

VALIDATION REPORT OF THE SOLAR LABS SOFTWARE

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| Report Title: Software Validation of Shadow Analysis in Reference to Real Time Data | Created By: TÜV SÜD South Asia Private Ltd., India Power & System | Report No: 2019/PWS-005005/Software validation/The Solar Labs/26082019 |
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INTRODUCTION TO THE SOLAR LABS

The Solar Labs makes sales & design software for solar companies to automate designing in both prelim and detailed stage. It works on AI technology. The software assesses the roof area based on latitude and longitude of site. The software presents a comprehensive analysis of shading pattern for a full cycle of sun path throughout the year. It also generates prelim quotes and detailed engineering designs for the ready input of Engineering/EPC team.

THE NEED FOR ACCURATE SHADING ANALYSIS

Accuracy of simulation software is utmost important for any rooftop solar PV installation. Actual shadow free area must be computed to estimate possible PV system capacity which can be installed in a given space. A photovoltaic system is highly susceptible even to partial shading as photovoltaic system relies on solar irradiance to generate electrical power. Parapet, adjacent elevated structure, water tanks, signboards etc. are some common structures which may cast shadow. It becomes extremely crucial to compute shadow free area on which the PV panels can be installed.

REPORTING AGENCY

TÜV SÜD South Asia Private Ltd., India Power & System

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METHODOLOGY

Shadow simulated by software has been validated with real time data taken by TÜV SÜD team. For validation 2 parameters of shadows are evaluated:

i) *Real time measured area* and ii) *Pattern of shading area*

For better reliability of software, three different locations at *Noida* (Latitude-28° 35'), *Chennai* (Latitude-12° 58') and *Gurgaon* (Latitude 28° 30') has been selected to analyze results of simulation. In this study real time data has been analyzed at 9.00 A.M, 11.00 A.M, 3.00 P.M and 5.00 P.M. Since there has been some *deviation* in timing of data collection due to cloud and some other constraints, the same has been taken into account while comparing with the simulated data. The validation methodology involves the use of *Ring theory* wherein simulated shade area has been compared with actual shade area.

RESULTS

| Location | Accuracy Based on Ring Intersection Theory | Total Error* due to time interval and approximation | Software Accuracy upto |
|----------|--|---|------------------------|
| Gurgaon | 95.58% | 3.92% | 99.50% |
| Chennai | 95.18% | 2.80% | 97.98% |
| Noida | 94.55% | 4.32% | 98.87% |

Overall accuracy based on ring intersection theory and computed error comes out to be 98.78%.

*The error is at the time of measurement in real world conditions; does not originate from design studio.