NUS National University of Singapore

SERIS Solar Energy Research Institute of Singapore

Solar Energy System Cluster

SERIS' Real-Time PV Assets Management Platform
Advanced On-Site Diagnostics
Climate-Specific Testing of PV Modules and Systems
Owner / Lender's Engineer Services
Technical & Financial Feasibility Studies

National Research Foundation
Prime Minister's Office
Singapore

Energy Market Authority
Our Clean Energy Future

EDB: Singapore

SERIS is a research institute at the National University of Singapore (NUS). SERIS is supported by NUS, the National Research Foundation Singapore (NRF), the Energy Market Authority of Singapore (EMA) and the Singapore Economic Development Board (EDB).

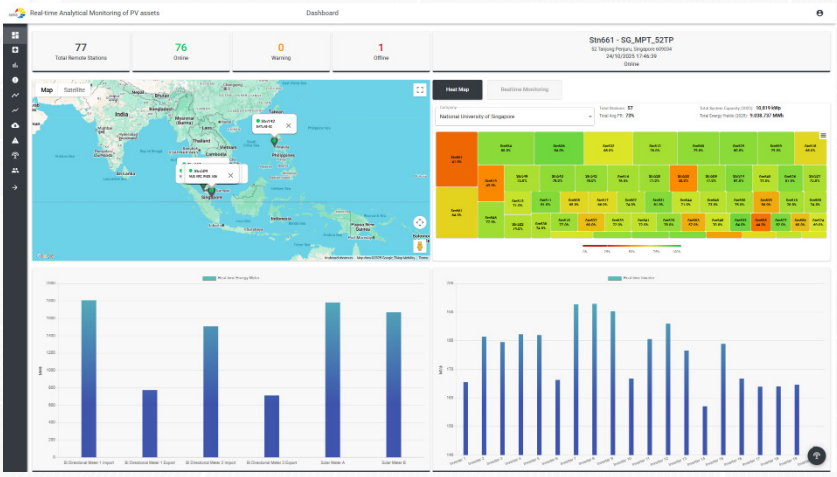
SERIS' REAL-TIME PV ASSETS MANAGEMENT PLATFORM

SERIS' cloud-based solution offers advanced analytics that go beyond standard monitoring capabilities, enabling seamless integration and management of PV asset performance.

It captures and analyses detailed error logs in real-time, delivering actionable insights for critical fault detection. The solution helps prevent device failures, minimises system downtime, and optimises overall energy generation for reliable operation.

Key features of the cloud-based PV monitoring system developed by SERIS:

- Cloud-based architecture designed for scalability and easy configuration
- Advanced algorithms to analyse and detect critical faults and performance anomalies across various inverter types and brands to support targeted troubleshooting
- 1-minute time-resolution data for weather parameters,energy generation, inverter performance, and other system indicators
- Evaluation of individual system performance, including regular performance ratio (PR) assessments across the PV fleet
- Energy management and export control, e.g. bidirectional net metering for real-time optimisation of PV generation, load consumption and PV export to the grid



SERIS' Real-time PV Assets Management Portal

NATIONAL SOLAR REPOSITORY (NSR) OF SINGAPORE

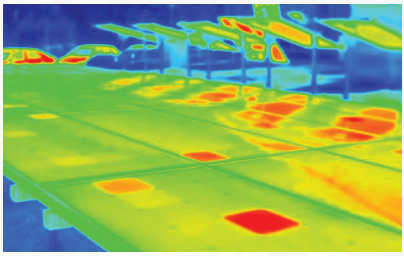
One of SERIS' key goals is to "solarise" Singapore and help to disseminate solar information to the public. The NSR website (www.solar-repository.sg) contains many features, such as a dynamic Solar Economic Handbook which is regularly updated, a LCOE calculator, PV system database, real-life irradiance map, and more.

ADVANCED ON-SITE DIAGNOSTICS

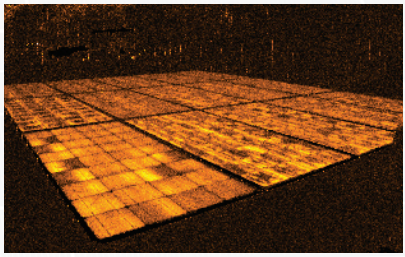
We offer an integrated diagnostic package to accurately locate PV defects in the field down to module level, using non-destructive techniques. It includes:

- Field inspections according to the latest IEC standards
- Electrical assessments on string level (including I-V curve evaluation)
- The following advanced imaging techniques (all applicable in daylight conditions):

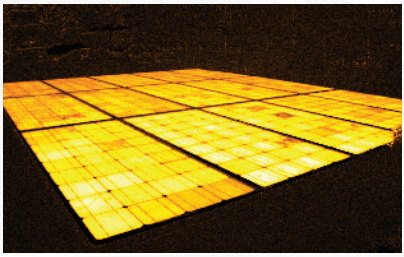
Optical imaging (OI)



Thermal imaging (IR)



Daytime electroluminescence imaging

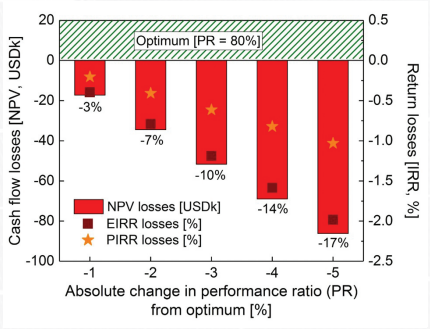


Daytime photoluminescence imaging

INDEPENDENT FINANCIAL ASSESSMENT

An under-performing PV system results in revenue losses and reduction of expected returns. Even small deviations from the optimal performance ratio can negatively impact a project's financial return and cash flow. Our financial service team offers:

- Financial impact analysis of the under-performance
- Life-cycle cost/benefit analysis of required rectification works needed to bring the system back to its optimum performance



An example of net present value (NPV) losses and equity & project internal rate of returns (EIRR, PIRR) impact for a 1 MW_p rooftop system

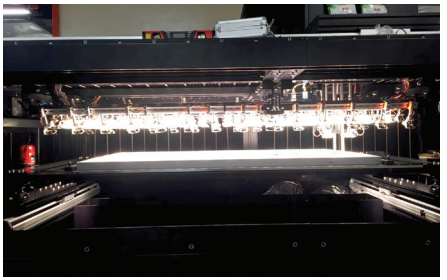
CLIMATE-SPECIFIC TESTING OF PV MODULES AND SYSTEMS

TruePower Alliance

Advanced combination of extended indoor and outdoor PV module & system testing across major climate zones.

Advanced & flexible indoor test facility

- Wide range of intensities and module temperatures, long pulse I-V measurement equipment
- Module-level spectral response measurements

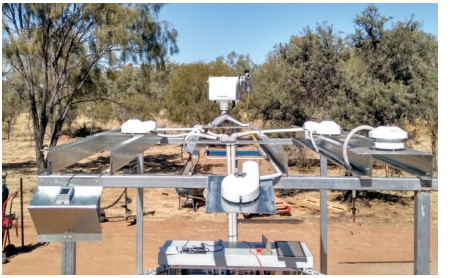


Cross-climatic outdoor testing

- Using high-precision equipment to measure realistic annual energy yield
- Identical module and system testing setup across four climatic zones

360° Solar irradiation measurement

- State-of-the-art meteorological sensors including albedo measurements
- > 5 years experience in monitoring with very high data quality



Scientific interpretation and data intelligence

- Big Data analysis
- Revise the standard set of indoor measurements representing real outdoor performance

SERIS' Outdoor Module and System Testing facility in Alice Springs, Australia (desert climate)

SERIS' Outdoor Module and System Testing facility in Friedenshall, Germany (temperate climate)

SERIS' Outdoor Module Testing facility in Singapore (tropical climate)

OWNER / LENDER'S ENGINEER SERVICES

SERIS can assist project owners and developers in the design of their PV systems for performance optimisation and to meet the highest quality standards, in particular for installations in the tropics. SERIS' project services start from initial yield estimations until the systems are fully operational and perform as originally planned.

SERIS also works with lenders on the technical and financial evaluation of a proposed solar project.

Typical PV system services offered by SERIS are illustrated by the image on the right.

FLOATING SOLAR

SERIS has special expertise in the area of "Floating Solar" where it operates the World's largest testbed of Floating PV installations and carries out technical and financial assessments around it.

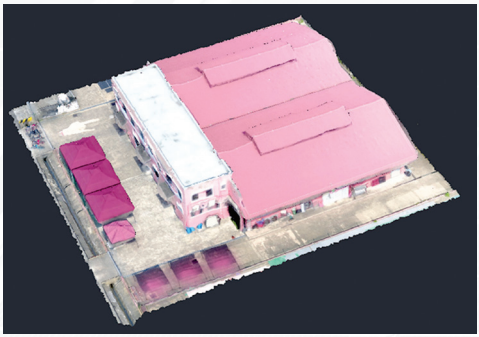
The floating PV system at Tengeh reservoir Singapore comprises different types of floating structures and PV modules of approximately 100 kW_p each

TECHNICAL & FINANCIAL FEASIBILITY STUDIES

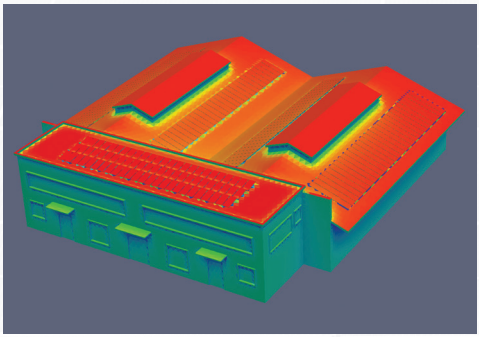
We offer a wide range of feasibility studies, from specific technical questions to comprehensive studies including commercial and regulatory aspects, for example:

- Technical and economic feasibility of solar projects of any size and any deployment option, e.g. ground-mounted, floating PV, or roof-top.
- Commercial and regulatory feasibility of large-scale PV projects in Asia
- Analysis of solar PV potential for cities and regions
- Solar PV roadmaps

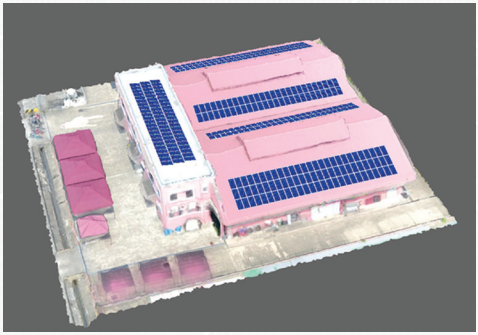
SERIS also offers an integrated techno-economic assessment that combines PV capacity estimation, energy yield projection and economic evaluation. This service blends innovative UAV (unmanned aerial vehicle) surveying techniques, specialised in-house modelling capabilities and know-how to produce visually engaging evaluations for optimised solar PV installations.



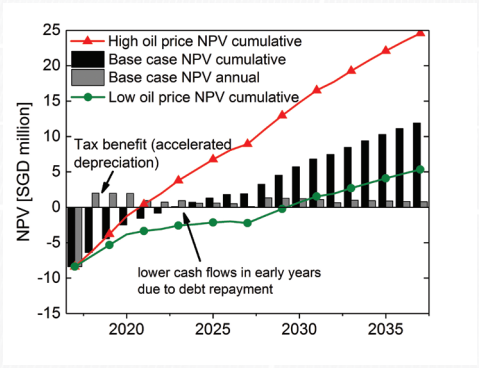
3D building model after UAV surveying



Detailed irradiance modelling to assess maximum solar energy harvest



Optimum PV system layout for maximising solar energy generation throughout the year, including shading analysis



Detailed economic viability assessment (NPV = net present value)

ABOUT THE SOLAR ENERGY SYSTEM CLUSTER AT SERIS

The Solar Energy Systems (SES) Cluster focuses on making solar power a cost-effective and trusted source of electricity. The SES activities have a wide variety and span from remote monitoring to novel PV system deployments such as Agrivoltaics (= combining agriculture + PV) and forecasting of irradiance for better grid integration management. The cluster also addresses the specific challenges when deploying solar technologies in urban environments like Singapore and other megacities. SES is driving the SERIS flagship project on Floating Solar and focuses on important aspects to increase solar adoption, such as solar potential analysis, quality assurance, technical standards, long-term reliability, smart operation and maintenance (O&M) of PV assets, and the economics of PV installations.

The SES Cluster comprises three R&D groups which also offer other professional services:

- Solar System Technology
- PV Quality Assurance
- Digitisation of Energy

Contacts:

Dr Thomas REINDL
SES Cluster Director
Email: thomas.reindl@nus.edu.sg

Mr Eddy BLOKKEN
Business Development
Email: eddy.blokken@nus.edu.sg