

Study of Solar & Wind Energy Potential in the Kingdom of Bahrain

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Khalid A. Burashid
Electricity & Water Authority – Kingdom of Bahrain



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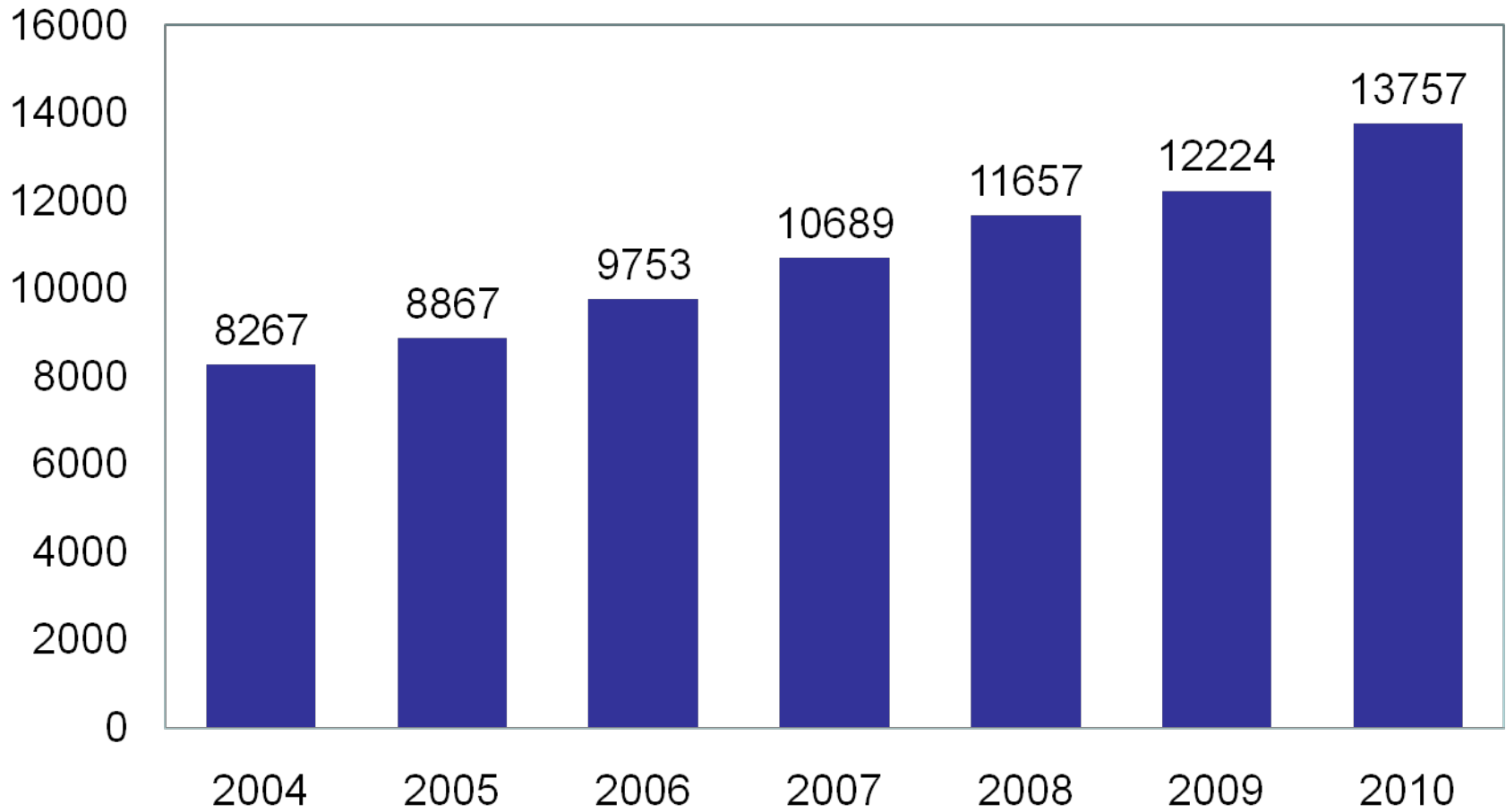




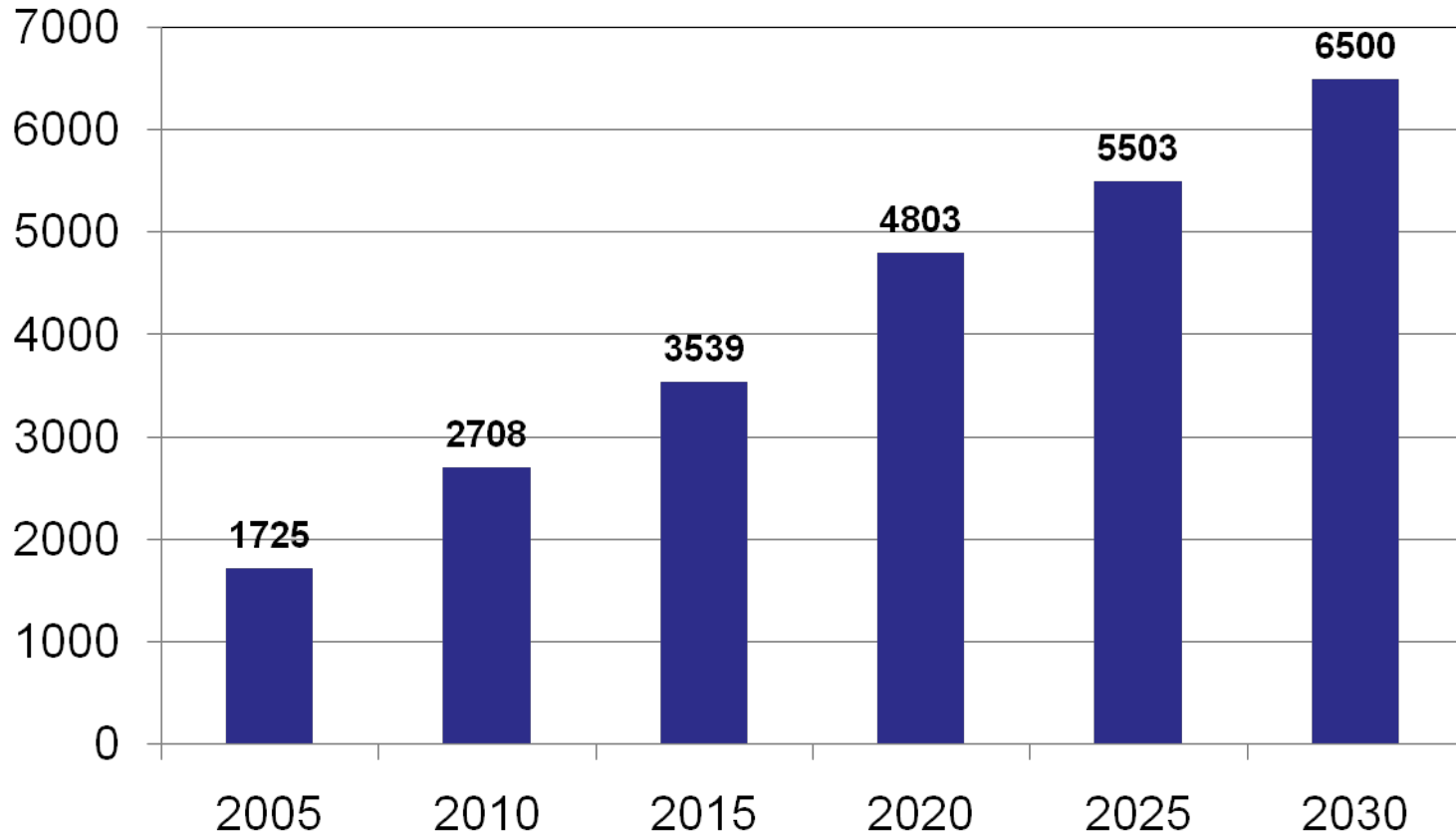
Category	Quantity
Area	757.5 Sq km
Population	1,170,000
Population growth	2.8%/year
Peak load in 2011	2812 MW
Peak load demand growth rate	10%/year
Expected Power growth rate	8%



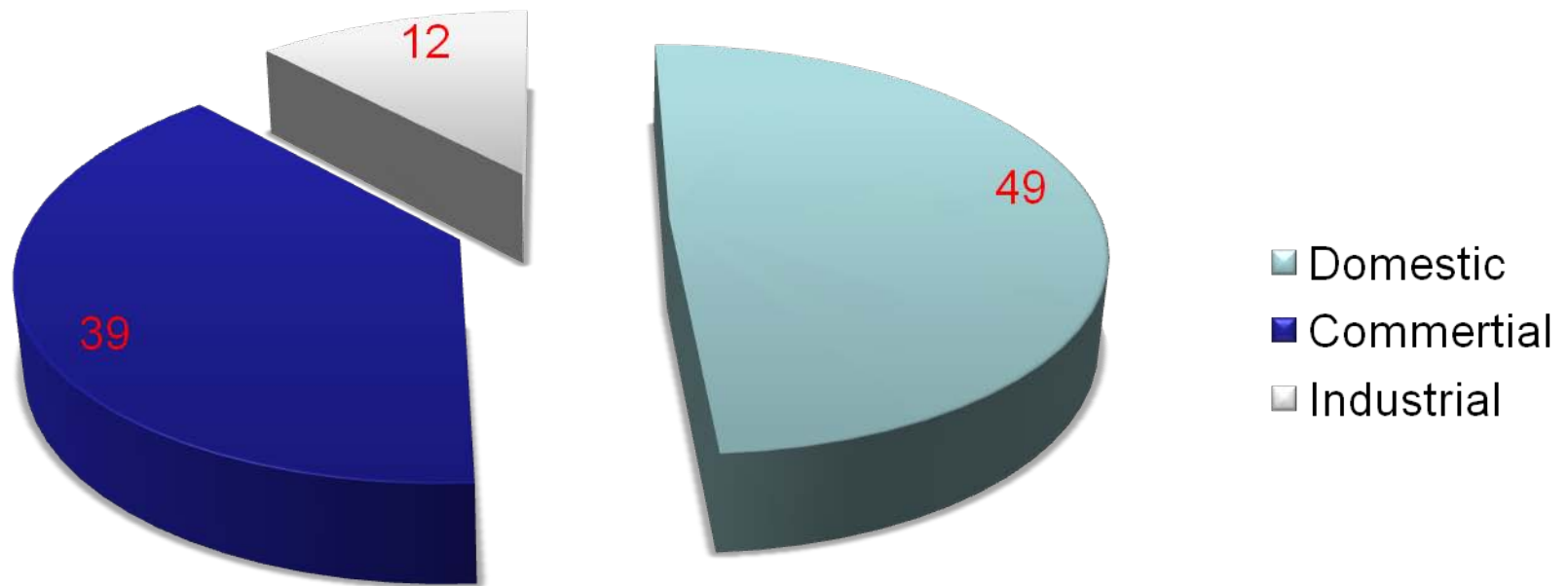
Energy Consumption GWh



Electrical Energy Peak Load (MW)



Energy consumption by sector



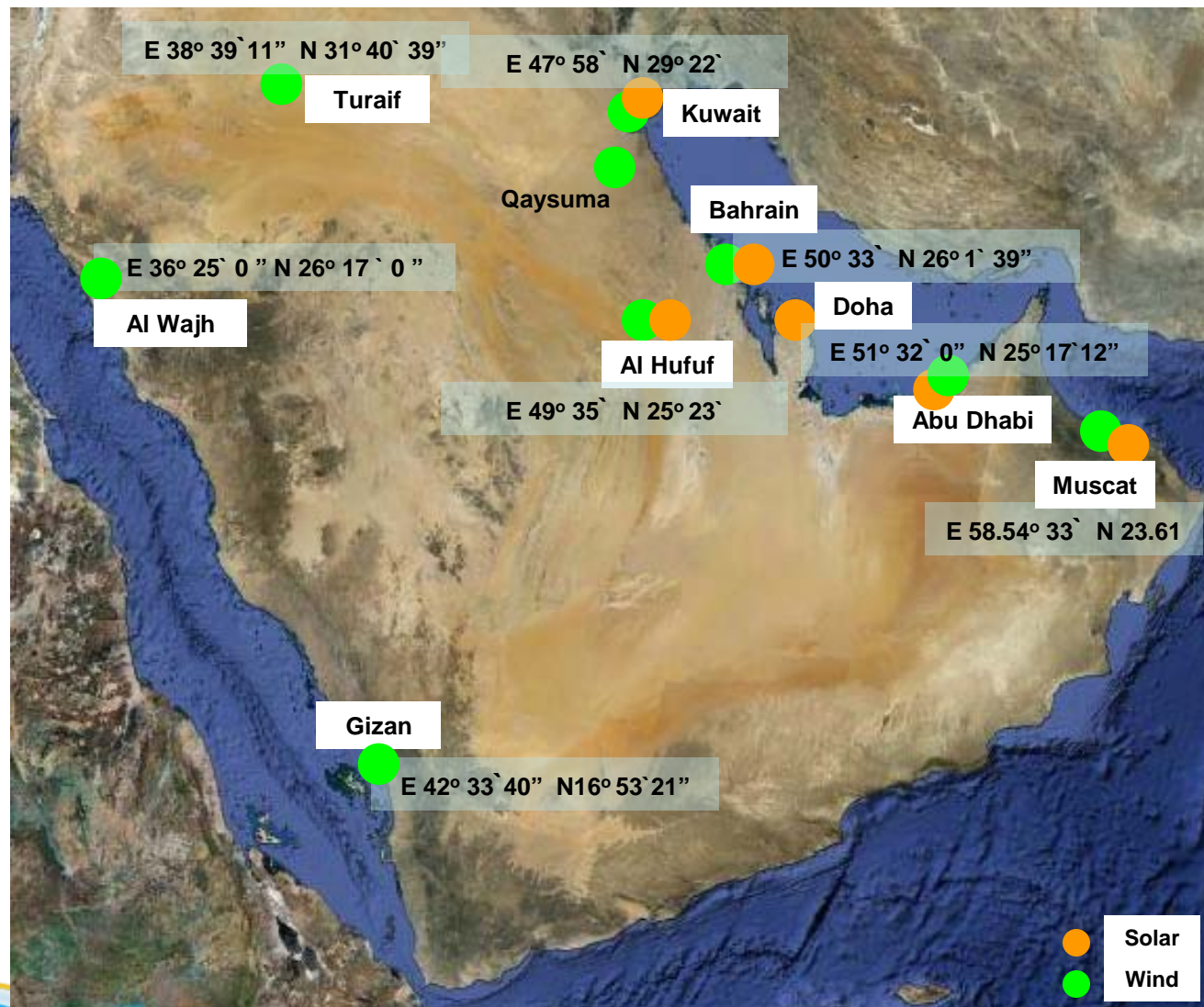
% of Total EWA Production



The Study



Coverage Zone

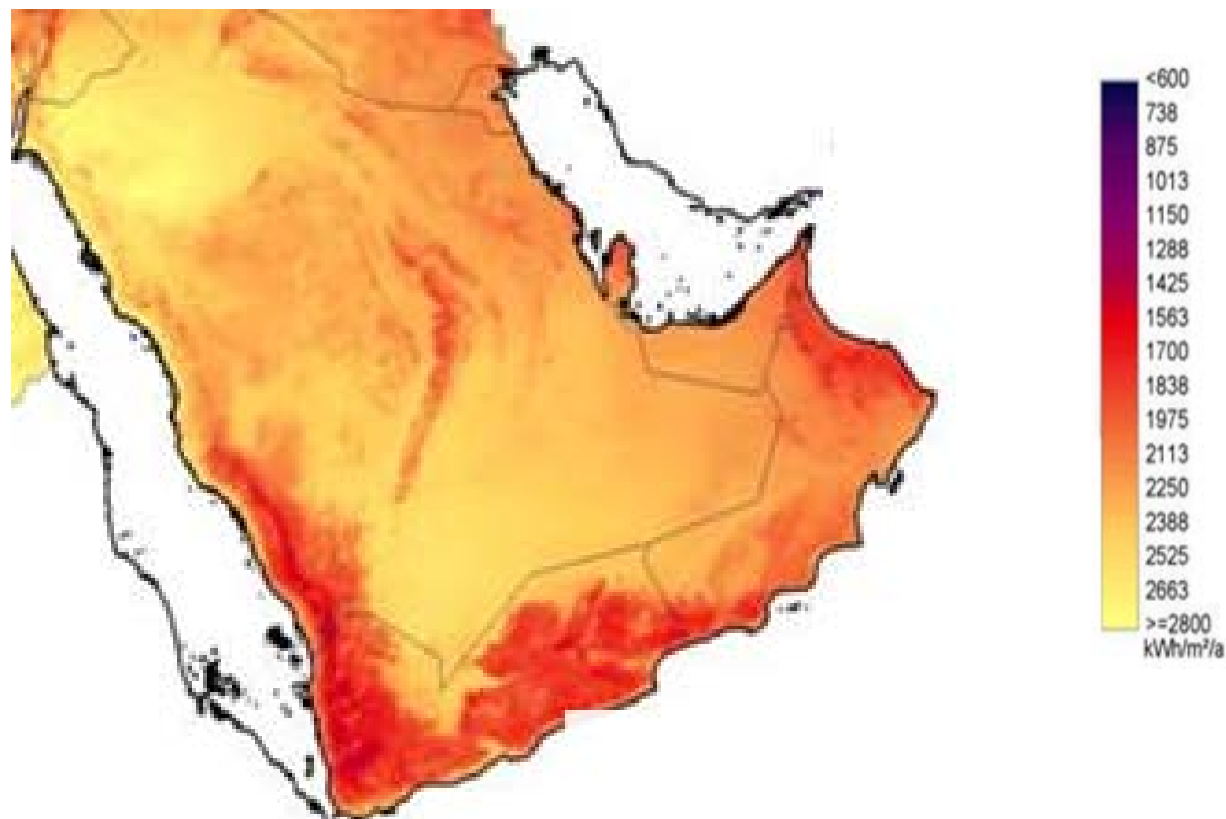


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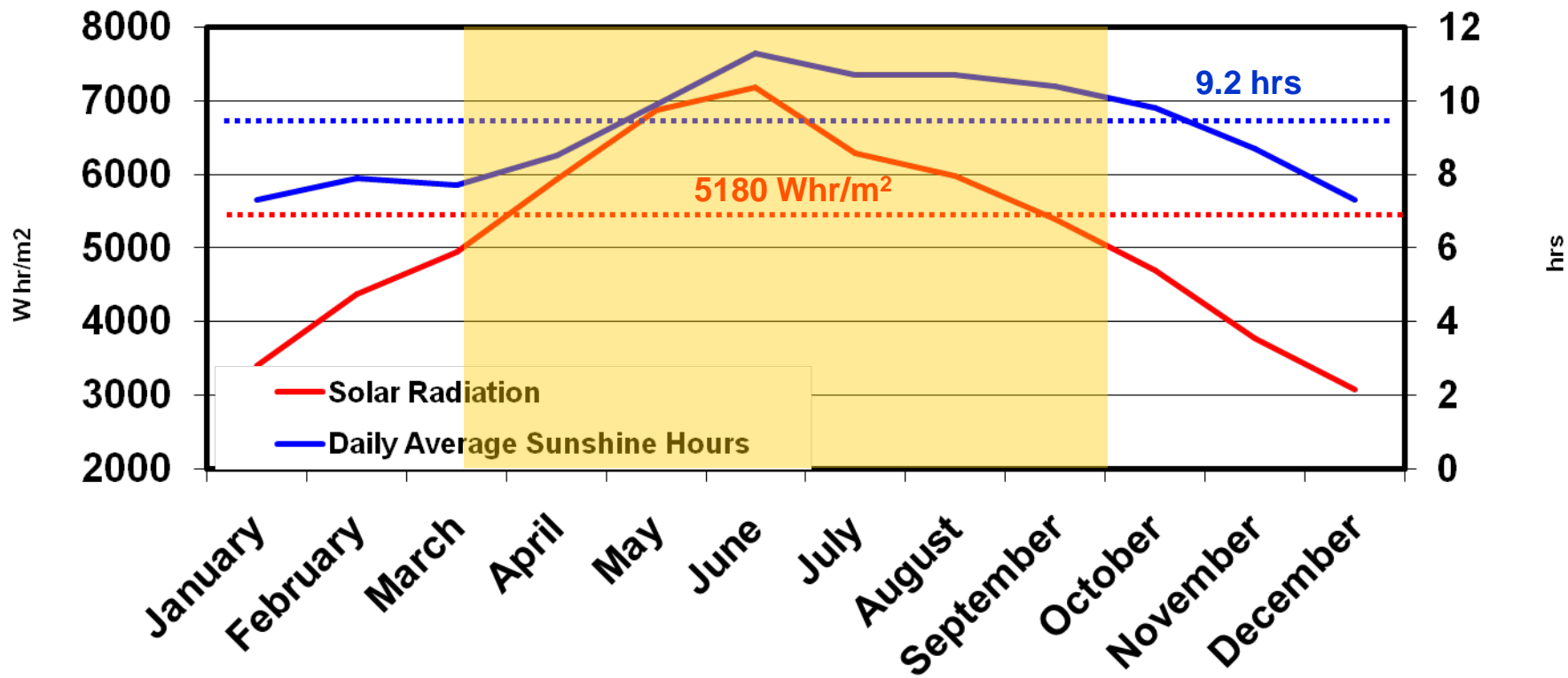


EWA
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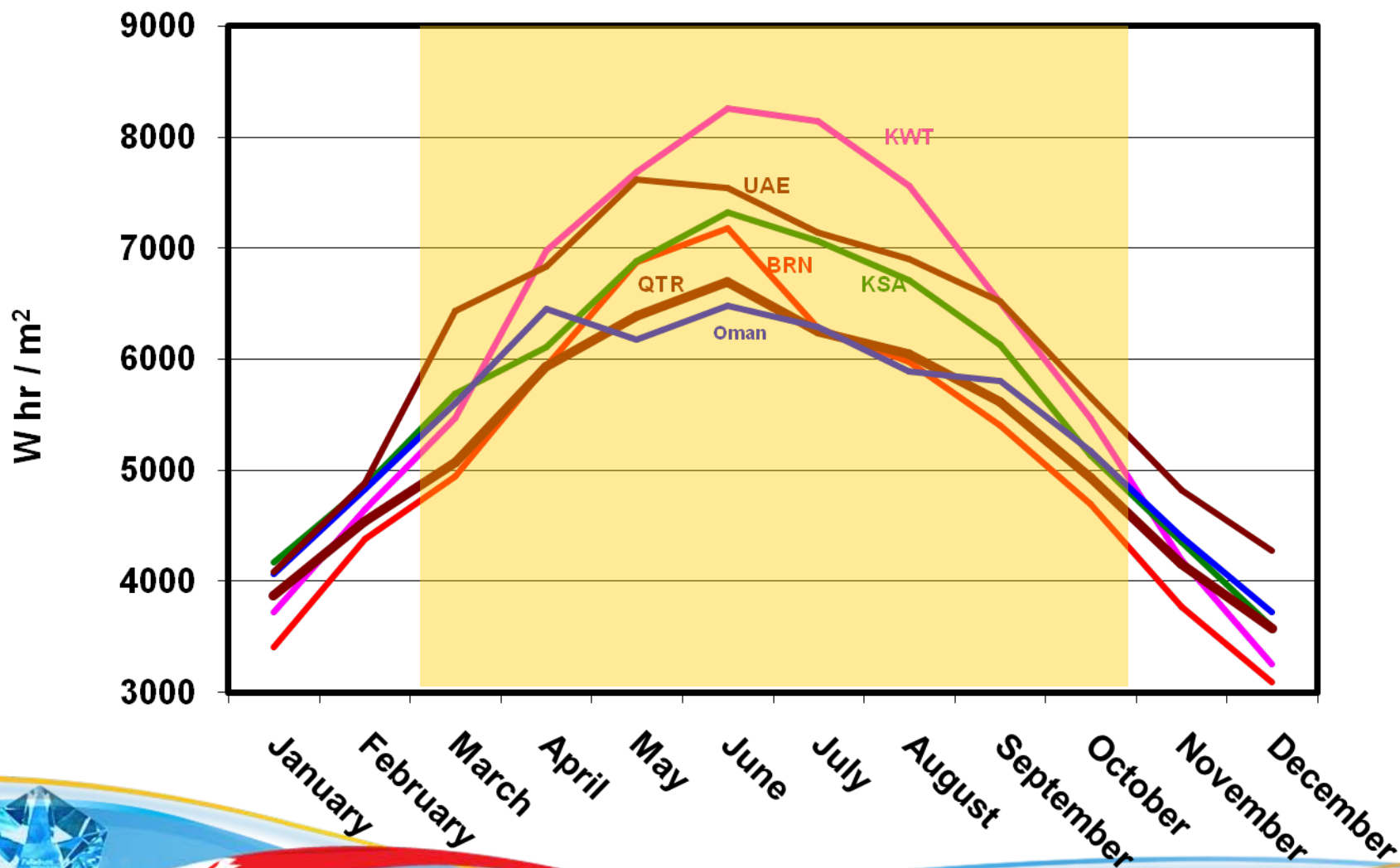
Annual direct normal irradiance “GCC”



Monthly Average Daily Global Radiation and average Sunshine hours in Bahrain

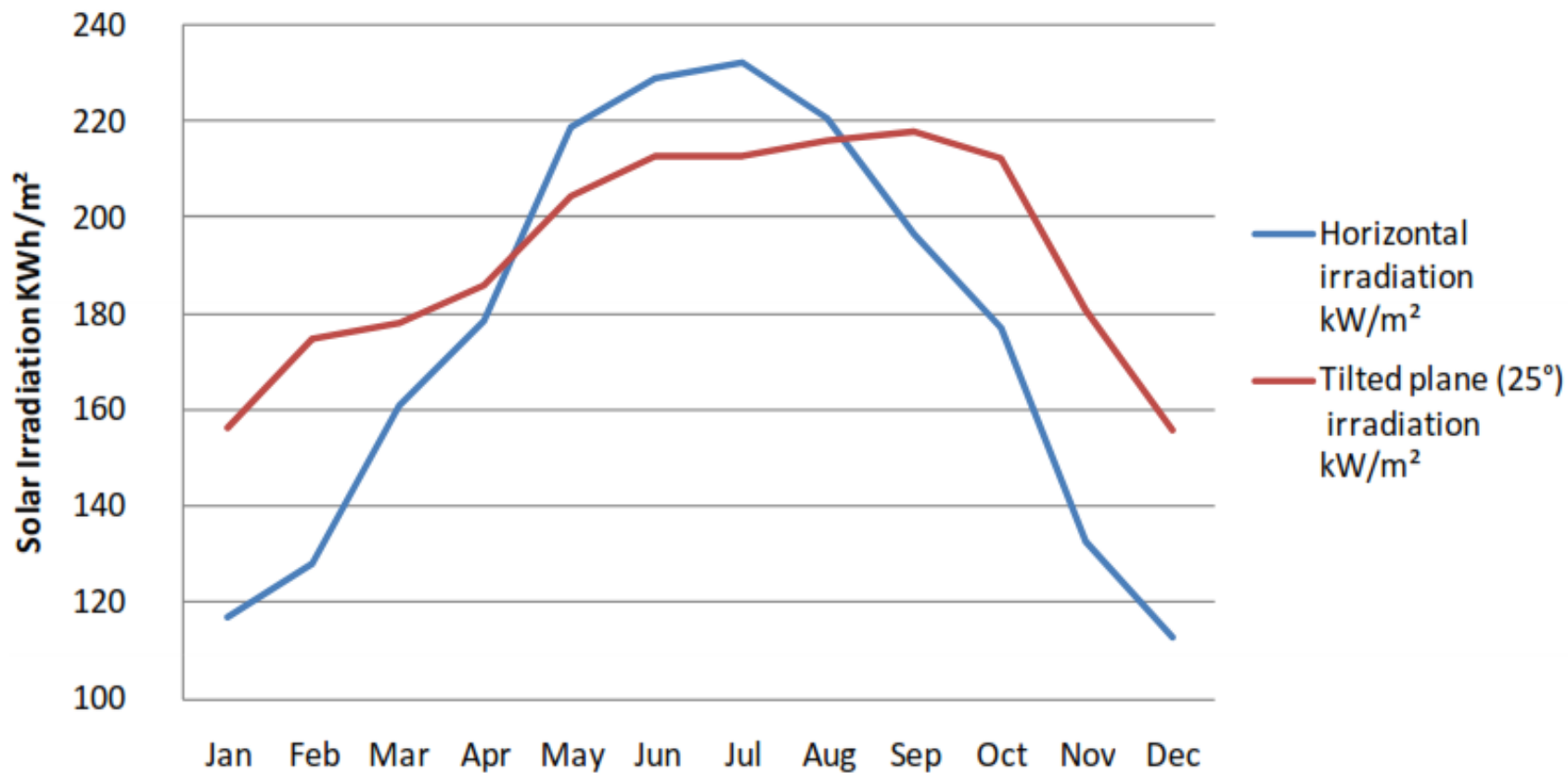


Daily average solar radiation in the G.C.C Countries



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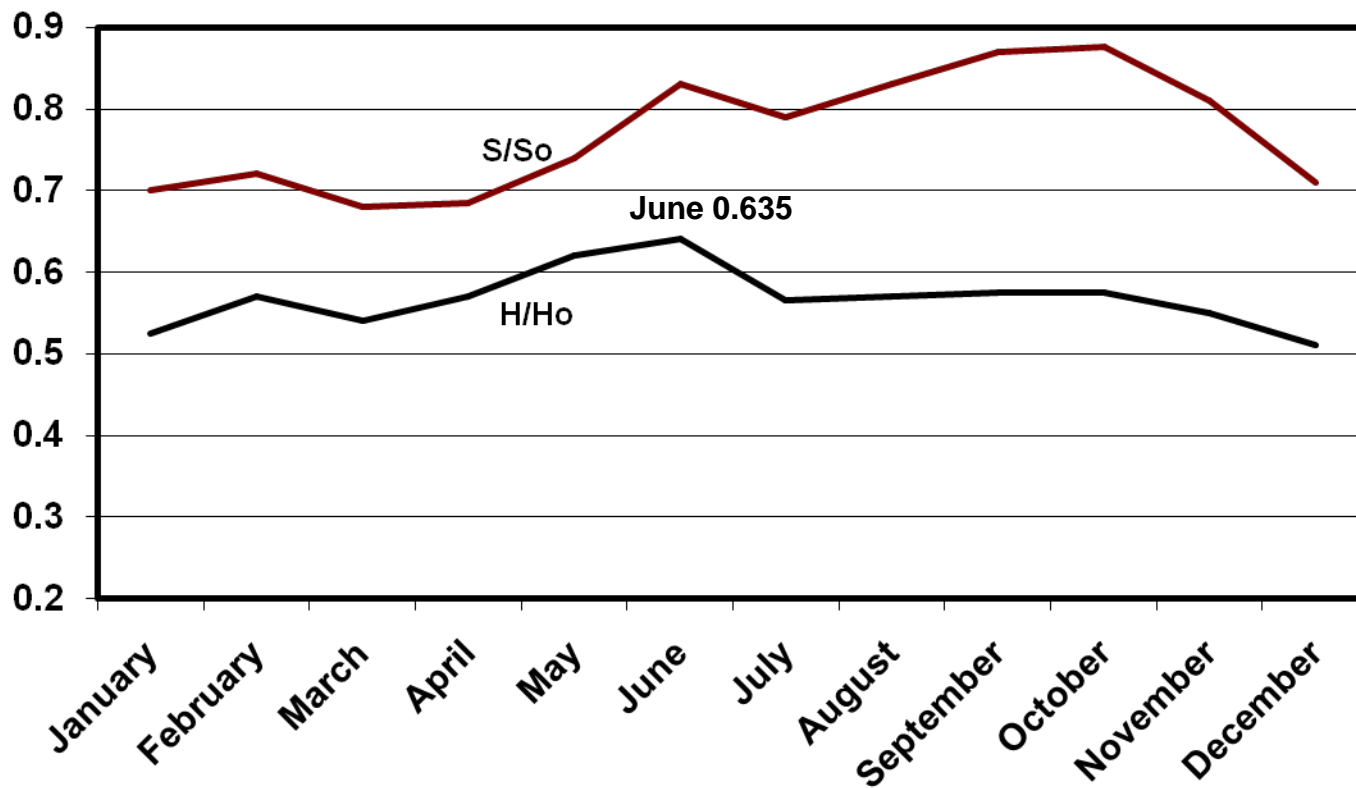
Monthly average Irradiance on tilted plane



Mathematical Model for Monthly Average Daily Global Radiation in Bahrain



Bahrain's monthly variation of the fraction of possible duration of sunshine hours and the Clearness Index



$$H = H_o [A + B (S/S_o)]$$

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The Radiation Model For the Kingdom of Bahrain

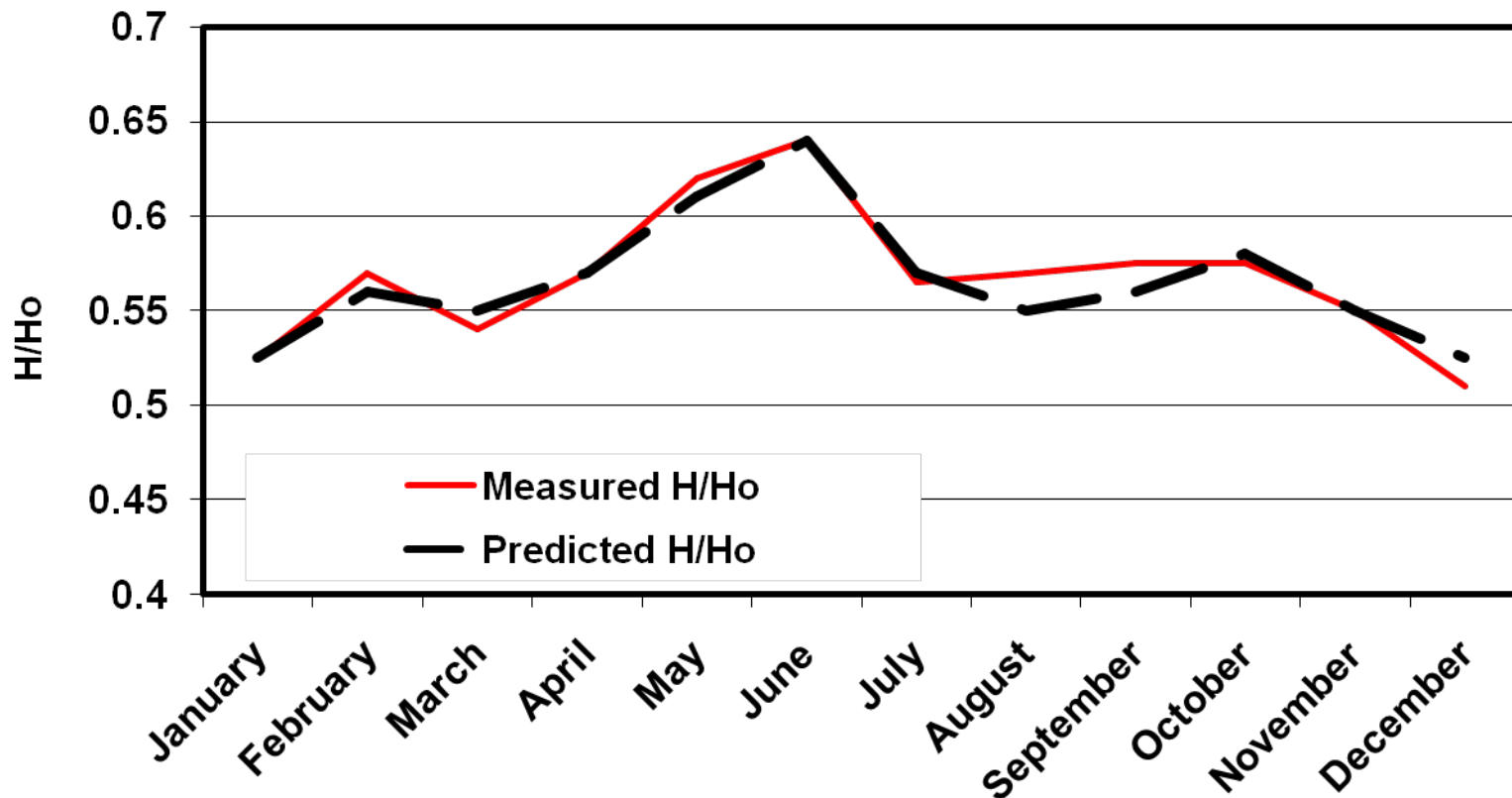
$$H/H_o = 0.45186 S/S_o - 0.00924 RH - 0.00788 T + 1.03452$$

T : monthly mean daily temperature in °C.

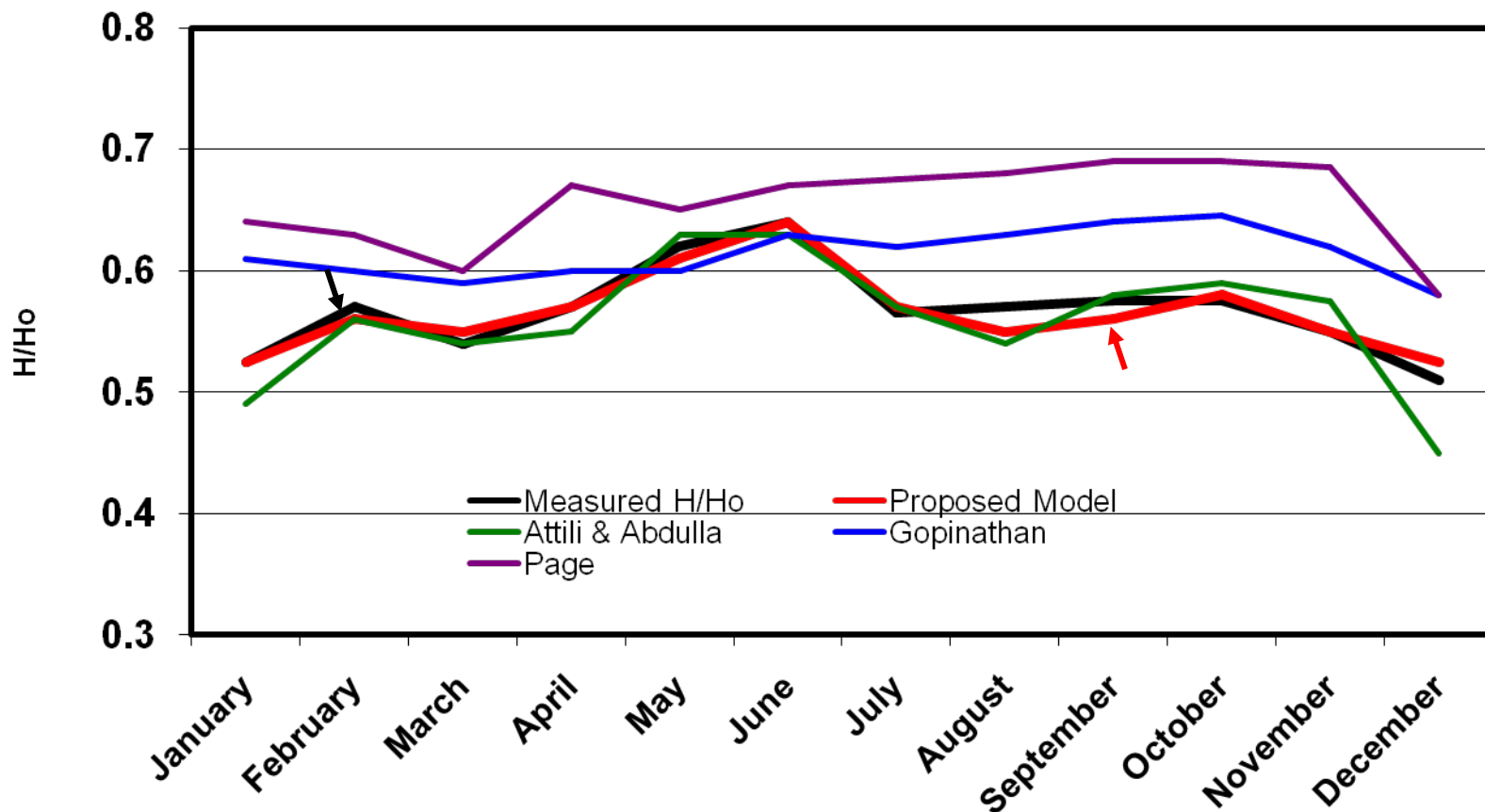
RH : monthly mean relative humidity



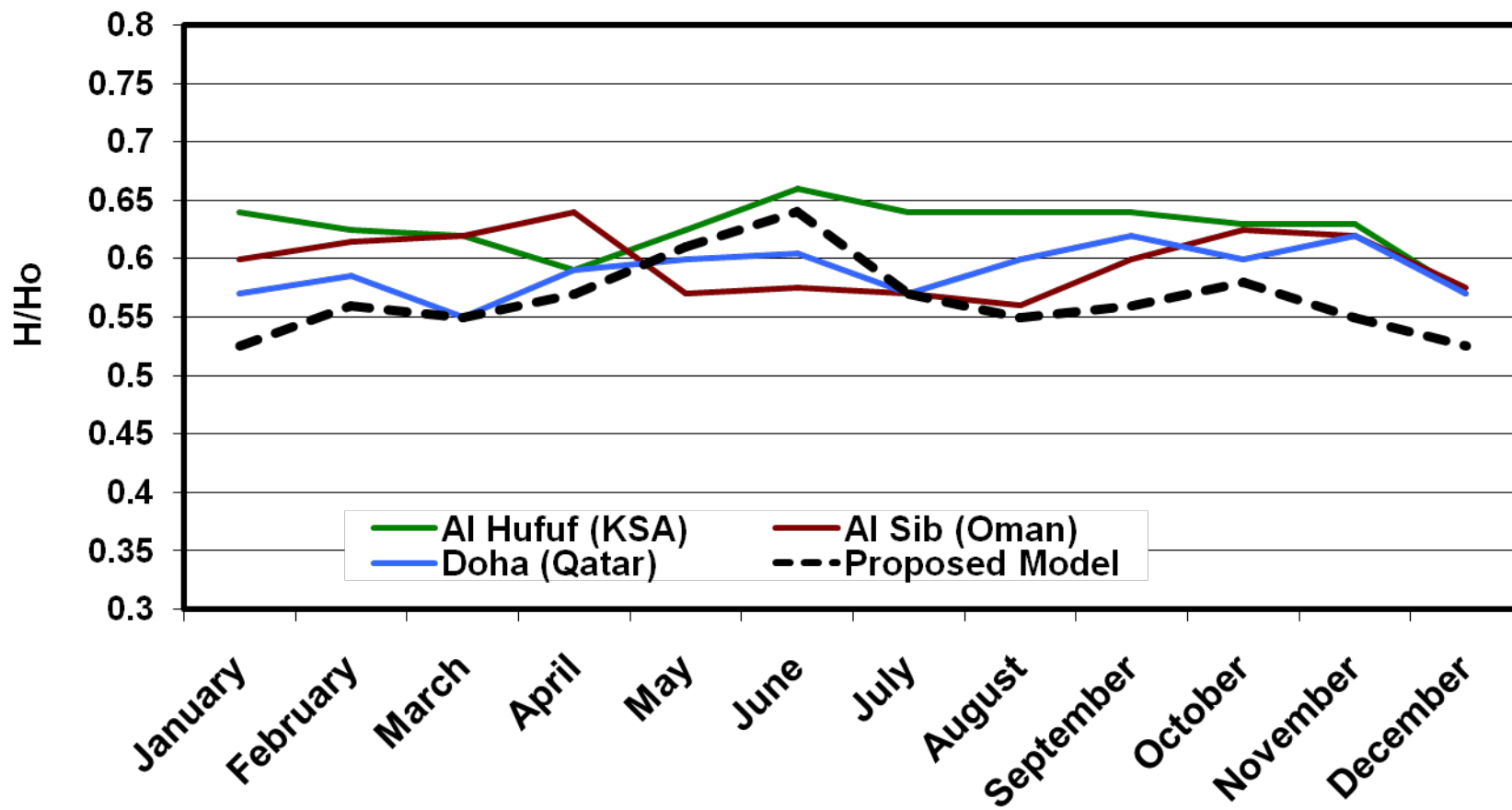
Comparison of the proposed model of the Clearness Index K_t with the measured values for Bahrain



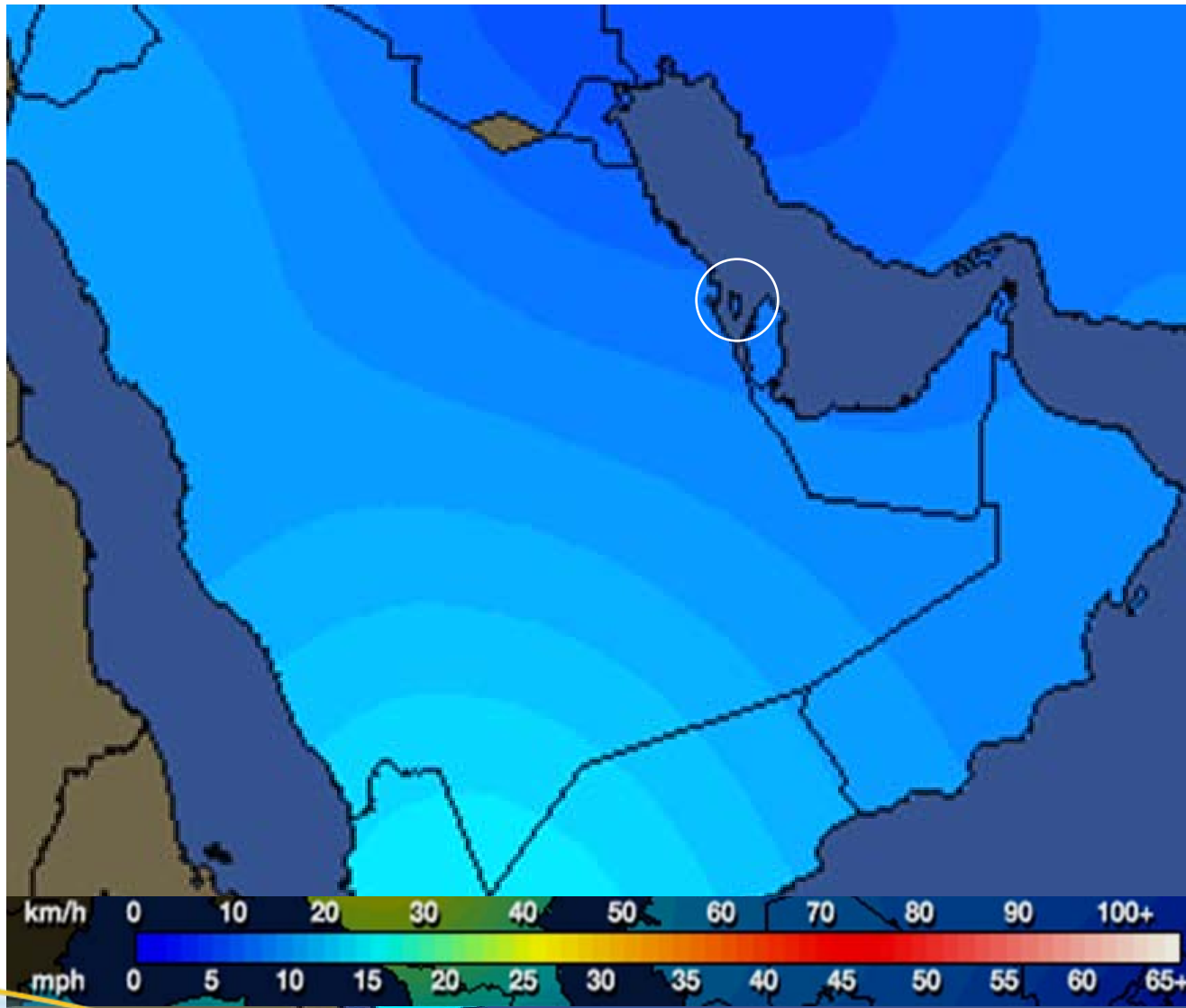
Comparison between the proposed H/Ho model and other models for Bahrain



Comparison of the proposed model with the measured values for some GCC locations



Wind Energy

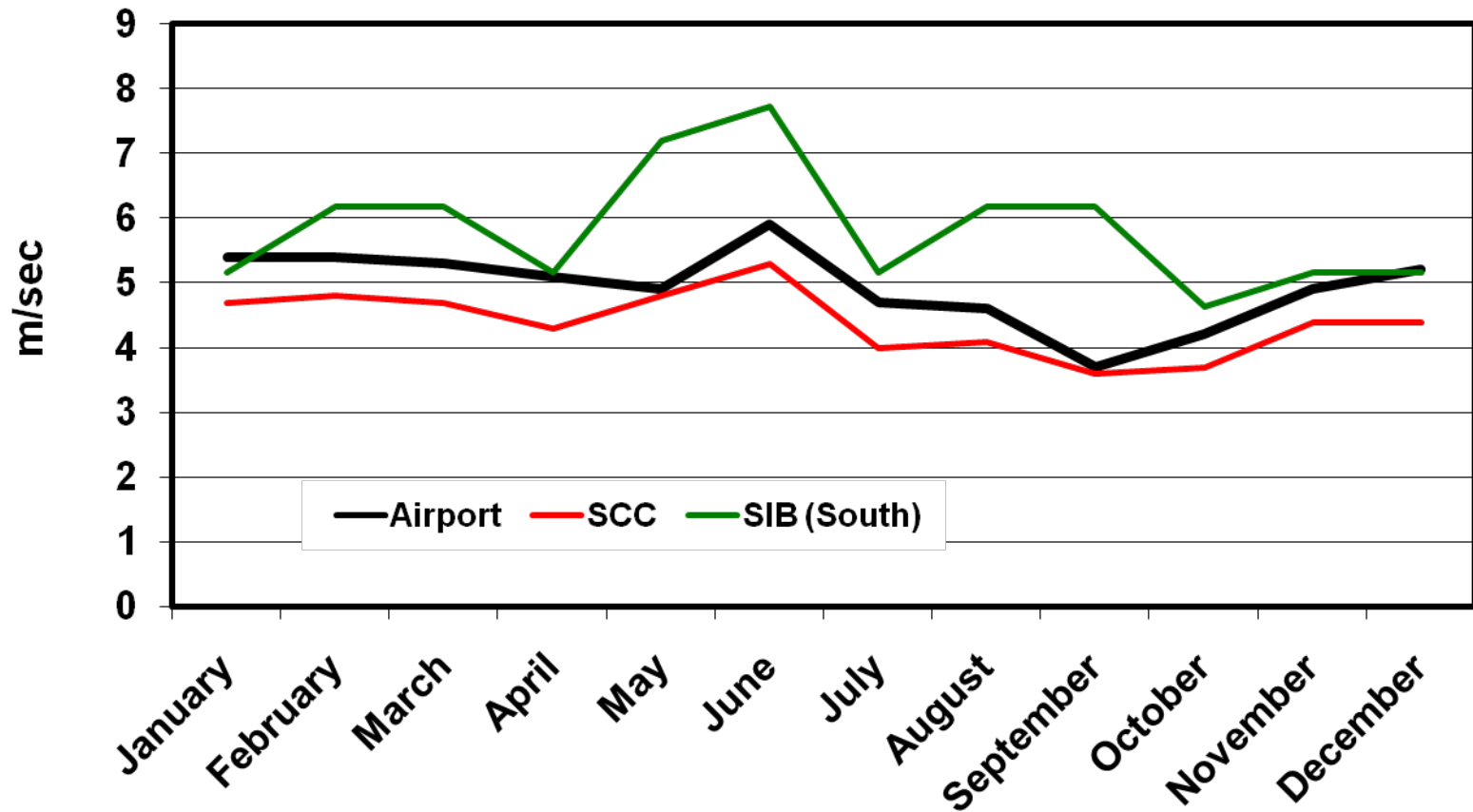


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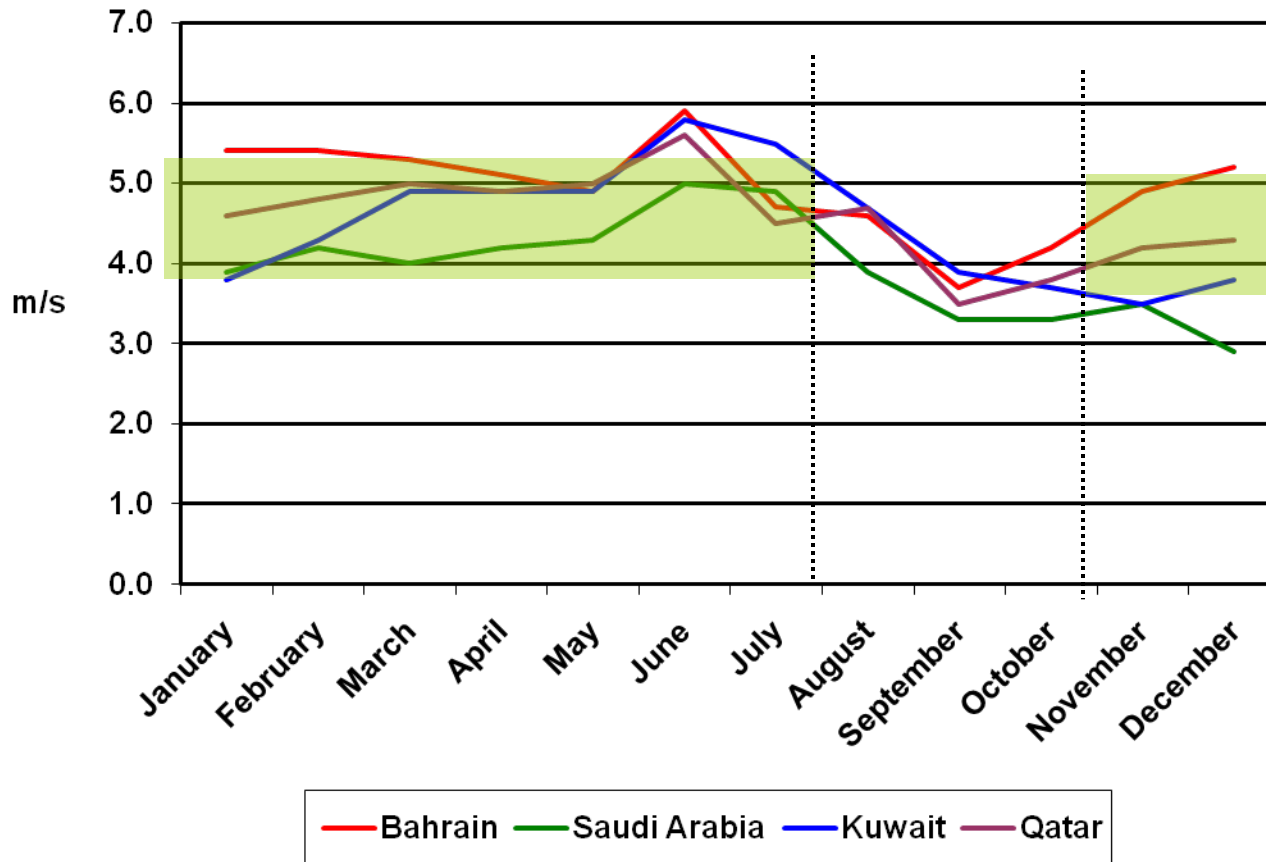


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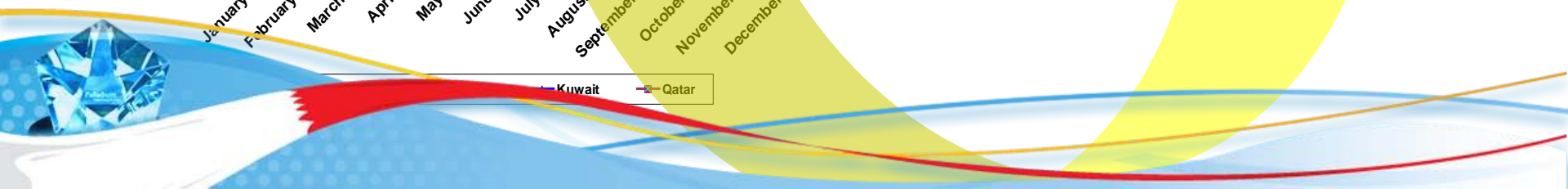
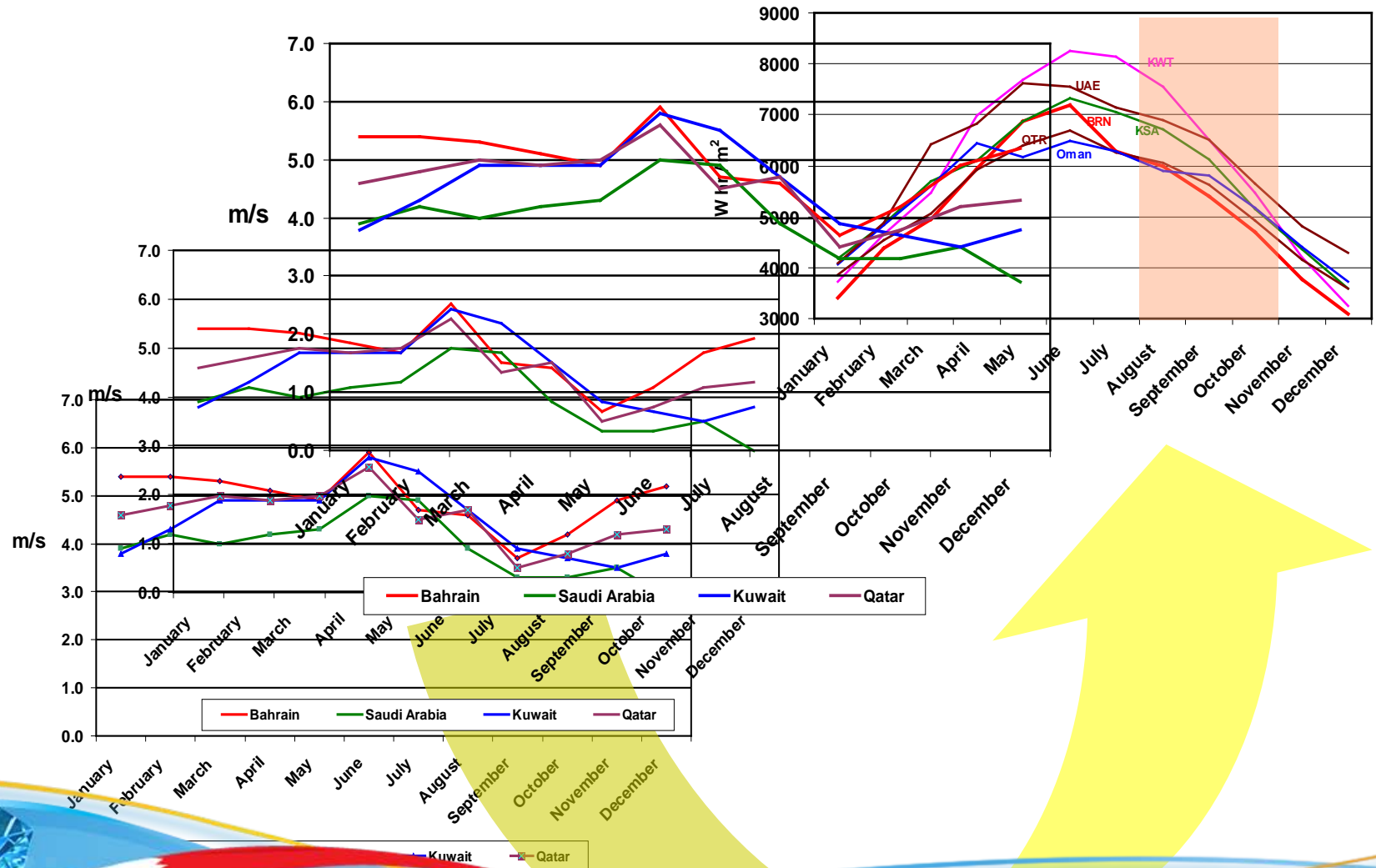
Mean Annual Wind Speeds in Bahrain



Monthly average wind speeds in Bahrain and selected GCC locations



Monthly average wind speeds in Bahrain and selected GCC locations



Bahrain's Demonstration Project Solar and Wind

Bahrain's Vision for Renewal energy

Why go for solar & wind

Implementation Program



Conclusion

Solar Energy:

Bahrain and the rest of the GCC states are subjected to high solar radiation levels during summer months reaching up to 7200 Whr/m² with an annual mean radiation of 5200 Whr/m² which justifies the use of this energy for small/medium size power generation

Despite the availability of such enormous energy, which is clean and renewable, applications are still very limited in this region. There are only a few ambitious programs for research and development aimed to expand the usage of these energies.

Electricity production and Sea water desalination utilizing Reverse Osmosis process powered by Solar and wind turbines may also be considered for small and medium size plants in remote locations.



Wind Energy:

Preliminary results show that the average wind ranges between 4.0 and 5.5 m/s. In a windy day wind power is equivalent to about 225 Watt/m² distributed over 24 hours period.

Because of the frequency of calms, wind power may not contribute significantly to a firm power generation, however, it could be efficiently used in hybrid wind/solar schemes.

Further research and Studies on wind potential is recommended for developing experience with turbine generators performance and their economics in this region



Thank You

Khalid Burashid

