Lord Howe Island Renewable Energy Project

ARENA Knowledge Sharing Report: Solar Resource Data

April 2021-April 2022

Lord Howe Island Hybrid Renewable Energy Project

ARENA Knowledge Category:	Community Engagement
Technology Type:	Solar PV and Battery Storage
State/Territory:	New South Wales
Project Client:	Lord Howe Island Board
Project Manager & Owners Engineer:	Jacobs
Community Engagement:	Jacobs
Principal Contractor:	Photon Energy
Date:	November 2022
Report Title:	ARENA Knowledge Sharing Report - Solar Resource Data
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This project received funding from the Australian Renewable Energy Agency (ARENA) as part of ARENA's Advancing Renewables Program.

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
A	25/11/22	Draft for LHIB review	KS	NW	NW	NW
B	30/11/22	Draft for ARENA review	KS	NW	GH	NW
C	07/02/23	Final, incorporating ARENA comments	KS	NW	NW	NW

Contents

1. Introduction

The Hybrid Renewable Energy Project (HREP) was undertaken to provide a sustainable supply of electricity for 400 residents and up to 400 tourists on Lord Howe Island. The primary driver for the project, as with many islanded micro-grid projects, is to reduce reliance on fossil fuels by displacing diesel with renewable generation. The Project scope included installation of a 1.3MWp solar PV plant with a 3.7MWh battery energy storage system (BESS) and micro-grid controller to accompany an existing diesel generation system of three (3) 300kW Detroit Series 60 generating units. HREP is expected to provide in excess of 67% of the island's power requirements from renewable sources. The final stage of commissioning for HREP was completed in late April 2021.

Figure 1-1 HREP solar array, BESS (white container) and powerhouse (green shed)

The HREP solar array covers an area of 12,250 m^2 installed at a fixed 20° tilt. The array is situated on a north-west facing slope, immediately south of the existing diesel generation system located at GDA94 MGA Zone 57 grid reference (507100, 6511800).

This report presents the solar irradiation data measured onsite for the first 12 months of operation and compares this to the resource analysis completed during project development.

2. Solar Resource Data

This section describes the measurement of solar irradiation via pyranometers and presents the data collected.

2.1 Measurement

The available solar resource is monitored via horizontal and plane of array (POA) pyranometers. The POA pyranometer is model SMP10-A by Kipp & Zonen. Adjacent to the POA pyranometer is a soiling station with temperature measurement (Kipp & Zonen DustIQ). The POA pyranometer and soiling station are installed at one end of the PV array.

The project also includes a weather station located at GDA94 MGA Zone 57 grid reference (507253, 6511612), 80.1 m above sea level, which measures global horizontal irradiance, ambient temperature, air pressure, rainfall, wind speed and direction (Lufft WS510-UMB and Lufft WTB100).

Data collected from all meteorological sensors is stored at 15-minute intervals in the SCADA historian, residing on the SCADA PC in the Powerhouse control room. Data presented in this report was collected from 23 April 2021 to 23 April 2022.

2.2 Results

Average daily global horizontal irradiation (GHI) and plane of array (POA) irradiation is presented in Figure 2-1. POA was measured at 20° tilt, facing north west. The total GHI received in the first year of operation was 1,629 kWh/m^2. The total POA received in the first year of operation was 1,800 kWh/m^2. As expected, POA measurements are higher than GHI in Winter.

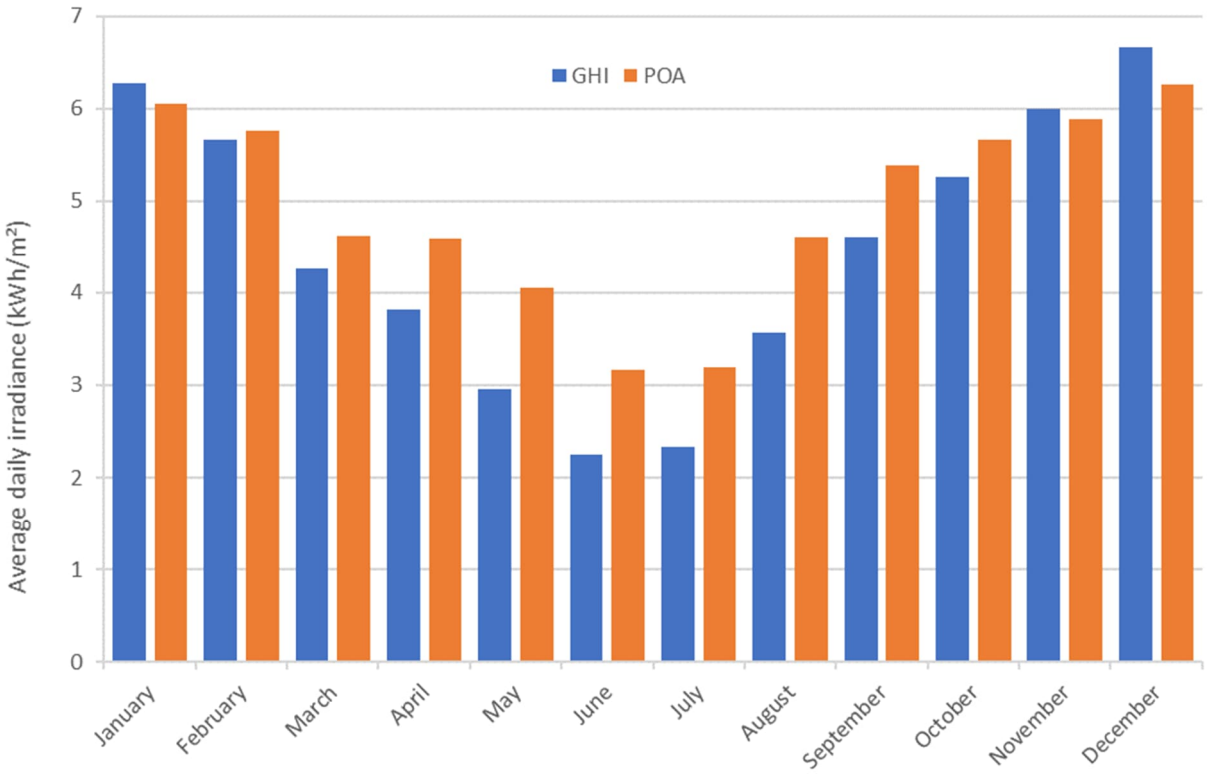

Figure 2-1 Total measured global horizontal and plane of array irradiation for 23 April 2021 to 23 April 2022

Figure 2-2 shows the available irradiation, averaged across one month for the minimum and maximum exposures (June and December) for both GHI and POA.

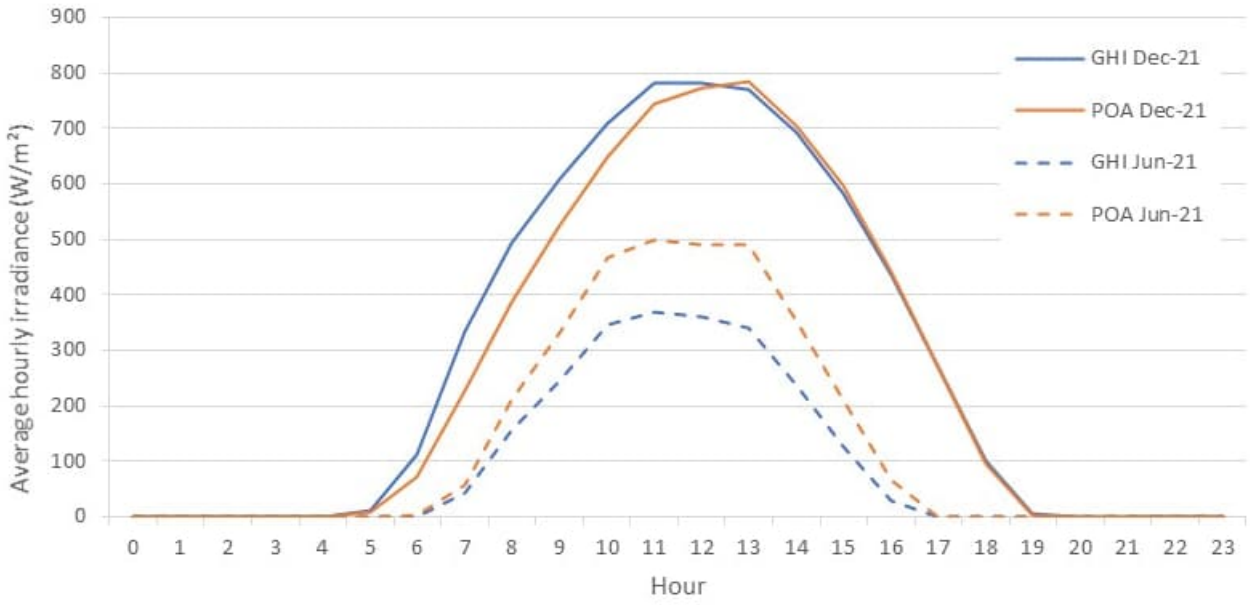

Figure 2-2 Average diurnal GHI and POA for December and June

3. Solar Resource Analysis

Analysis of the solar resource was conducted in 2016 to optimise the project scope and capacity prior to an investment decision. A long-term average site resource was synthesised from site monitoring conducted from December 2014 to November 2015 and compared with SolarGIS[1] satellite data including short- and long-term averages. The sum of the measured values were found to be 2.6% less than the SolarGIS data for the same period. This variance was attributed to localised factors on the island and is well within the uncertainty associated with satellite measurements.

An hourly, long-term average irradiance dataset totalling 1,648.7 kWh/m^2 in a year was used to size the solar array and battery capacity to achieve the targeted reduction in diesel consumption. As discussed in section 2.2, the measured global horizontal irradiance onsite for the period of April 2021 to March 2022 was 1,629 kWh/m^2, i.e. 1.2% less than the synthesised long-term average irradiance used to predict project performance. Given the variability of solar irradiation from year to year, this is considered to be a good correlation. A month-by-month comparison is provided in Figure 3-1.

[1] The SolarGIS database is a high resolution database recognised as one of the most reliable and accurate source of solar resource information. The database resides on about 100 terabytes of data and it is updated on a daily basis. The data is calculated using in-house developed algorithms that process satellite imagery and atmospheric and geographical inputs (http://solargis.info/).

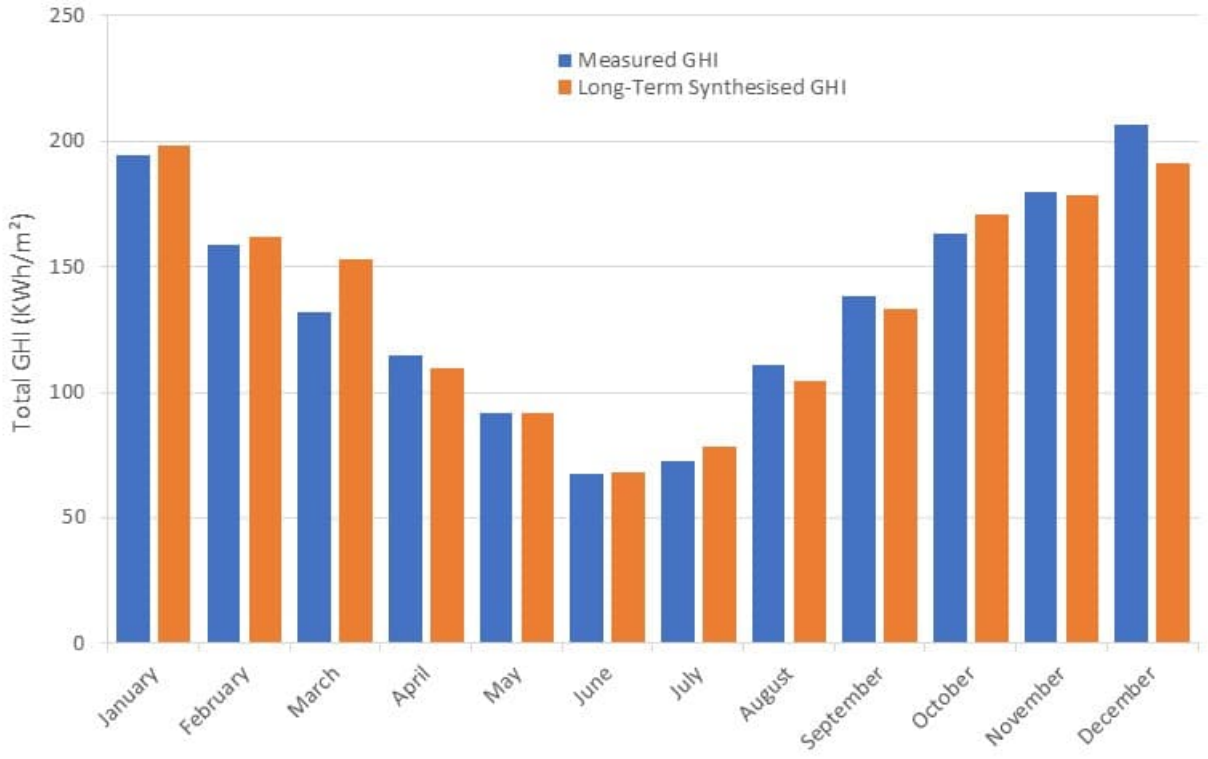

Figure 3-1 Comparison of synthesised and measured GHI (kWh/m^2)

4. Conclusion

The total GHI measured in the first year of operation was 1,629 kWh/m^2. The total POA measured in the first year of operation was 1,800 kWh/m^2.

In 2016 prior to an investment decision, a long-term annual average irradiance dataset was used to size the solar array and battery capacity to achieve the targeted reduction in diesel consumption. The sum of this GHI dataset was 1,648.7 kWh/m^2.

The strong correlation between the data used to make an investment decision and the measured irradiance during the first 12 months of operation indicates that the project target of a 67% reduction in diesel consumption is attainable. The performance of the power plant is discussed in detail in a separate report.