

Solar Energy For More Eco-friendly Mosque In Qatar

[10.5339/qfarc.2014.EEPP0606](https://doi.org/10.5339/qfarc.2014.EEPP0606)

Mohamad Kharseh; Mohammed Al-khawaja; Saud Abdu Ghani

CORRESPONDING AUTHOR :

kharseh@qu.edu.qa

Qatar University, Doha, Qatar

Abstract

There is mounting evidence that the global warming and, consequently, the climate changes are anthropogenic and attributed to fossil fuel consumption. Therefore, it is mandatory to find alternative solutions that can replace current resources. One of those resources is solar energy, and specifically Photovoltaic solar panels. Qatar is a sun-belt country with daily average solar radiation in the range of 5.1 kWh/m². Namely, in such hot and dry region, solar energy seems to be the most important source of renewable energy. The local government has been aware of this fact and planning to generate 200 MW of electricity in 2020 from solar power.

In hot country like Qatar air conditioning systems account for more than 65% energy consumption. This provides the challenge to study the possibility of utilizing renewable energy in air conditioning sector. In the light of the improvements achieving in the performance of photovoltaic systems beside the reduction in its price, the combination between the photovoltaic and air conditioning systems is becoming more practical. Unlike other renewable energy resources, the maximum available solar energy corresponds with the peak cooling demand. This increases the viability of utilizing solar energy in air conditioning applications.

The current work demonstrates the technical and economic potential of utilizing solar energy at the working conditions of Qatar. For this aim a most common mosque design in Doha, Qatar, was selected as a case study. Among the different solar module brands available in the market, Solar Leading module brand was considered. Two simulation models including hourly analysis program and system advice model were used in order to carry out the technical and economic analysis.

From technical viewpoint, current study resulted in determination of required number of a considered PV module which has been found to be 77 panels. These panels can provide the air conditioning system of the considered mosque with annual electricity demand the A/C system, see Figure 1.

The objective of the economic analysis is to determine the costs and the benefits of investment and to quantify with the determination of appropriate financial indicators the economic convenience of PV systems. In particular the economic analysis resulted in determination of different figures of merit including net present value (NPV), internal rate of return (IRR), the payback time (PBT), and levelized cost of electricity (LCOE). The NPV, IRR, PBT, and LCOE were found to be \$3700, 3.8%, 22 years, and 0.070 \$/KWh, respectively, see Figure 2.

The obtained results show that utilization of solar energy for air conditioning purposes has big potential for saving economic and environment at working conditions of Qatar.