



Republic of Yemen

Ministry of Water & Environment

Urban Water Supply and Sanitation Project

ADEN

Supply, Installation and Operation of Solar PV Energy units

Al-Muwaijah Field

Al-SHAER

Funded by: World Bank through UNOPS

Sub-project No.: IUS-AF-UWS-SHA-001

Site Investigation Report

Site Investigation

The project is located in Al-Shaer, Hadhramout, Yemen. The 0.534 MW Hybrid PV System, shall compromise all facilities necessary for the generation of power from the solar resource as specified in the tender, as per the mentioned above, the system will be located with coordinates:

- **Longitude: 14° 52' 27.05"N**
- **Latitude: 49° 31' 22.17" E**

The proposed system compromise the following:

Project Expected Duration	6Months
Nominal Power(MW _{AC})	0.4 MWAC
Peak Power(MW _p)	0.54MWp
Total area covered by the PV plant(m ²)	6400m ²

The design of the PV plant will take into account a useful life of the more than 25 years. This requirement shall govern the choice of equipment, materials and finishes of the plant. The choice of materials is an important fact or to achieve the purpose of service life longer than 25 years.

All materials will be selected to withstand the weather, changes in temperature ,precipitation, corrosion ,wind pressure, exposure to UV rays and other conditions of the location of the photovoltaic plant. Structural steel will be hot dip galvanized according, ISO 1461 ,ISO 14713.

The design ambient temperature used was the range from 9°C to 45°C.The photovoltaic plant will operate automatically and independently with minimal intervention. If a failure in grid occurs the ATS shall be automatically switch to backup generator, which shall be already operated. This process shall be managed by the controller. The inverters should automatically disconnect from the Grid in case of Shutdown. In most cases ,inverters will reconnect automatically once the problems have been solved.

The panels, structures and cable trays are integrated in the structures, and go to the step-up transformed by underground tubes, without any impact on the roads in and around the land.

Our designs will go after to obtain:

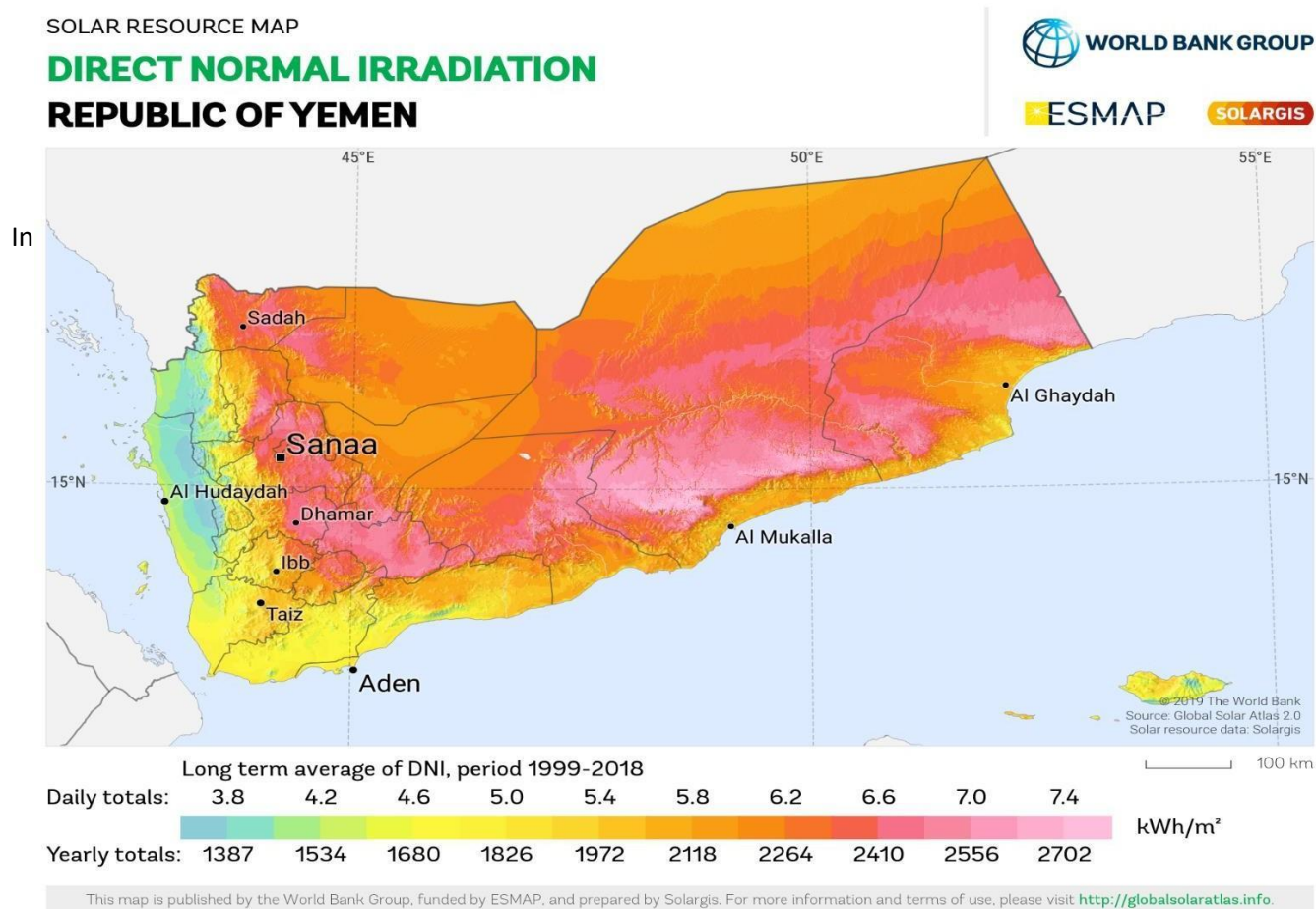
- The maximum materials efficiency ,and therefore the maximum electricity output,
- The cleaning systems for 0.534MWp, achieved by minimum costs and high performance overall.
- The best designs for the PV Structures of the 0.534MWp look for solving the dust control issue.

At this stage the real soil characteristics is still unknown and cannot be discovered unless a soil test (Geotechnical report) is performed. For this reason we suggested to execute a Geotechnical survey, taking into account the following minimum requirements.

Site Radiation

Yemen, for its location and climate, is a country where the solar resource is a abundant. The whole country has a very high radiation values .The following figure shows the map with the solar radiation

distribution in Yemen. The different colors represent scales of incident energy (in kWh/m^2) per square meter of horizontal surface, divided into different steps



addition, the radiation values as shown above in daily average yearly showcase the suitability of the location for the solar plant.

Site Topography ,Drainage and Vegetation

There is no large-sized vegetation on the ground. The average annual temperature is 38°C (Highest rate temps). The highest temperature (44°C or more). The lowest is around 9°C .

Shadings

There are no near obstacles that project any shadowing on the PV modules, in addition the system is designed free of shadowing such as fencing, row spacing, lighting Rod sand electrical poles.

The shadows by trees, structures, buildings or nearby objects are avoided as possible .An environmental ,health and safety policies will be applied in order to avoid any source of showing or projection on the proposed system. All aspects of design and construction of the photovoltaic plant are governed by these premises.

System Proposed Layout

Attached the system proposed layout (See Drawings)