Al-Kharsaah Solar Project:
Supplying 10% of Qatar's Peak Electricity Demand

Al Kharsaah is the first utility-scale solar power plant in Qatar and will help reduce Qatar's CO_2 emissions while meeting its increasing electricity demand. The plant is expected to generate almost 2,000,000 MWh of electrical energy, the equivalent energy consumption of approximately 55,000 Qatari households, while avoiding 26 million metric tons of CO_2 emissions over its lifespan.

Starting date of the project	06/02/2020
Project Localization	Al-Kharsaah -Qatar
Project objectives	Al-Kharsaah project aims to produce clean and affordable energy using the latest cutting-edge technologies in the solar PV industry to reinforce Qatar's National Vision 2030 for sustainable development. Additionally, the project will support the first carbon-neutral FIFA World Cup in November 2022.
Detailed project description	Located in Al Kharsaah, Qatar, this is the first large-scale solar power plant (800 MWp) in the country and one of the largest solar power plants in the world. The plant will be the world's largest solar power plant equipped with high-efficiency, half-cut bifacial modules. The plant will cover 10 square kilometers (the equivalent of 1,400 soccer fields) and will feature 2 million modules mounted on trackers, making it possible to achieve substantial power gains and take full advantage of the region's exceptional sunshine. The use of string inverters further increases the annual yield by enabling better tracking of the maximum power point at the string level. A total of 3,240 string inverters will be installed. The plant has a full capacity of 800 MWp and is being built in two phases of 400 MWp each. The 800 MWp will be fully operational in the second half of 2022.
Main project's drivers for reducing the greenhouse gas emissions	

Reduction levers	**Details on the aspects of the project**
☐ Energy and resource efficiency (including behavior)	
☒ Energy Decarbonization	Electricity generation through renewable energy system (Solar PV)
☒ Energy efficiency improvements	Bifacial modules technology & Geotextile studies and prototypes to enhance power output.
☒ Improving efficiency in non-energy resources	Robotic cleaning -Less water consumption over manual cleaning.
☐ Emissions absorption: creation of carbon sinks, negative emissions (BECCS, CCU/S, ...)	
☐ Financing low-carbon producers or disinvestment from carbon assets	
☐ Reduction of other greenhouse gases emission	

Emission scope(s) on which the project has a significant impact and quantification of GHG emission reductions per emission scope

	Aspects of the project contributing to the reduction of emissions by emission category	Quantification of associated GHG emissions by emission category Please follow the quantification methodology used in the Afep guidelines.
Reduction of the company's carbon dependency		
Scope 1 *Direct emissions generated by the company's activity.*		
Scope 2 *Indirect emissions associated with the company's electricity and heat consumption.*		
Scope 3 *Emissions induced (upstream or downstream) by the company's activities, products and/or services in its value chain.*		
Increase of carbon sinks		
Emissions Absorption *Carbon sinks creation, (BECCS, CCU/S, …)*		
GHG emissions avoided by the company at third parties		
Avoided Emissions *Emissions avoided by the activities, products and/or services in charge of the project, or by the financing of emission reduction projects.*	The Al Kharsaah solar PV power plant will provide decarbonized electricity that would otherwise have been produced from gas-fired power plants.	0.85 $MtCO_2e$ during the first year of operation 26 $MtCO_2e$ over the project's lifespan

Clarification on the calculation or other remarks:

Pre-project situation:
At client's level:
Units of energy generated by combined-cycle gas turbines: 1,949,141,000 kWh/year(1)
Units of energy imported from Solar PV Power Plant (Siraj 1): 0 kWh/year
CO_2 emissions = 843,978 $ktCO_2e$/year(2)

At Siraj1 level:
Units of energy supplied to client through Solar PV: 0 kWh/year
CO_2 emissions = 0 tCO_2e/year

Post-project situation:
At client's level:
Units of energy generated by combined-cycle gas turbines: 0 kWh/year
Units of energy imported from Solar PV Power Plant (Siraj 1): 1,949,141 kWh/year(1)
CO_2 emissions = 0 tCO_2e/year

At Siraj1 level:
Units of energy supplied to client through Solar PV: 1,949,141 kWh/year(1)
CO2 emissions = 2 $ktCO_2e$/year(3)

Avoided emissions: 842 $ktCO_2e$/year

Notes:
1. Year 1 estimated production of Al Kharsaah PV power plant
2. Natural gas emissions factor= 433 gCO_2e/kWh_{elec}; project's own calculation from "CO_2 emission factor including upstream chain emissions" (UBA 2019, p.43) / "power plant efficiency"
3. Project's estimate of annual CO_2 emissions for Operations & Maintenance

Modality of verification of the quantification.

Calculation standard used (ADEME base, GHG protocol, etc.): UBA benchmarks (https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2019-11-07_cc-37-2019_emissionsbilanz-erneuerbarer-energien_2018.pdf)

	Verification of the calculation (internal or external): Internal verification
Other environmental and social benefits of the project	SDG7: Affordable and Clean Energy SDG8: Decent Work and Economic Growth SDG9: Industries, Innovation, and Infrastructure SDG13: Climate Action
Project maturity level	☐ Prototype laboratory test (TRL 7) ☐ Real life testing (TRL 7-8) ☐ Pre-commercial prototype (TRL 9) ☐ Small-scale implementation ☒ Medium to large scale implementation **Remarks**: Actual system proven in operational environment
Capacity and conditions of the project reproducibility, with associated climate impact mitigation potential	800 MWp Conditions of reproducibility: area with favorable sunlight conditions and the availability of land that is not in competition with other uses such as agriculture.
Amount of investment made (in €)	M€ 440
Economic profitability of the project (ROI)	☐ ST (0-3 years) ☐ MT (4-10 years) ☒ LT (> 10 years)
Engaged partnerships	The project is being developed and operated by Siraj 1 SPV, jointly owned by the Consortium of TotalEnergies and Marubeni (40%), alongside Siraj Energy (60%), a Joint Venture between Qatar Energy (40%) and QEWC (Qatar Electricity & Water Company, 60%).
Open comments from the project owner	-
More about the project	
Contact the company carrying the project	Jeffrey Norman: jeffrey.norman@totalenergies.com
Project URL links	https://totalenergies.com/projects/renewables-electricity/al-kharsaah-pioneering-solar-power-plant-qatar

Illustrations of the project