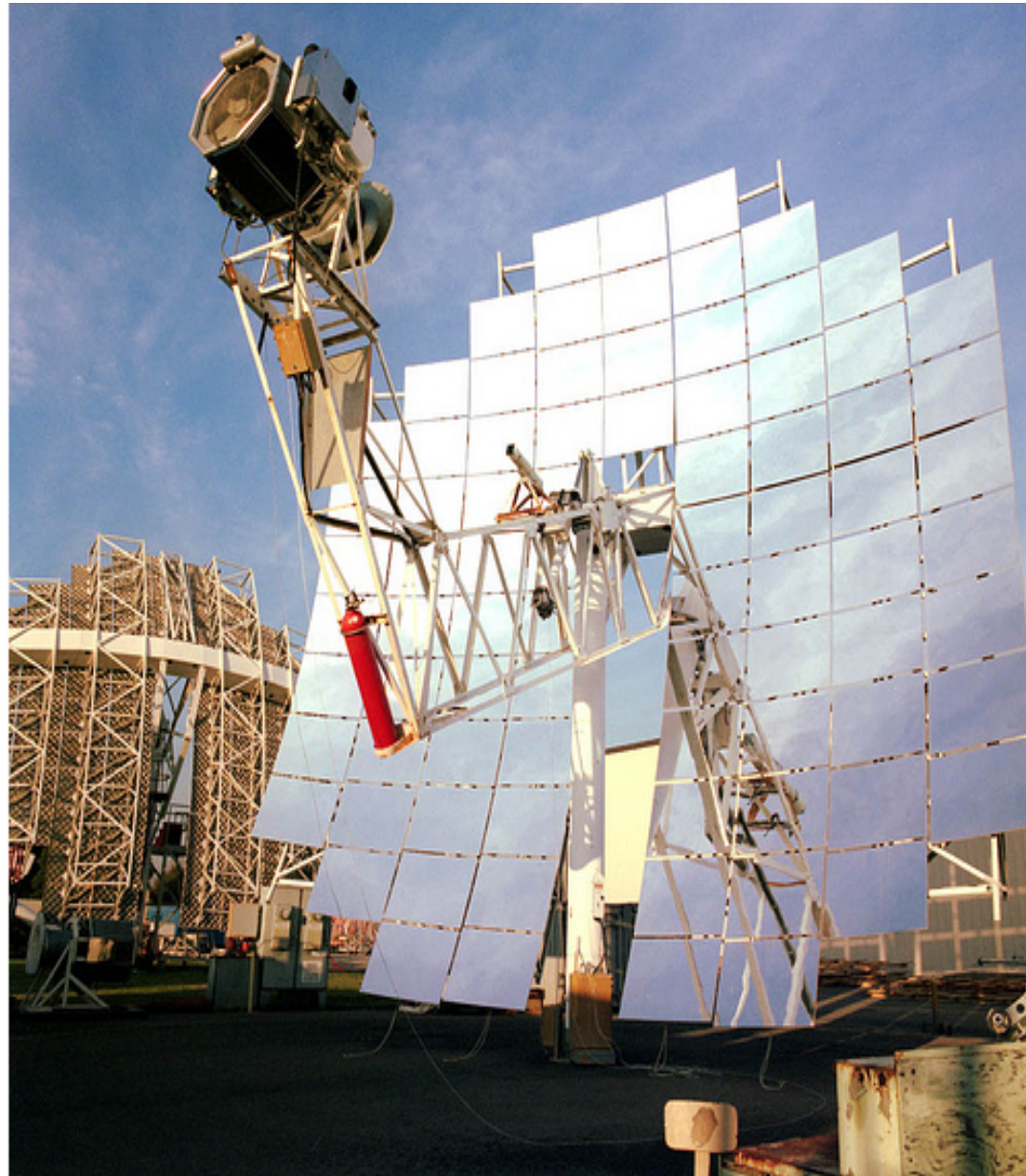


The Schlaich Bergemann und Partner direct intercept concentration dish formed by a depressurised membrane



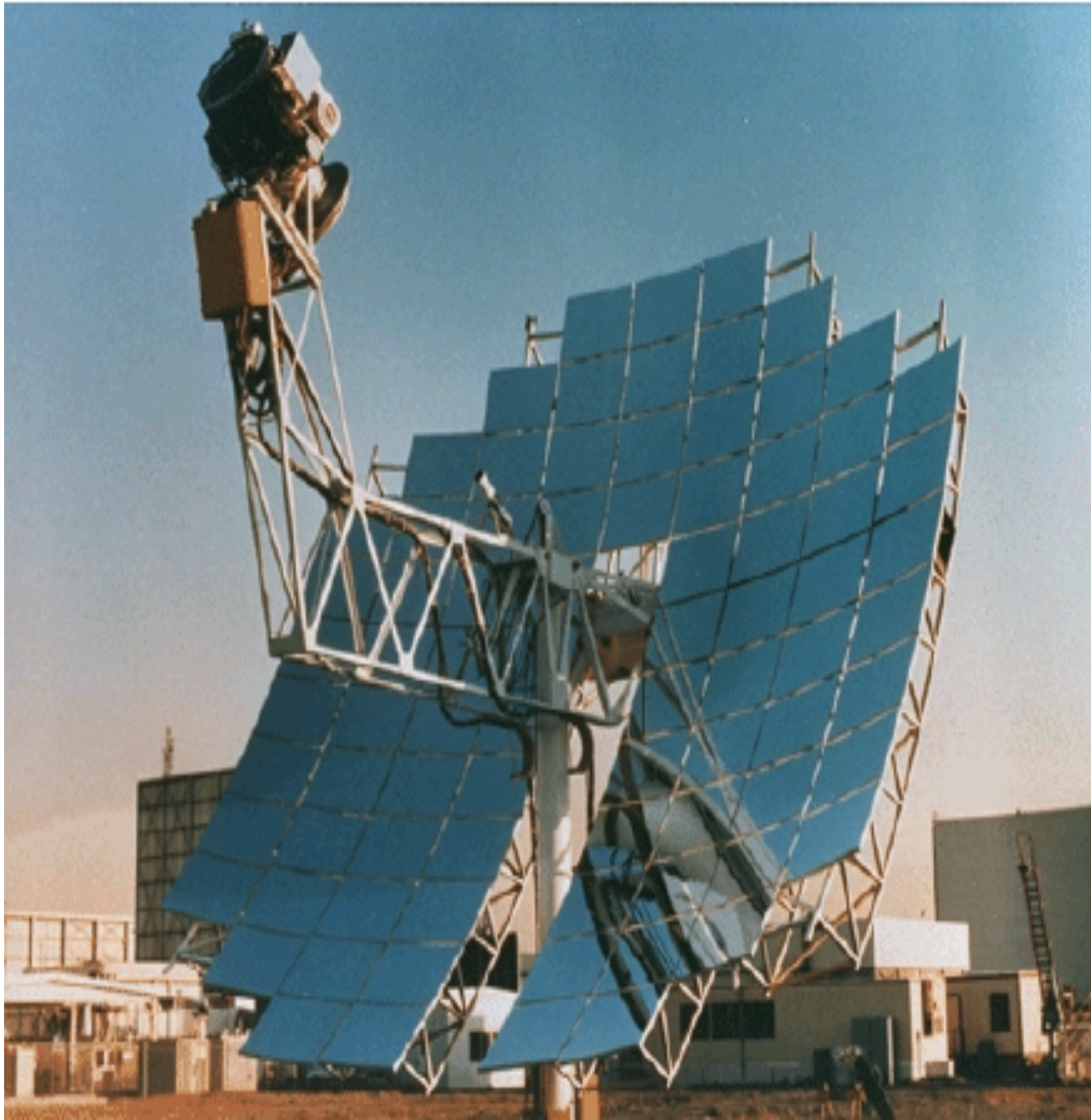


# Boeing-SES 25 kW Dish Stirling System





# Solar dish Stirling system by McDonnell Douglas



Point focus parabolic dish with Stirling engine and its [solar tracker](#) at Plataforma Solar de Almería (PSA) in Spain.





6 dish Stirling system, was installed by Stirling Energy Systems (SES) at Sandia National Laboratories in early 2005.





An array of 114 solar concentrators dishes



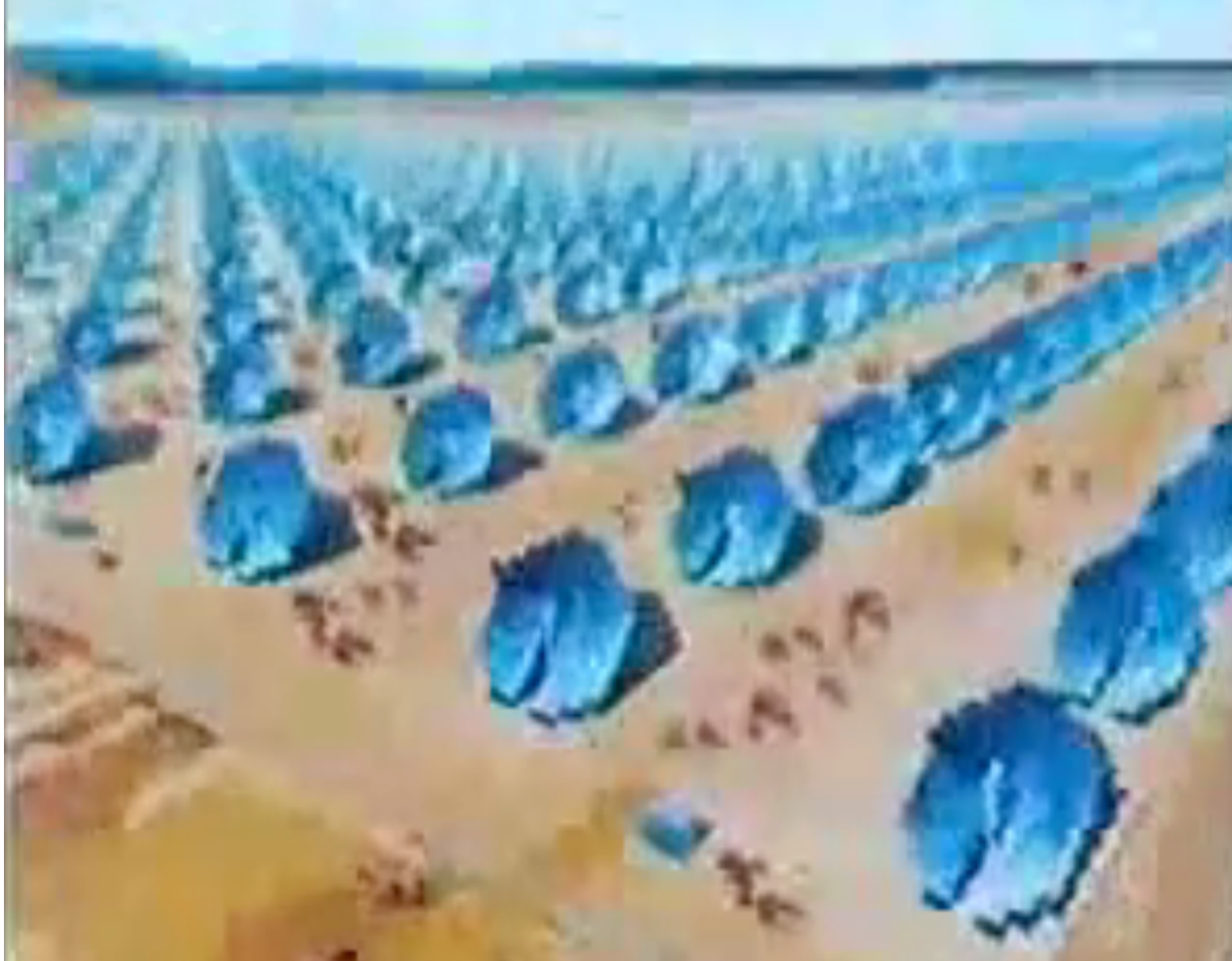


## 500 MW Solar Dish Stirling Engines

20,000 x 25 kW Stirling engine in California,  
**Tessera Solar and SunCatcher** plan to start  
construction between 2010 and 2012



# 500 MW (20,000) unit of 25 kW Stirling engines



- Building **500 MW** would require about 3,500 acres (14 Km<sup>2</sup>)
- 500 MW cost \$ 7,000 million

# GCC 400 kV Interconnection

- 400 kV Overhead Line connecting to backbone that connects Kuwait, Saudi Arabia, Bahrain and UAE-Oman.
- 750 MW to share reserves.
- Power Exchange agreement ratified.



# Conclusion

- Qatar expects to add **16,260 MW** of power to the national grid between 2011 to 2036, almost three times current capacity (**5,000 MW**).
- Solar energy is available year around, the measured data on ground is compared with the satellite's data. This preliminary investigation and data analysis could be good preliminary design for "Qatar Solar Atlas".
- Mature and proven solar technologies are available.
- **We need to select the suitable technology to fit our environment.**





# Thank You



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*عضو في مؤسسة قطر* Member of Qatar Foundation

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