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Climate change threatens Middle East's solar power generation capacity

Independent Researcher

Egypt is expected to lose 5 to 10% of its potential PV production over the next 40 years

By Mohammed Al-Saeed On November 5, 2020



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35 km north of The City of Aswan in the far south of Egypt, the village of Banban, one of the brightest sunregions in the world, is home to the Banban Solar Complex, the largest in Egypt, and one of the largest in the world with an operating capacity of 1,465 MW, with 32 solar stations.

While the massive project, which began commercial operation in April 2018 at an estimated cost of \$2.2 billion, boosts its energy production capacity, Egypt's ambition to master the world's solar energy could be threatened if the effects of climate change, which could affect its ability to generate solar energy, are ignored by rising temperatures.

Egypt's actual production of solar pv energy reached 3,955 gigawatt hours in fiscal year 2019-2020, according to the latest statistics from the [Egyptian Renewable Energy Authority](#). The actual production of energy from [solar centres](#) was 463 gigawatt hours per year. Energy from solar centres or compounds is generated by harvesting thermal energy from sunlight and storing it for use afterwards.

In a study published September 22 in the journal [Nature Communications](#), researchers warned that warming the earth's surface, increased humidity, aerosols and suspended particles could lead to an overall decrease in solar radiation, and an increase in the number of days when the sun's brightness decreases and clouds increase.

Hot and arid areas such as the Middle East and South-West America, considered to be among the highest potential solar producers, were most vulnerable to greater fluctuations in the amount of solar radiation, according to the study's study group.

The study, prepared by researchers at princeton universities in the United States, Khalifa of the United Arab Emirates and Nanjing of China, draws attention to the seriousness of climate change, which causes the earth's temperature to rise, increasing the planet's ability to generate energy by heating its atmosphere, as refuted by this study. The results also represent a warning to countries moving towards this type of renewable energy, such as the UAE and Egypt, which are expanding solar energy projects.

Photovoltaic cells and cutting

Climate change will have a direct impact on the performance of pv plants, consisting of variation or disruption in the amount of solar radiation reaching the Earth's surface, which is necessary to maintain solar energy production.

The team relied on satellite data and climate model outputs to describe solar radiation cuts and assess the future stability of PV energy in different parts of the world. The results of the study showed that a slight decrease in solar radiation in the Middle East and North Africa could lead to a significant increase in energy loss rates.

The researchers point to a discrepancy between the average solar radiation that determines the total potential solar energy, and the stability of that energy, which is still threatened by the problem of disruption, especially in the absence of storage options. This discrepancy between the availability and instability of solar energy requires special attention in assessing future solar energy scenarios.

The study shows that the problem of cutting is a major and influential variable in the production of photovoltaic cells in the light of climate change, while previous research has been exposed to trends of average solar radiation, which, while important, is unable to provide a complete picture of the problem, according to Analisa Molini, professor of environmental engineering and civil infrastructure at Khalifa University in the UAE, and a researcher involved in the study.

Molini explains in a statement to Science that relatively small changes in solar radiation reaching the Earth can bring about significant changes in energy stability, especially in areas where pv production is growing rapidly, particularly in arid regions seeking ambitious plans for the future. "Our study shows that these areas are most sensitive to the effects of climate change on the stability of pv production."

The study links desertification and drought with increased aerosols and thus the dispersion or withholding of radiation, and high temperatures contribute to the formation of more moisture that also blocks solar radiation by forming clouds filled with clouds and keeping suspended particles in the atmosphere longer. As atmospheric disturbances increase and temperatures rise in dry areas such as the Middle East, dry soils are likely to cause larger amounts of aerosols and dust to exacerbate the problem.

Aerosols and dust have another effect, according to a study published last June in the journal *Nature Sustainability*, which is to contaminate photovoltaic panels and disrupt their ability to receive solar radiation. The results showed that in highly polluted and desert areas such as North Africa and the Middle East, suspended materials reduce the PV efficiency of panels by more than 50%. The study's researchers stress the importance of cleaning the panels regularly, even every few months.

Stefan de Wolf, a professor of engineering and materials science at Saudi Arabia's King Abdullah University of Science and Technology who was not involved in the study, said researchers have not given the effects of temperatures as important as they deserve in terms of their "critical" role in raising the cost of energy production. "Normally, the temperature of the solar unit can be 15 to 20 degrees higher than the surrounding temperature easily. "I expect unit temperatures to rise as global temperatures increase." According to the researcher.

The relationship between the PV unit and ambient temperature is influenced by environmental factors, de Wolf explains in a statement to Science. If the clarity of the sky decreases, the unit is less able to cool, resulting in further heating, thereby losing the generating capacity.

Energy storage

Estimating the losses of any country, such as Egypt or the UAE, to solar energy production requires more accurate and detailed analysis, which the research team plans to do in the future, according to Molini, the study's co-author. The researcher believes that the solution that Egypt and other Middle Eastern countries should adopt to address the risks of climate change on solar energy is energy storage.

But Panayots Cosmopolis, a renewable energy expert at the National Observatory in Athens, Greece, which agrees with the study's methodology and results, stresses that future trends in clouds and aerosols will determine the stability of the solar energy produced, and rejects the study's proposal on energy storage as the only solution to mitigate the impact of climate change on the stability of pv production in arid regions such as Egypt and the Middle East.

In his remarks to "Science", Cosmopolis, a non-co-author of the study and co-author of the [Egypt Solar Atlas](#), explained that the reason he rejected the solution presented by the study is that solar power potential in the Middle East is significantly higher than in Europe, so existing storage techniques will not be suitable for all regions, as well as future changes in technology dealing with energy loads, which will draw a completely different landscape for future energy production. "Storing energy through batteries is useful now, but not in the future."

A new [study](#) published in The Nature journal on October 14th supports Cosmopolis's view of the prospects for a major change in electricity transmission technologies in the coming decades. It is a change that the study describes as changing everything we know about access to energy and its use, "making current energy storage solutions, such as batteries, just techniques of the past."

By studying solar radiation in Egypt, the researcher predicts that the loss in PV production over the next 40 years will be between 5 and 10% of the potential production volume.

"Countries most affected by climate change need to move to a low-carbon economy and build a life-building lifestyle based on renewable energy. Potential levels of solar energy in the Middle East and Egypt are a gift from nature that must be exploited to provide affordable, modern and clean energy," according to Cosmopolis.

ABOUT THE BOOK.

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