

Solar Energy Potential in Saudi Arabia: A Geographic Information System (GIS) Based Study

Saudi Arabia is ideal for photovoltaic solar panel installation on rooftops. The solar Irradiation in most locations of Saudi Arabia ranges from 6 to 8 KW/m²/h, sufficient to produce clean electricity and to reduce households electricity bill. This study examines the potential of solar panel installations in cities with higher population density. A GIS approach was used to

- (A) Locate areas of solar radiation higher than 5 KW/m²/h
- (B) Locate cities with higher population density
- (C) Merge the solar radiation and population density datasets to analyze "Ideal" sites for the installation of the photovoltaic panels

The area between latitudes 40N and 40S is a so-called sun belt, and Saudi Arabia lies in it, between latitudes 31N and 17.5N. Saudi Arabia is conveniently located in the sun belt to take advantage of solar energy. Insolation is the most important aspect to consider when selecting suitable sites to build PV power. Average solar radiation in Saudi Arabia varies between a maximum of 8.004 KW/m²/h at the city of Bisha and a minimum of 4.479 KW/m²/h at the city of Tabuk. The higher values of solar radiation (>5 KW/m²/h) are observed in most parts of the southern region of the country.

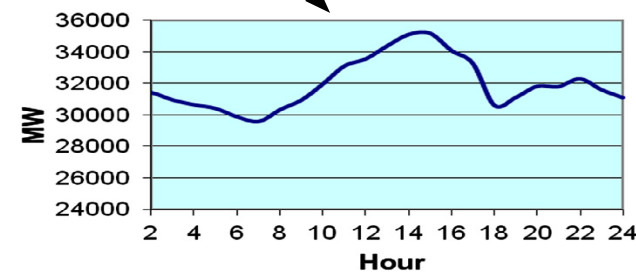
Population centers are close to the seashore. There are four cities /regions with density of more than 300 people per Km². **These population centers also have solar radiation ranging from 6 KW/m²/h to 8 KW/m²/h. These population centers are Jeddah, northeast section of Capital City of Riyadh, eastern cities of Al-Hofuf and Dammam.** Cities with higher population density have higher demand for electricity; and by putting solar panel on the rooftops would help to reduce the overall electricity supply load.

The population of Saudi Arabia is 28.8 million (World Bank, 2013). The population of these four regions combined is 918,5117, approximately 31 percentage of the total population. The population growth rate is a major driving factor of higher electricity demand. By 2020, Saudi Arabia is projected to have a population of 34 million (United Nations, 2013).

The average annual Income per capita is \$26,200 (World Bank, 2013) and the average electricity consumption per household estimated in 2011, was 8,161.20 KWh (Saudi Arabia Ministry of Energy). The relative higher per capita Income and the demand for the electricity makes Saudi Arabia a good candidate to explore solar energy.

Sanford & Bernstein Research Group estimates that Saudi oil fired power costs at about **16 U.S. cents/KWh**, based on a modern power station with an efficiency of around 37 percent, compared to **less than 9 cents/KWh for solar, assuming an installation cost of \$1/W.**

In Saudi Arabia, peak load demands occur on sunny days because of the heavy use of air conditioners. The peak load coincides with the maximum incident solar radiation, hence PV system produces the highest power. **Load profiles** in Saudi Arabia show that the period of peak loads lies mostly from 12:00 P.M. to 5:00 P.M. Accordingly, solar panel on the rooftops may serve to carry the peak load capacity and provide a part of the spinning reserve capacity for the daytime period This's known as peak saving (Amasoud, 2013).



Government Initiative

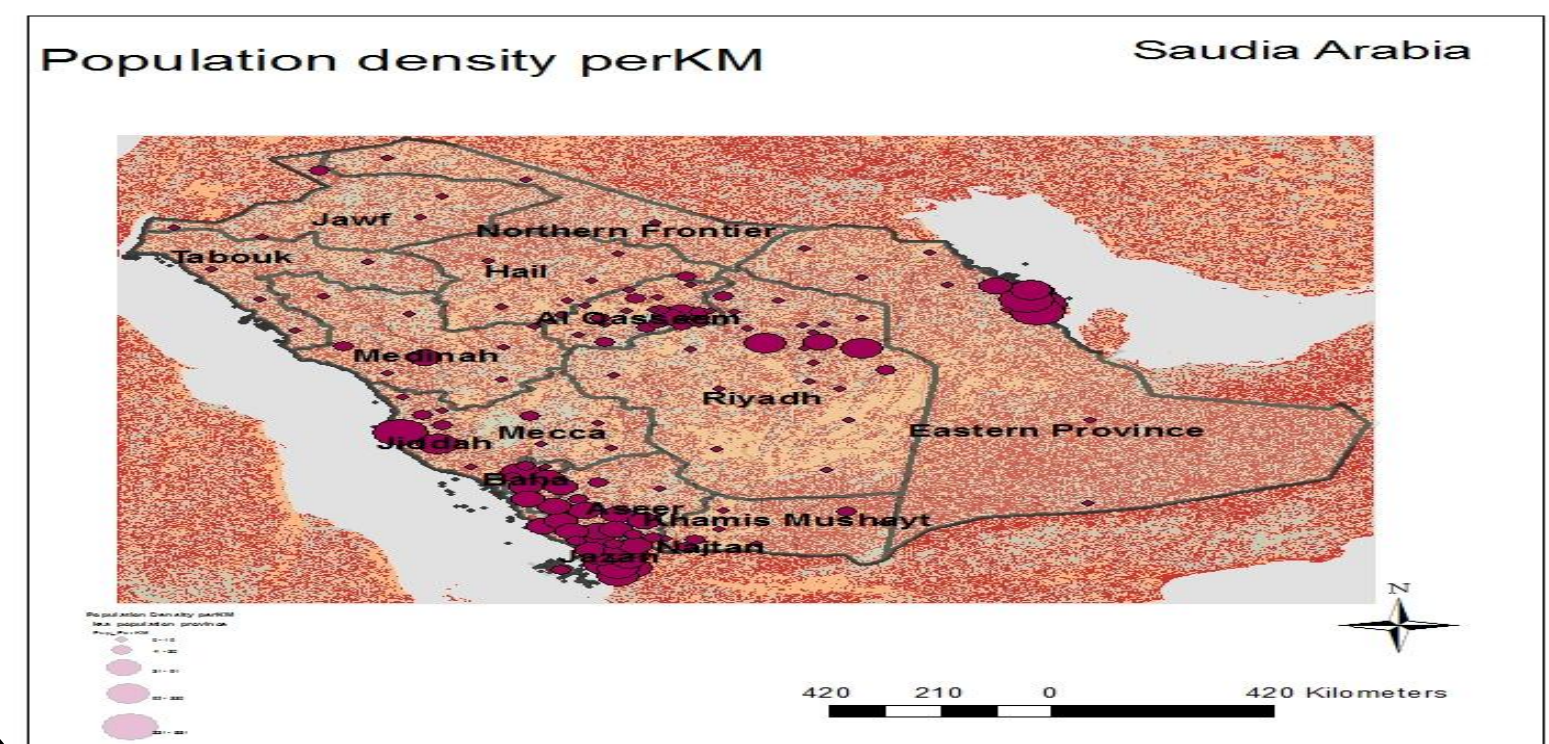
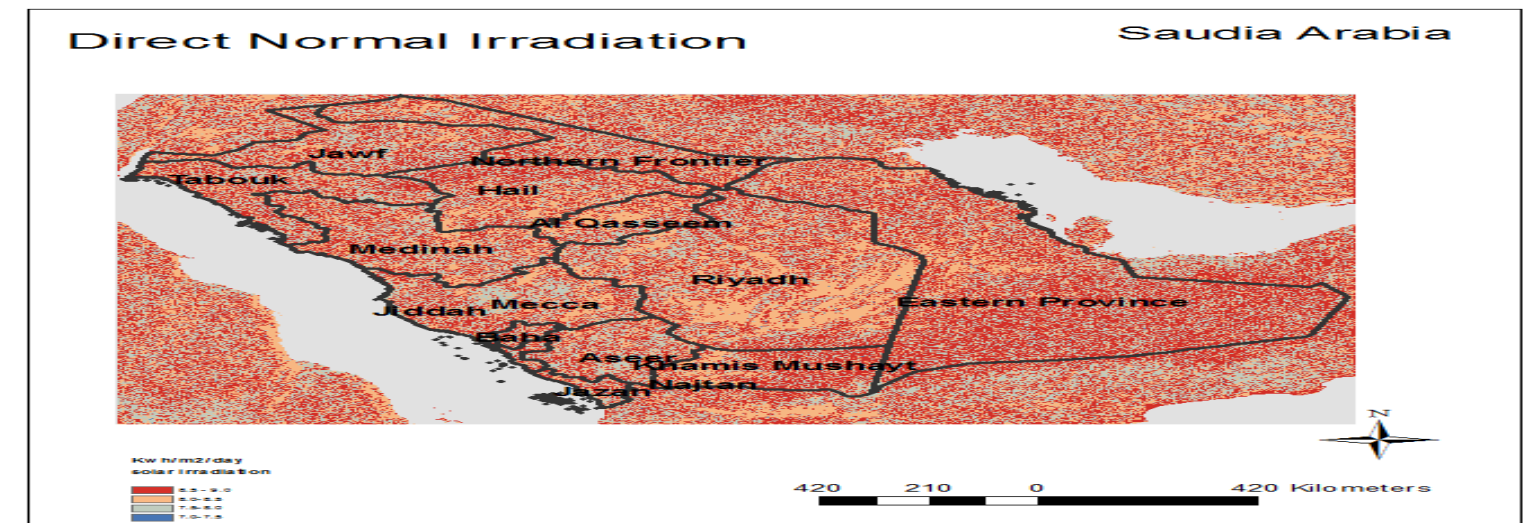
According to Saudi Electric Company, the country generates more than 26,300 MW per year of electricity mostly from crude oil. Solar power in **Saudi Arabia** has become more important as oil prices have risen. In 2011, over 90 % of electricity was produced by burning oil. The Saudi agency in charge of developing the nation renewable energy sector, **Ka-car**, announced in May 2012, that the country would install 41 gigawatts of solar capacity by 2032.

Sources:

Future of solar energy in Saudi Arabia. A.H. Almasoud *, Hatim M. Gandayh, Electrical and Computer Engineering Department, King Abdulaziz University, Jeddah, Saudi Arabia, 2013

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Population density 300>=perKM Saudi Arabia

