



31 October - 3 November 2022  
Abu Dhabi, United Arab Emirates

# Saudi Aramco Awards Winning Project

**TVP SOLAR – M. Silvio SPARANO**

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# TVP Solar Thermal Plant at Qurayyah (KSA)

- Operational since 26th December 2020 on Saudi Aramco's premises at Qurayyah (KSA), TVP Solar thermal plant has shown the potential of energy and CO<sub>2</sub> savings offered by the solar thermal technology of the Swiss company TVP Solar.
- Because of its proven performances, TVP Solar plant has been awarded in 2021 by Saudi Aramco with the Environment and Energy Excellence Awards.



TVP Solar plant in Qurayyah (thermal bloc is on the right of picture)

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# Specifications of the TVP Solar Field



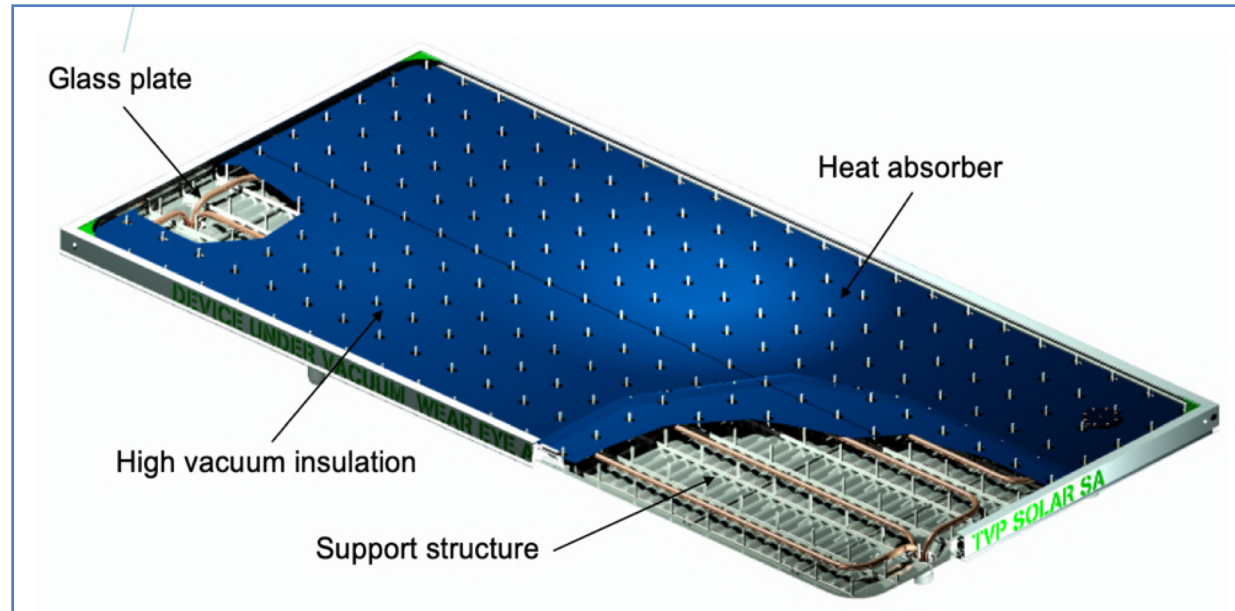
<b>EPC</b>	TVP Solar SA
<b>Application</b>	Boiler feedwater pre-heating
<b>Solar field</b>	1,020 m <sup>2</sup> gross area (1,800 m <sup>2</sup> land use) 0.6 MW <sub>t</sub> peak power 103°C T <sub>in</sub> up to 174°C T <sub>out</sub> operating temperature
<b>Production:</b>	1,000MWh <sub>t</sub> (3,410 MMBtu/year)
<b>Fuel savings</b>	137,479 L/year of diesel (75% boiler efficiency)
<b>CO<sub>2</sub> avoided</b>	372 T/year



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- Qurayyah's solar plant has been constructed using MT-Power v4 panels, the last generation of TVP Solar high vacuum solar flat collectors.
- The use of high vacuum together with a high-performance selective coating ensures the best possible efficiency (above 60%) and highest energy production at any operating temperature and climate conditions, greatly outperforming any other flat plate collector.



MT-Power v4 TVP Solar collector

**Performances guaranteed  
25 years without degradation**

**All year-round performances  
of 150 – 180 °C in Middle East**

**Performances above 100 °C  
even in Northern Europe**

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- The solar plant has been engineered to preheat from 93 °C up to 164 °C the water fed to a set of two diesel fueled boilers used to generate steam.
- The specific ability of TVP Solar collectors to harvest energy from diffuse light allowed the solar field to have its performance minimally impacted by fouling, even if the panels were never cleaned during more than one year of operations.

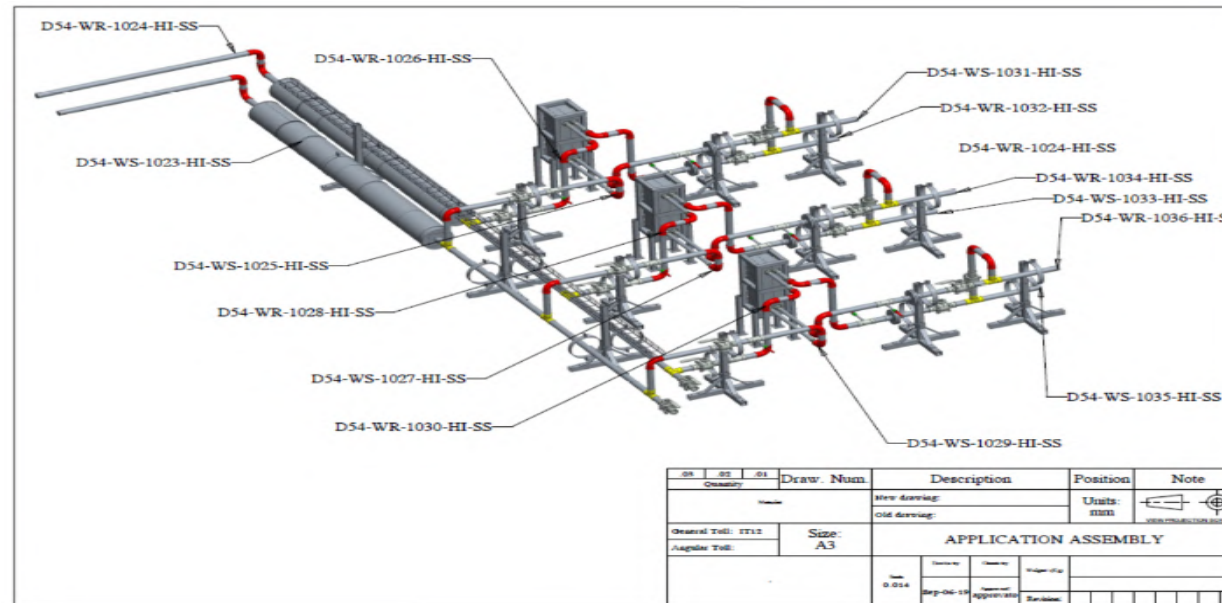


TVP Solar collector in Qurayyah covered with dust and sand

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- The plant consists of 510 MT-Power v4 for a total gross area of 1,020 m<sup>2</sup> (corresponding to a total land occupation of 1,800 m<sup>2</sup>), generating a total peak power of 0.6 MW<sub>T</sub>.
- The plant produces a flow of 7.5 t/h of pressurized hot water. This production is used to preheat - via a set of 3 water-to-water plate heat exchangers - the boiler feed water (BFW) used to a set of two boilers to produce steam at 4.9 barg and 158 °C.



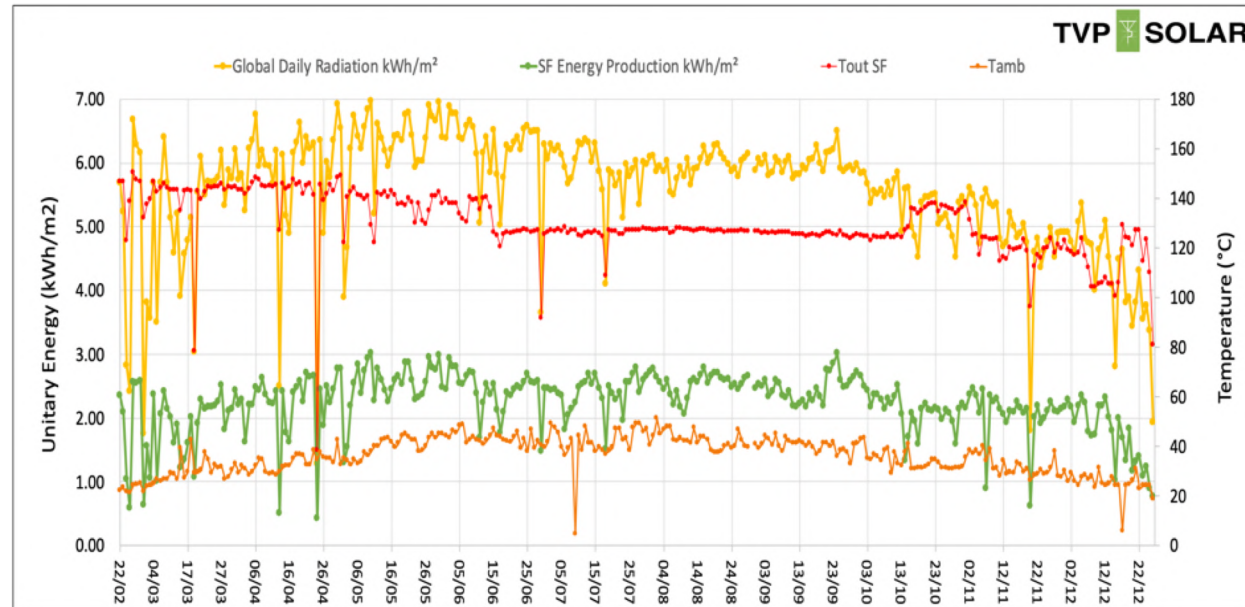
Integration of solar field pipe array in the heat exchangers

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- The operations of the solar plant between the 22nd of February and the 26th of December 2021 were reviewed by Saudi Aramco using information recovered in real time.
- During the reviewed period, the plant operated at a maximum temperature ( $T_{out}$ ) of 174 °C with daily average temperature as high as 158 °C and a reliability factor of 96.8%. Energy production was 2.29 kWh<sub>T</sub>/m<sup>2</sup>/day (kWh<sub>T</sub>/m<sup>2</sup>/year) with an average yield of 41%.



Data acquired between 22nd February and 26th December 2021

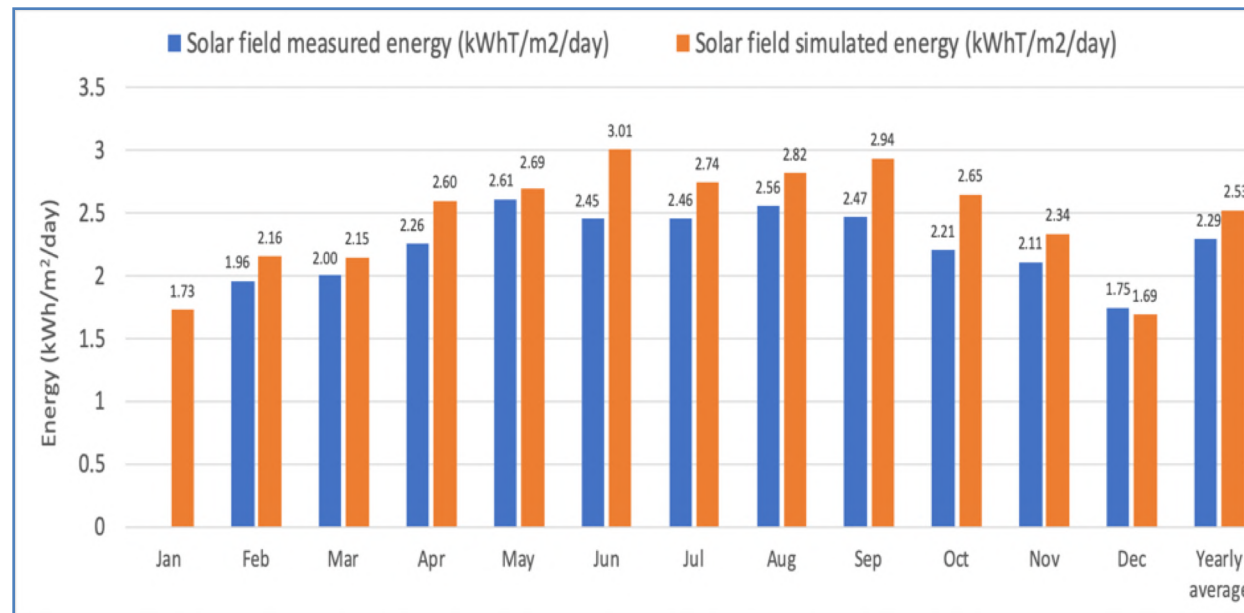
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# Operating Results vs. Simulations

- The actual production has been compared to the simulated expected energy performance using a model based on the Solar Keymark<sup>®</sup> certificated values of MT-Power v4.
- The difference between actual and simulated energy output can be largely accounted for the fouling effect, as the plant was never wet cleaned with water during the surveyed period but only three times dry-brushed cleaned in March and May 2021.



Measured vs. simulated monthly energy production

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- TVP Solar has shown in Qurayyah the potential offered by its last generation of solar collectors in terms of energy and CO<sub>2</sub> savings.
- Experience gained in Qurayyah shows that at this location 1 MW of peak thermal power requires 1,700 m<sup>2</sup> of TVP Solar collectors and produce 1.5 GWh<sub>T</sub>/year, thus reducing fuel consumption by 200 m<sup>3</sup>/year of diesel and avoiding 520 tons/year of CO<sub>2</sub> emissions.
- The solar plant in Qurayyah has shown the large potential of TVP Solar technology in Oil & Gas large applications and more particularly:
  - Boiler preheating
  - Production of steam for amine regeneration units
  - Tank heating
  - Fluid separation
  - Crude desalting
  - Sour water stripping

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