



INTEGRATED AERIAL SYSTEMS

Solar Power Plant DEMO Aerial PV Inspection Report

February 6,
2020



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Site Summary



Site Name	Demo Solar Power Plant
Location	-XX.XXXXXX XX.XXXXXX
Address	Demo Solar Power Plant
Inspected On	Wed, January 1 , 2020
Time of Day	8:00 PM

Results have been quality checked and reviewed for accuracy. Raptor Maps software analysis checks for all of the following anomalies: Cell, Cell Multi, Combiner, Cracking, Delamination, Diode, Diode Multi, Hot Spot, Hot Spot Multi, Inverter, Junction Box, Module, Missing Modules, Shadowing, String, Tracker, Reverse Polarity, Vegetation, and Suspected PID. The appendix located at the end of the report includes further descriptions of the found anomalies. All RGB (color) and IR (thermal) imagery has been cross- checked to tag the source of the anomaly.

Site Report

Site Overview

Company

NAME

PHONE

CONTACT

EMAIL

Site

POWER

45.999MW_{dc}

INVERTERS

Santerno Sunway
TG1800 1500V TE660
1750kW

MODULE NAME

Canadian Solar CS6U-
325P / 330P 4599.6W

MOUNT

55 degree North-South

MODULE TECH

Unknown

MODULE LAYOUT

30 modules per
string

Data Capture

UAS

DJI Matrice 210

IMAGING SYSTEM

Zenmuse XT2

Weather

HUMIDITY

22%

TEMPERATURE

29.19° C

CLOUD COVER

Clear

WIND SPEED

10.08 km/
h

Site Report

Findings

Anomaly	Anomalies ^{*(1)}	Modules ^{*(2)}	Est. Affected DC ^{*(3)}	Est. Affected DC ^{*(4)}	Est. Annual Impact (kWh) ^{*(5)}	Est. Annual Impact (\$) ^{*(6)}
Cell	3	3	4.60 kW	0.01%	6898.71 kWh	\$413.92
Cell Multi	1	1	2.30 kW	0.00%	3449.70 kWh	\$206.98
Combiner	1	450	2069.82 kW	4.50%	3104730.00 kWh	\$186 283.80
Diode	32	32	49.06 kW	0.11%	73586.24 kWh	\$4 415.17
Diode Multi	1	1	3.07 kW	0.01%	4599.62 kWh	\$275.98
Module	5	5	23.00 kW	0.05%	34497.00 kWh	\$2 069.82
Reverse Polarity	1	30	137.99 kW	0.30%	206982.00 kWh	\$12 418.92
String	26	780	3587.69 kW	7.80%	5381532.00 kWh	\$322 891.92
Totals	70	1302	5877.52 kW	12.78%	8816275.27 kWh	\$528 976.52

Findings

*(1) Anomalies: The number of instances of a specific anomaly.

*(2) Modules: The number of modules affected by a specific anomaly.

*(3) Est. Affected DC (kW): The estimated affected power is determined by multiplying the number of modules affected, the peak power of the solar module at STC, and a power factor ranging from 0 to 1 specific to the anomaly.

*(4) Est. Affected DC (%): The estimated affected power of the anomaly is divided by the total site's power and represented as a percent.

*(5) Est. Annual Impact (kWh): The estimated annual impact in kilowatt-hours is the estimated affected power multiplied by the site's peak sunlight hours. The peak sunlight hours can be changed by selecting the "\$ PPA Values" button in the left navigation menu.

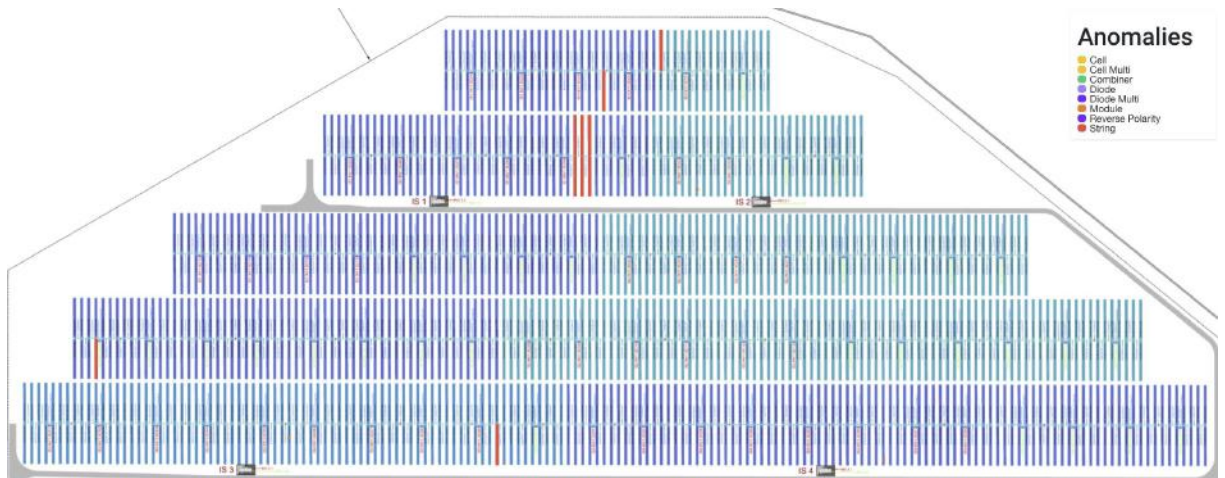
*(6) Est. Annual Impact (\$): The estimated annual impact in money is the estimated annual impact in kilowatt-hours multiplied by the money per kilowatt-hour i.e. power purchase agreement (PPA) rate. The PPA rate can be changed by selecting the "\$ PPA Values" button in the left navigation menu.

For more information on each class of anomaly please continue to the appendix to learn more.

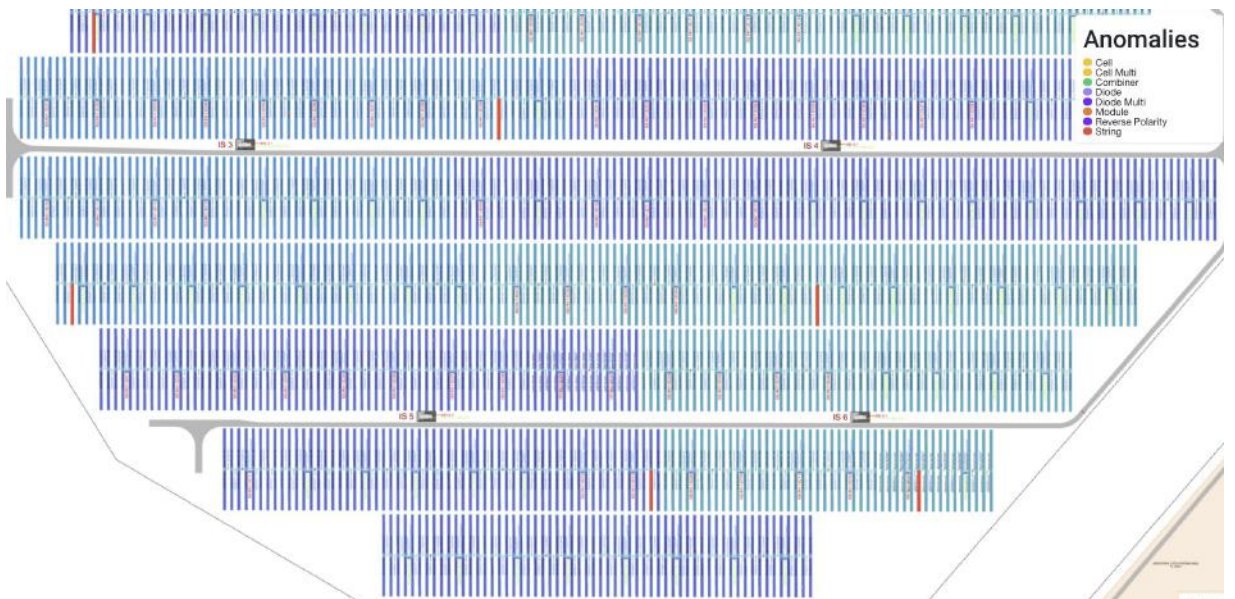
Site Report

Anomaly Map

Block A - North



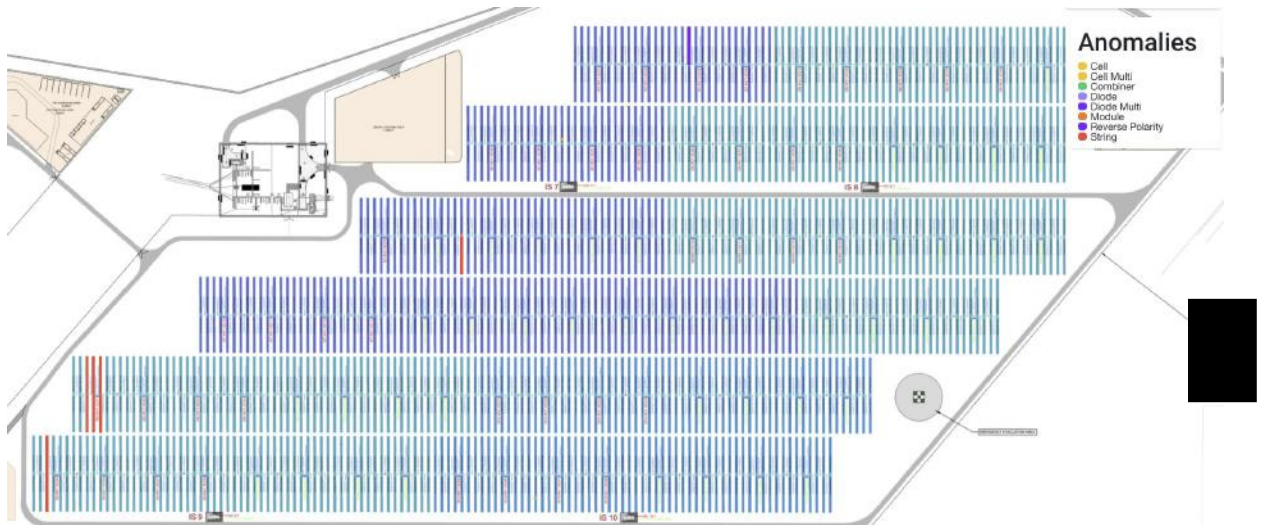
Block A - South



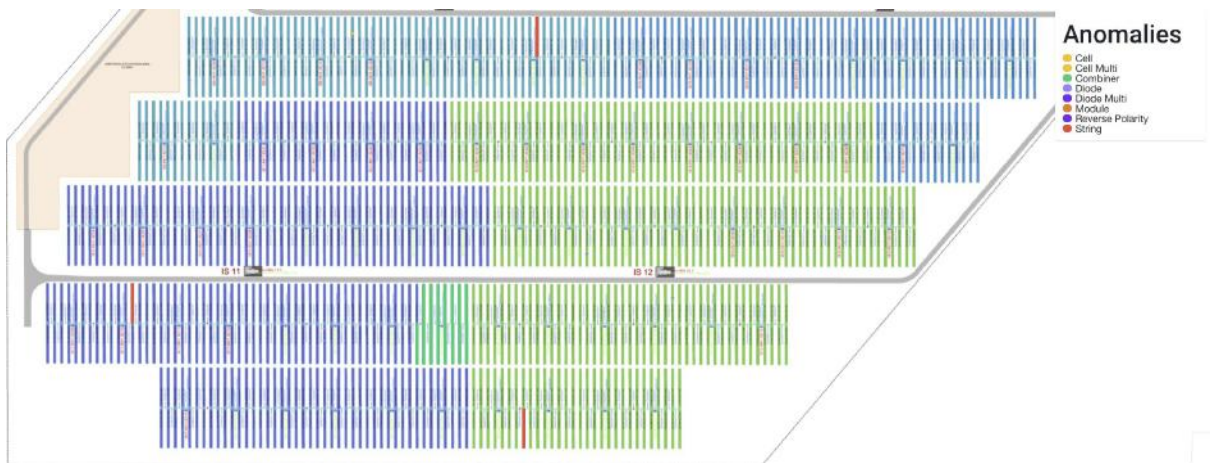
Site Report

Anomaly Map

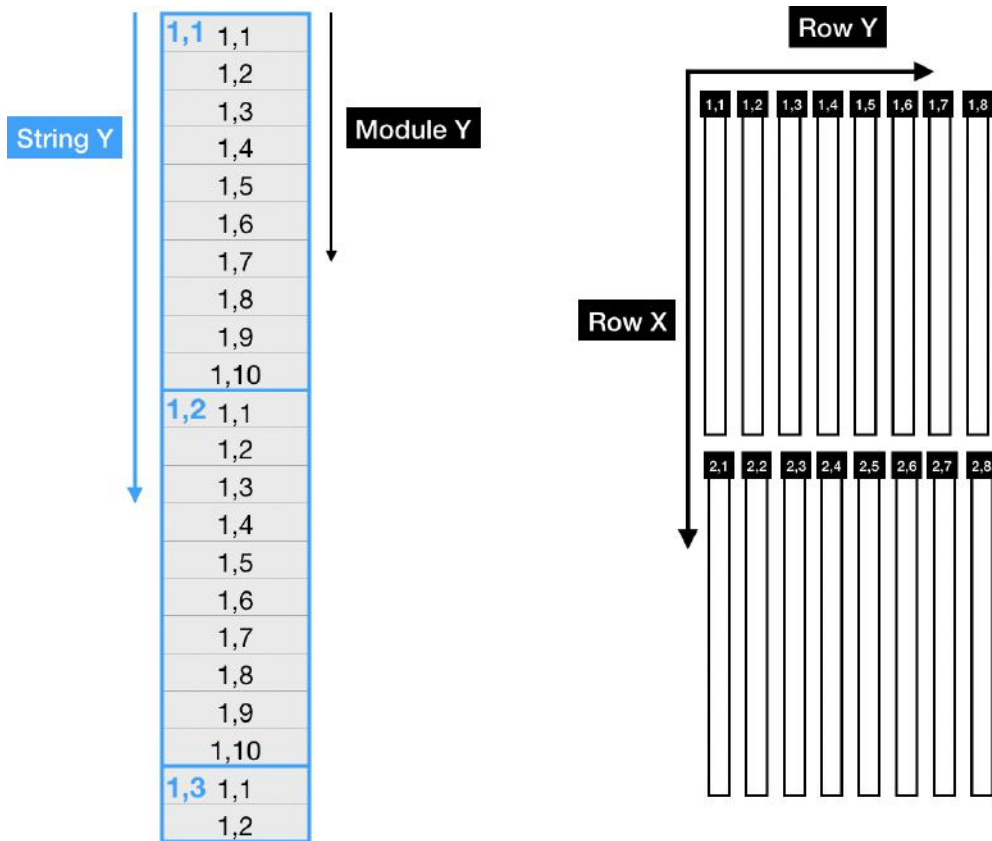
Block B - North



Block B - South

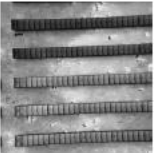

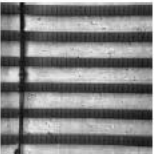
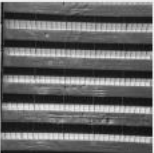

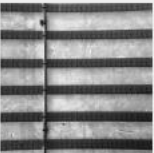
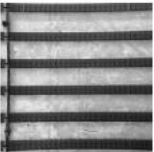


Localizing Anomalies




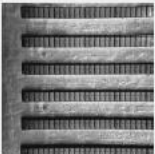
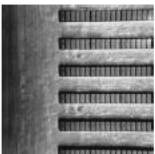
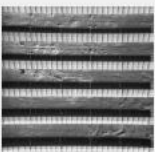
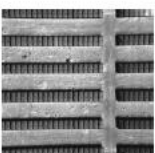
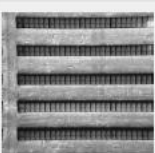
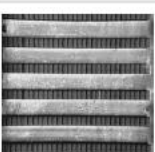
Site Report

Anomaly Location

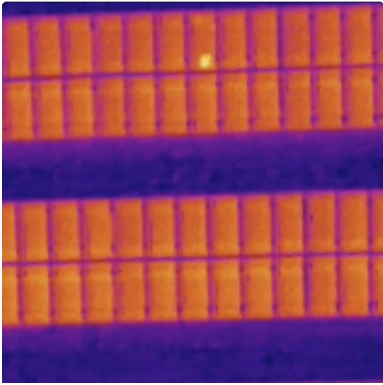
	Filename	Tag Name	Row X	Row Y	Module X	Module Y	Priority	Delta T
	DJI_0402_R.JPG	String	62	3			High	
	DJI_0503_R.JPG	Diode	58	15	1	8	Medium	4.0
	DJI_0459_R.JPG	Diode	55	20	1	21	Medium	5.5
	DJI_0339_R.JPG	Diode	51	13	1	29	Medium	10.5
	DJI_0357_R.JPG	Diode	50	15	1	21	Medium	9.2
	DJI_0176_R.JPG	Diode	47	14	1	3	Medium	5.1
	DJI_0178_R.JPG	Diode	47	14	1	24	Medium	2.5

Site Report

Anomaly Location

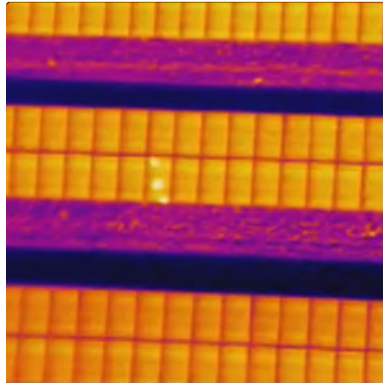
	Filename	Tag Name	Row X	Row Y	Module Y	Priority	Delta T
	DJI_0741_R.JPG	Diode	255	14	19	Medium	3.6
	DJI_0705_R.JPG	Cell Low	253	18	19	Low	6.5
	DJI_0703_R.JPG	Diode	253	18	19	Medium	6.5
	DJI_0406_R.JPG	Diode	25	15	16	Medium	9.7
	DJI_0162_R.JPG	Diode	244	15	10	Medium	6.1
	DJI_0272_R.JPG	String	242	12		High	
	DJI_0474_R.JPG	Diode	237	25	11	Medium	7.6

Example of Anomalies



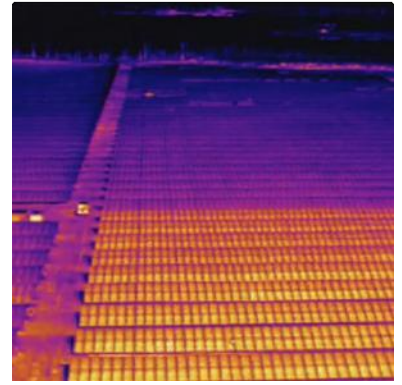
Cell

Hot spot occurring with square geometry in single cell



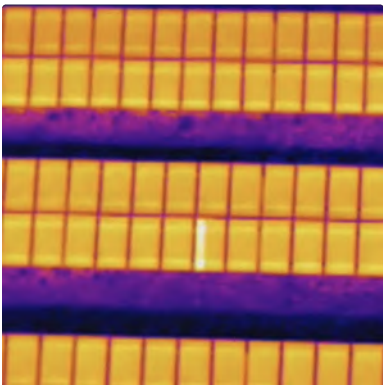
Cell Multi

Hot spots occurring with square geometry in multiple cells



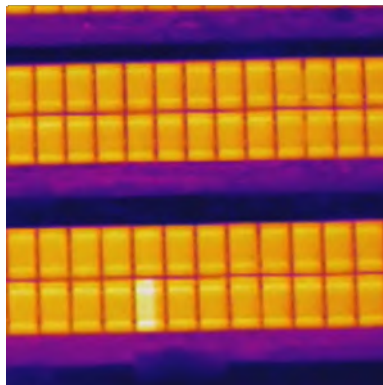
Combiner

A combiner combines many strings into a larger flow of DC (direct current). A combiner anomaly shows fault in contiguous strings matching the inverter layout.



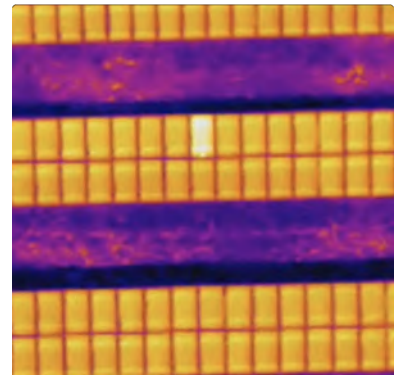
Diode

A bypass diode provides a current path around a faulty cell or module. A diode anomaly indicates as activated bypass diode, typically 1/3 of module.



Diode Multi

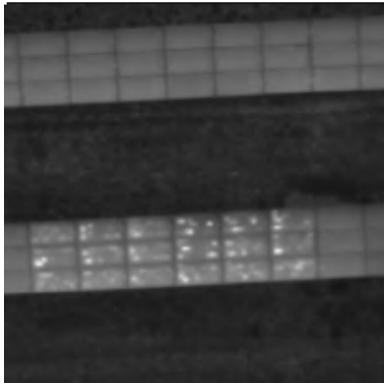
Multiple activated bypass diodes, typically affecting 1/2 of module



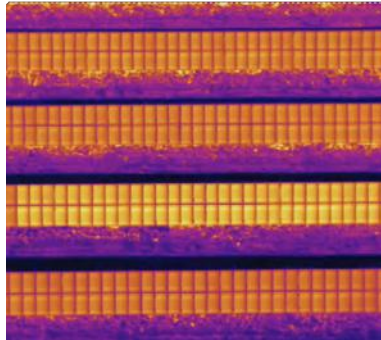
Module

Entire module is heated

Example of Anomalies



Reverse Polarity
Module anomaly due to incorrect wiring



String
A string consists of an individual set of modules connected in series. A string anomaly shows fault in contiguous modules matching the string layout.