

Data Insight

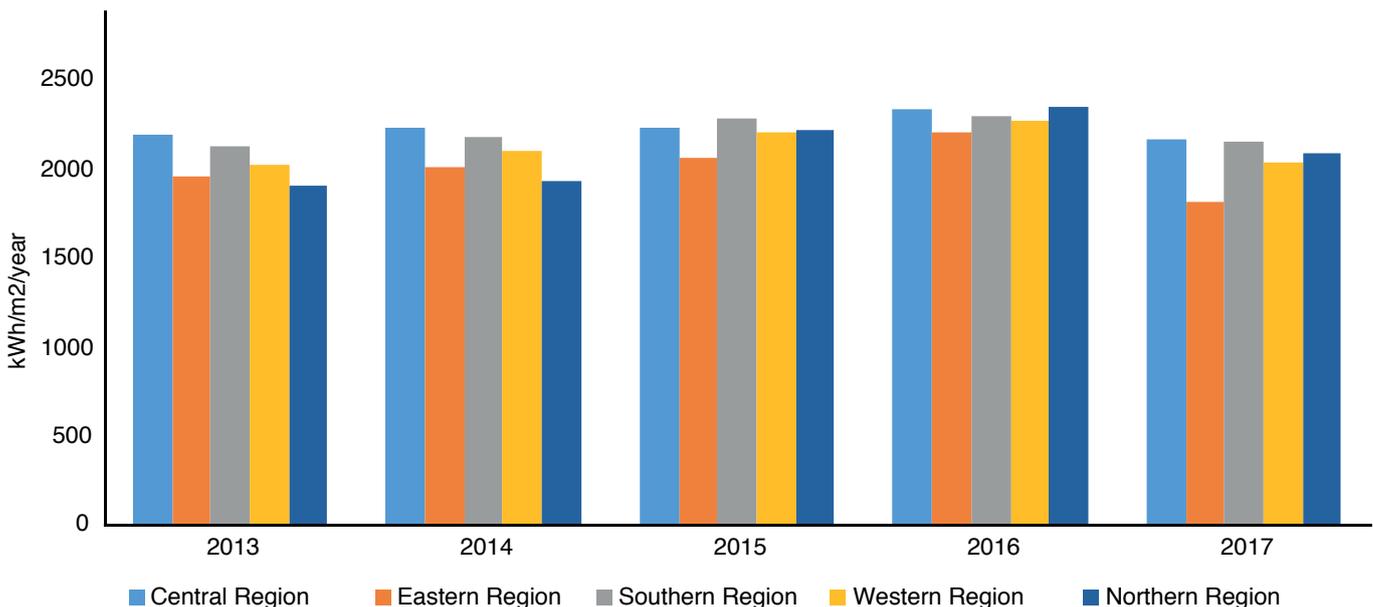
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Solar Energy in Saudi Arabia

Saudi Arabia aims to significantly increase the contribution of renewable energy in its power energy mix, in order to diversify its economy, reduce emissions and eliminate the use of liquid fuels in its power system.

In building a global hub for renewable energy, the Kingdom aims to future-proof its economy by relying less on oil export revenues and attracting new technologies into the region. Saudi Arabia is one of the best-placed countries to harness solar energy, with some of the highest solar radiation levels in the world.

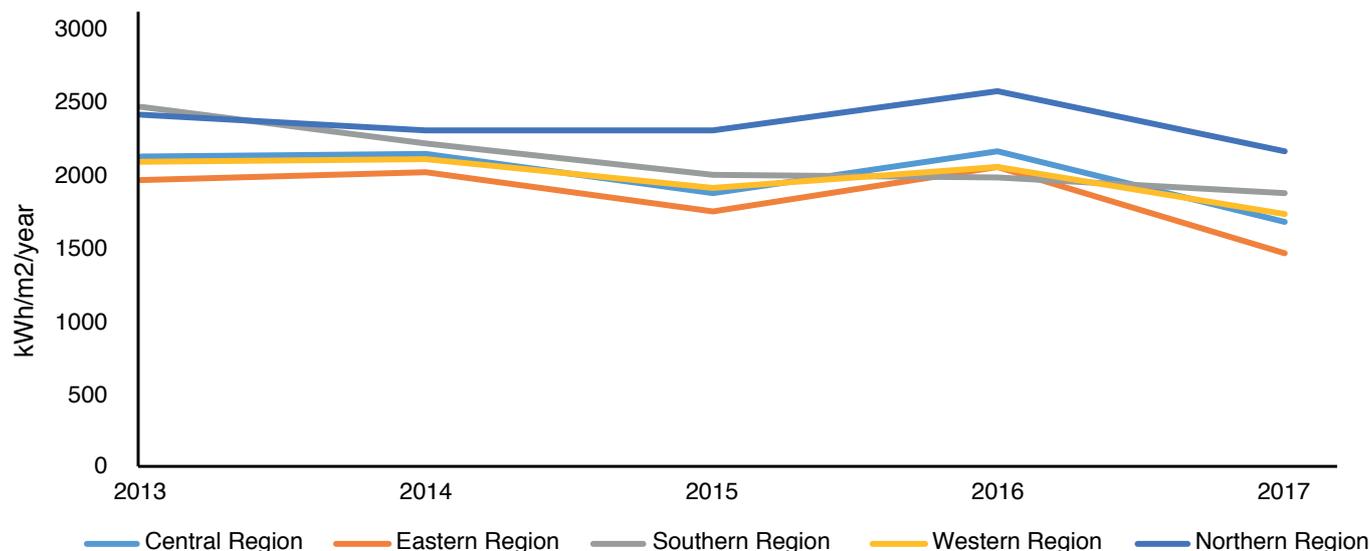
Figure 1. Annual average of global horizontal irradiance (GHI) used to produce photovoltaic power.



Source: Author's calculations and statistics based on data from General Authority for Statistics (GaStat) (2017 data is until June).

Photovoltaic (PV) cells convert solar energy directly into electricity. They comprise several solar panels that allow global horizontal irradiance (GHI) to be converted directly into electricity. The figure above shows that the average global horizontal irradiance in Saudi Arabia reached its highest regional average point in 2016 at 2,297 kilowatthours per square meter (kWh/m²) for the year. Between 2013 and 2017, the lowest annual average was in the eastern region, at around 2,000 kWh/m². The GHI in this area decreased to 1,819 kWh/m² in 2017. The eastern region gets lower radiation than other regions in Saudi Arabia due its geographic location. The highest GHI was in the central region, where the weather is dry and humidity level is very low, at more than 2,200 kWh/m².

Figure 2. Annual average of direct normal irradiance (DNI) used to generate concentrated solar power in Saudi Arabia.

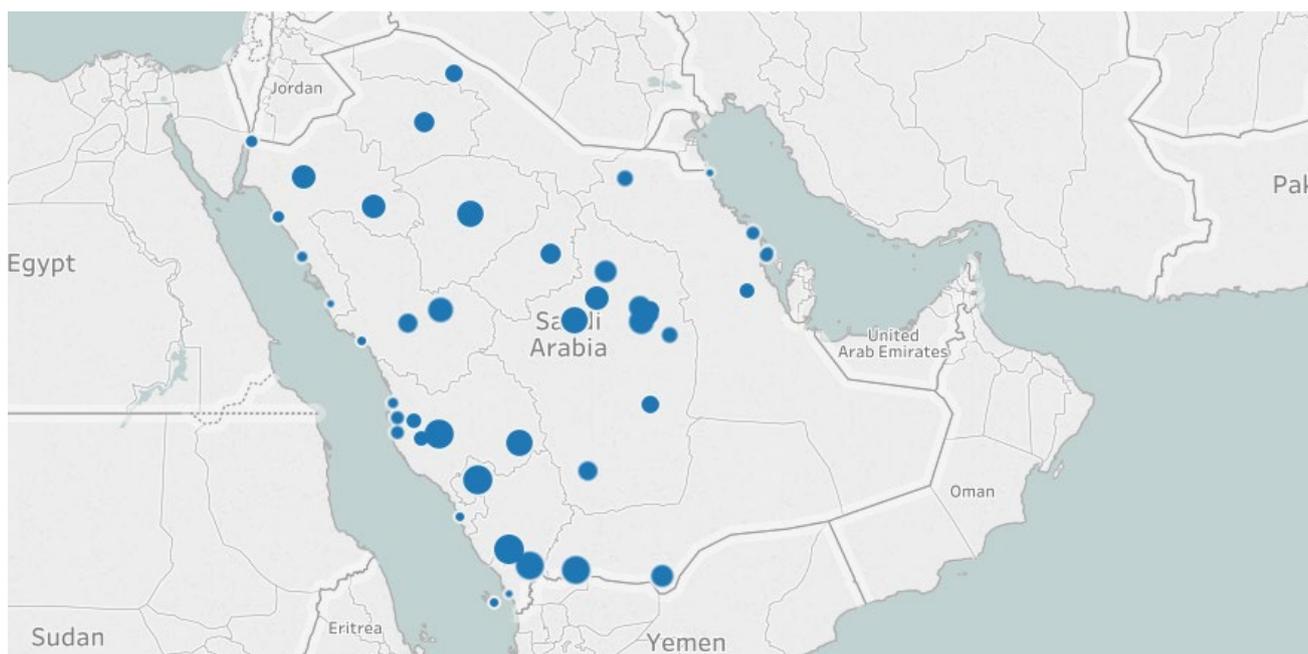


Source: Author's calculations and statistics based on data from General Authority for Statistics (GaStat) (2017 data is until June).

Concentrated solar thermal/power (CSP) converts the sun's radiation into heat. It generates power by using mirrors or lenses to concentrate the heat transmitted by sunlight onto a small area. That heat can then be stored in a device or instantaneously transferred to produce steam that runs through turbines to generate electricity. As shown in Figure 2, the average of direct normal irradiance steadily decreased from 2,219 kWh/m² in 2013 to around 1,800 kWh/m² in 2017. The lowest annual average DNI was in the eastern region. A study published in *Energy and Environmental Science* assessed the impacts of climate change on future PV and CSP energy output. It found that PV output is likely to decrease by a few percent in Saudi Arabia between 2010 and 2080.

More than 40 stations were established to measure solar energy, as shown in the map below.

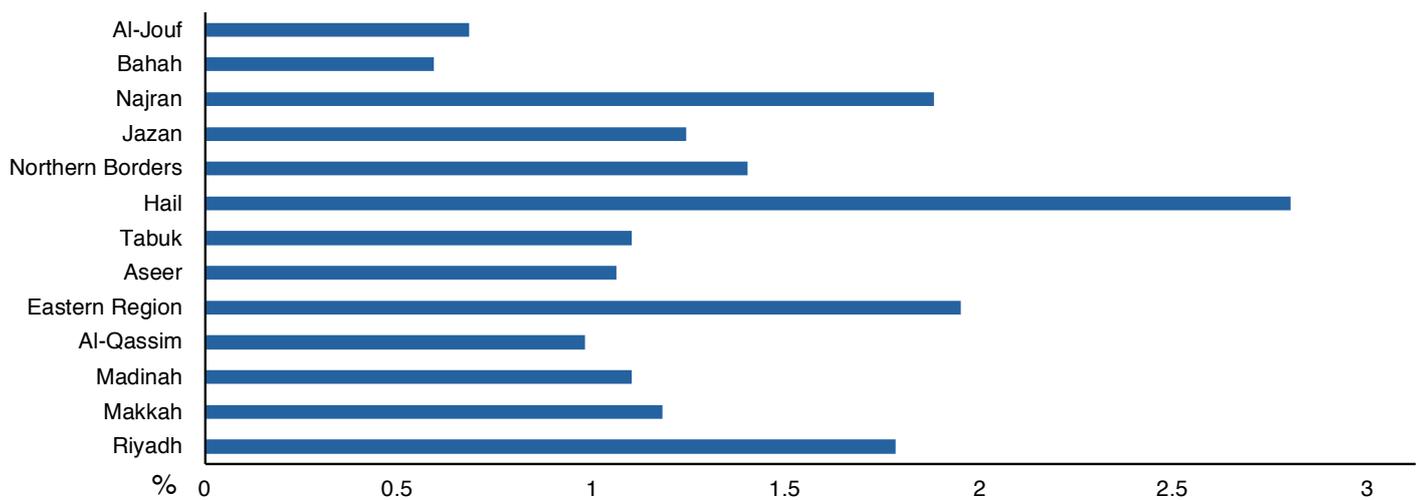
Figure 3. Solar energy stations in Saudi Arabia.



Source: King Abdullah City for Atomic and Renewable Energy (KA-Care).

In 2018, around 1.45% of households in Saudi Arabia used solar energy. This number is expected to rise due to the rapid increase in renewable projects.

Figure 4. Percentage of households using solar energy.



Source: General Authority for Statistics (GaStat).

At the end of 2019, Saudi Arabia's first utility-scale solar PV project was connected to the national grid. The Sakaka 300-megawatt (MW) solar power station, at the time of its establishment, achieved new breakthrough prices for solar PV.

The Sakaka solar project, which was pre-developed and tendered by the Ministry of Energy's Renewable Energy Project Development Office, was the first project launched under the Kingdom's National Renewable Energy Program (NREP). The NREP will deploy a series of utility-scale independent power generation projects to the international market in a bid to maintain globally competitive prices and technologies. A further 2.67 gigawatts of solar PV have been tendered to the market in 2019 and 2020, comprising projects across the Kingdom ranging from 20-700 MW.

The King Abdullah Petroleum Studies and Research Center (KAPSARC) currently operates a solar energy project with a capacity of 5 MW, comprising over 12,000 panels and covering 55,000 square meters (m²). Saudi Aramco also operates a 10.5 MW photovoltaic carport system, the world's largest car-park shade, covering 198,350 m² and using over 126,000 solar panels. These were the first two privately led projects in the Kingdom and are encouraging other corporations to initiate their own projects.

Access [this](#), and related datasets from the [KAPSARC data portal](#) for further analysis and visualization.

Sources:

KAPSARC; KA-Care; Saudi Aramco; GaStat; Renewable Energy Project Development Office (REPDO), Ministry of Energy; [Crook, Julia A.](#), [Laura A. Jones](#), [Piers M. Forster](#), and [Rolf Crook](#). 2011. "Climate change impacts on future photovoltaic and concentrated solar power energy output." *Energy and Environmental Science* 9.

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