“NREL SAM – SUNDAT” INTEGRATION
AN OVERVIEW

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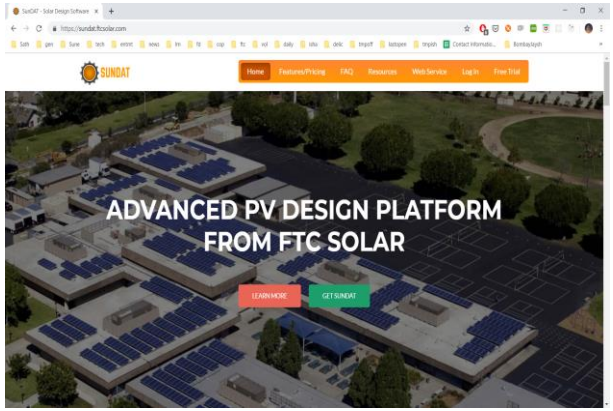
FTCSOLAR

BRIEF ON SUNDAT

- **Plugin for Sketchup 3D environment for automated and optimized solar design**
- **Allows user to design residential, commercial and utility scale sites based on industry design standards – NO SIZE LIMITS**
- **Automates a major portion of**
  - Shadow simulation
  - Terrain Analysis
  - Module layout with parametric options using Cloud
  - Structural layout
  - Electrical Design
  - Yearly Shade for trackers on Terrain using cloud service
  - Energy modeling with NREL SAM



Yearly Shade % for R_1

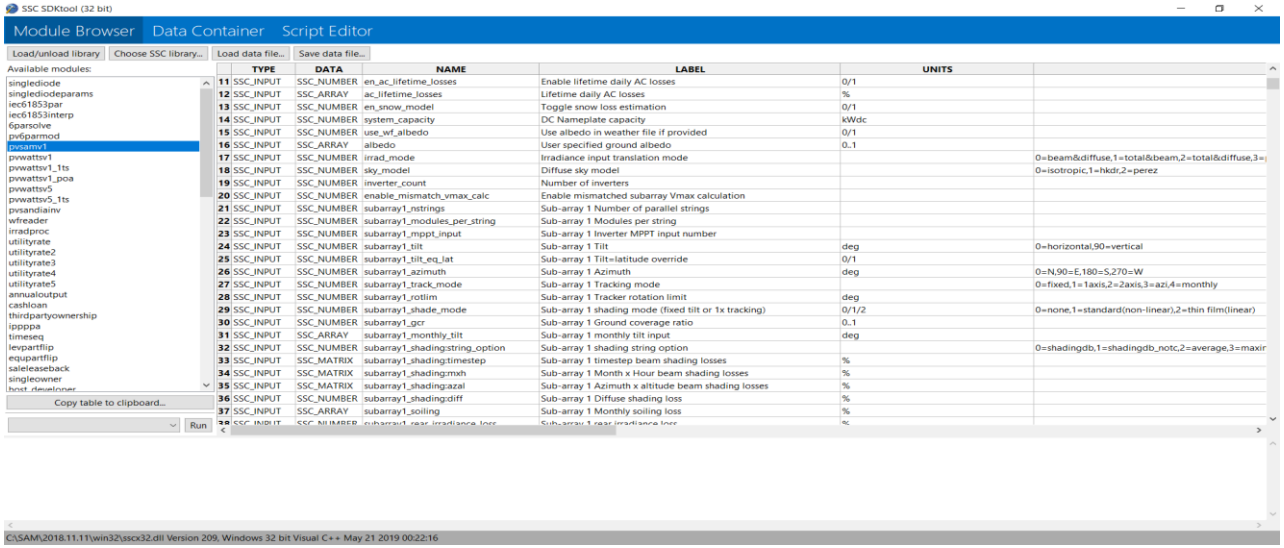
Month	0:00	1:00	2:00	3:00	4:00	5:00	6:00	7:00	8:00	9:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00	21:00	22:00	23:00
Jan	100	100	100	100	100	100	100	100	19.09	35.6	0	0	0	0	0	0.35	64.4	61.94	100	100	100	100	100	100
Feb	100	100	100	100	100	100	100	11.59	1.17	12.06	0	0	0	0	0	0.35	52.46	60.54	100	100	100	100	100	100
Mar	100	100	100	100	100	100	100	22.01	1.05	0	0	0	0	0	0	0.23	1.05	57.61	57.73	100	100	100	100	100
Apr	100	100	100	100	100	100	22.6	27.05	0	0	0	0	0	0	0	0	0.35	54.8	0.94	100	100	100	100	100
May	100	100	100	100	100	100	22.95	27.52	0	0	0	0	0	0	0	0	0.35	1.41	1.52	20.26	100	100	100	100
Jun	100	100	100	100	100	100	22.95	28.57	0	0	0	0	0	0	0	0	0.35	0.94	1.76	7.61	100	100	100	100
Jul	100	100	100	100	100	100	23.19	27.63	0	0	0	0	0	0	0	0	0.35	1.05	1.76	11.48	100	100	100	100
Aug	100	100	100	100	100	100	23.3	27.87	0.82	0	0	0	0	0	0	0	0.35	55.74	1.17	100	100	100	100	100
Sep	100	100	100	100	100	100	100	0.7	1.05	0	0	0	0	0	0	0.35	23.42	59.25	47.31	100	100	100	100	100
Oct	100	100	100	100	100	100	100	1.17	1.17	0	0	0	0	0	0	0.7	61.83	61.71	100	100	100	100	100	100
Nov	100	100	100	100	100	100	100	100	35.48	9.84	0	0	0	0	0.23	29.39	60.54	100	100	100	100	100	100	100
Dec	100	100	100	100	100	100	100	100	35.48	36.53	0	0	0	0	0.12	18.62	66.16	100	100	100	100	100	100	100

WHY NREL SAM?

- ✓ SDK Support
- ✓ Simple to pack with SunDAT – Just 3 dlls
- ✓ Vast Module and Inverter Libraries – Ability to create custom components
- ✓ Support for Trackers and Fixed Tilt Tables
- ✓ Shade Import Facility
- ✓ Weather file library
- ✓ Support for weather file formats import
- ✓ Fast computation of production and yield
- ✓ Computation with numbers rather than whole site

CHALLENGES

- **Challenges:**
  - Ruby SDK support was not there – we used python base to develop Ruby SDK
    NrelSam.rb
  - Large number of variables(250), modules and inverters mapping.
  - User acceptance on taking SAM simulation values as final when compared to Pvsyst

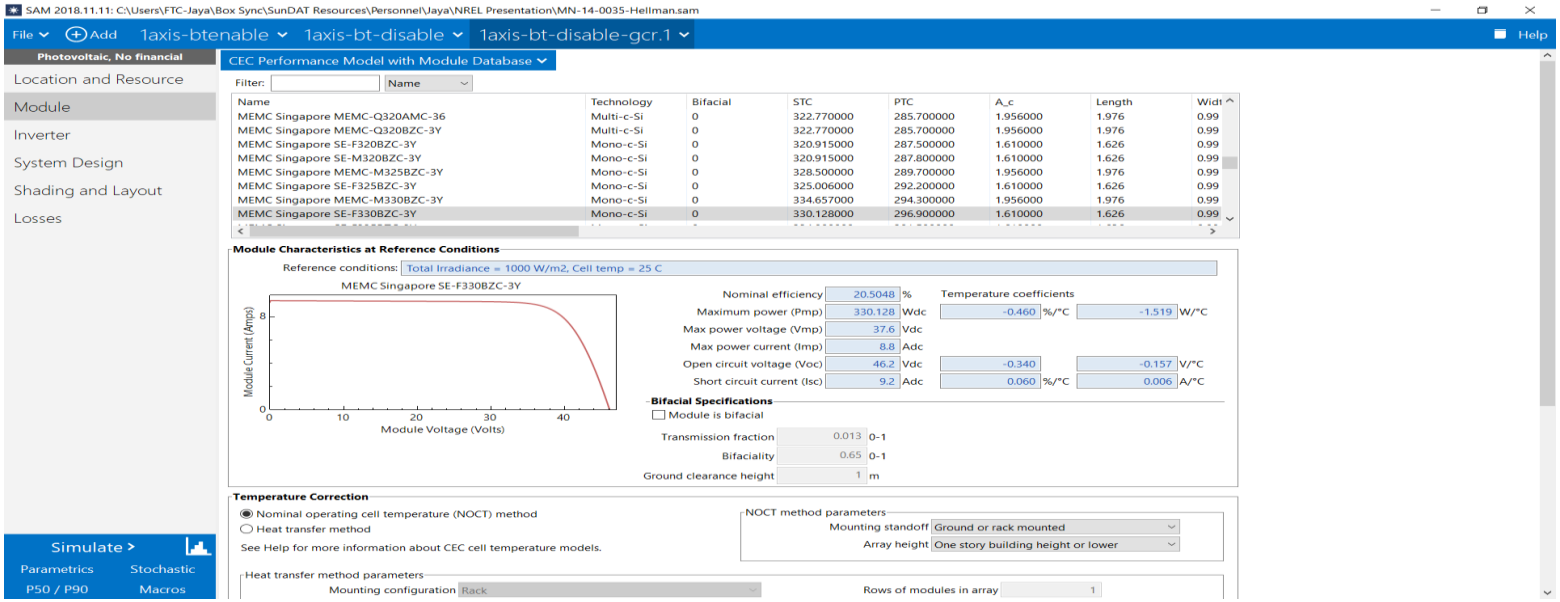


IMPLEMENTATION

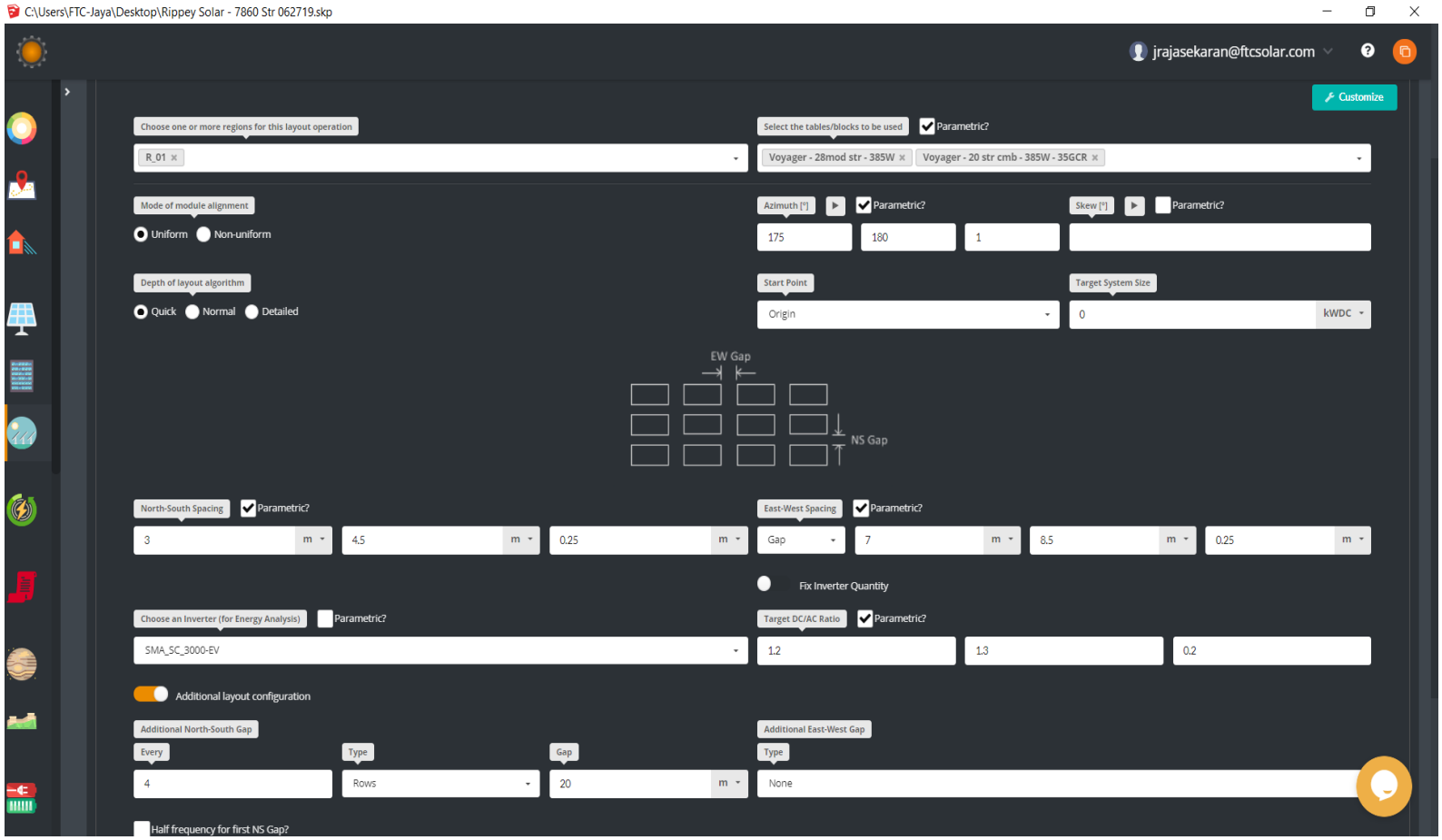
- **Implementation:**
  - Picked ‘pvsam1’ – Photovoltaic (Detailed) with No Financial Model module for automation
  - Used SSC SDK Tool for mapping variables to SunDAT variables 

  - Created a sample sdk script for simulating SunDAT Values by following 

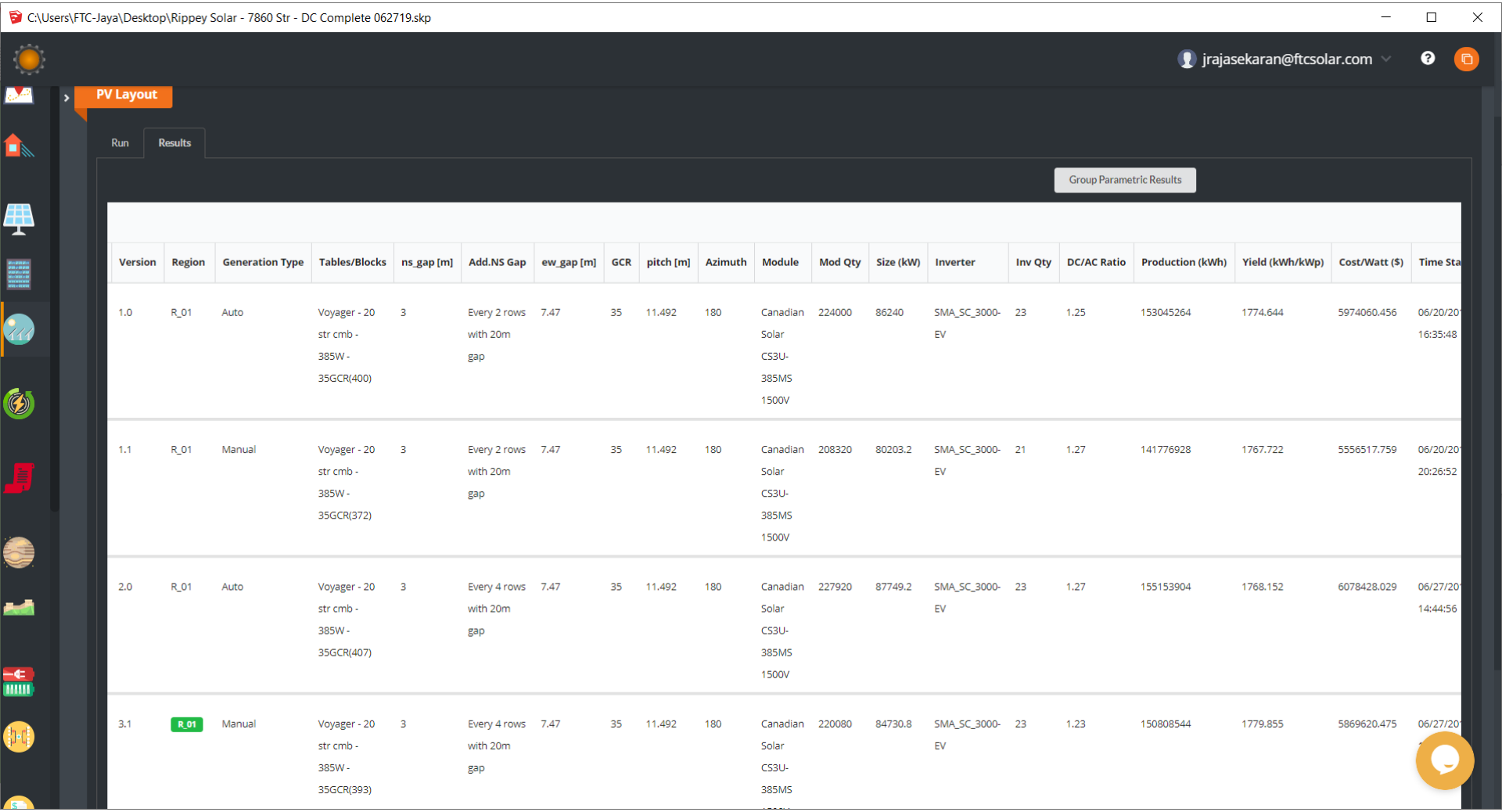
  - Converted this implementation to Ruby for SunDAT Simulation



LAYOUT RUNS WITH PARAMETRIC INPUT

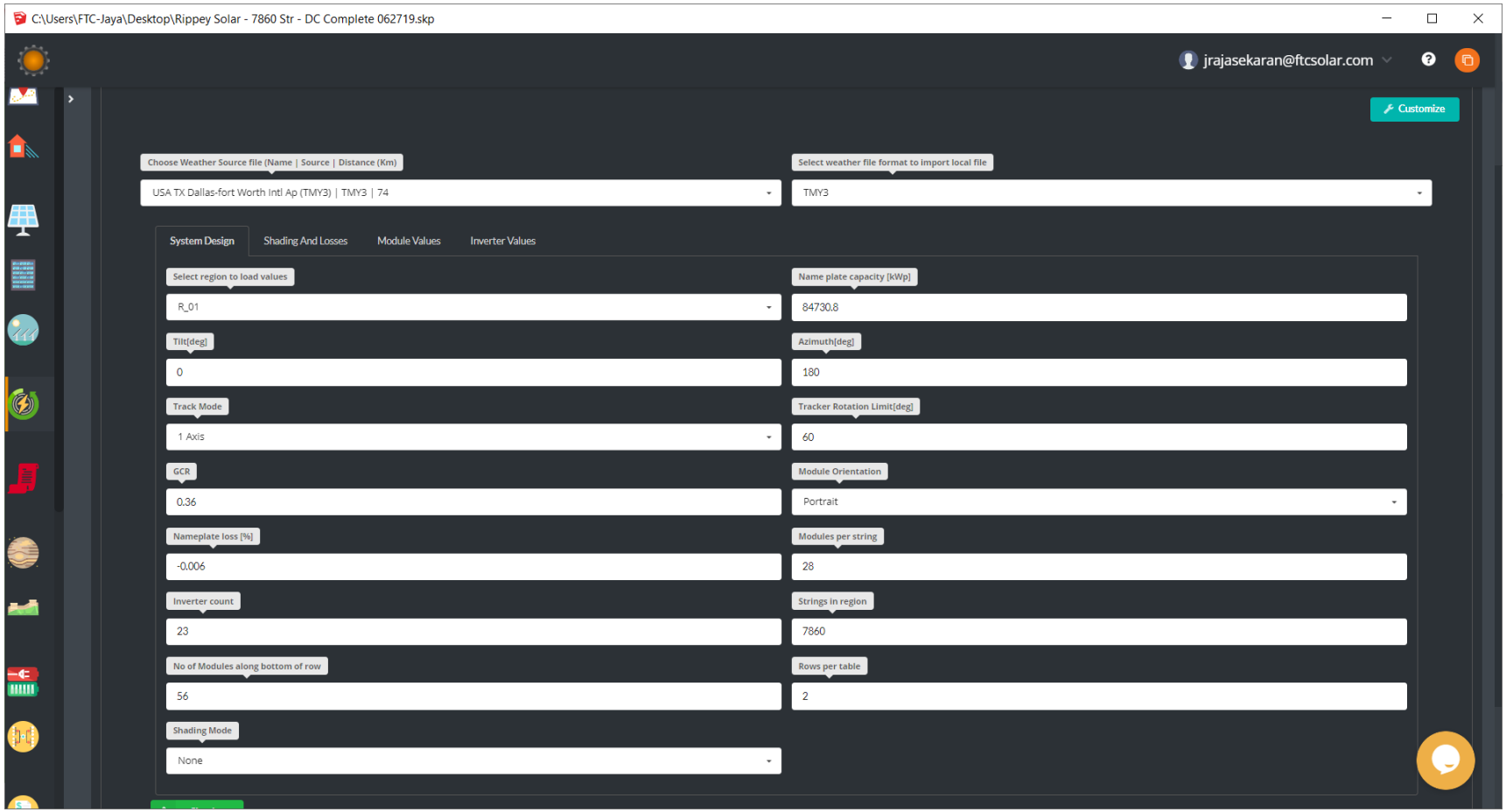


ENERGY VALUES FOR EACH LAYOUT

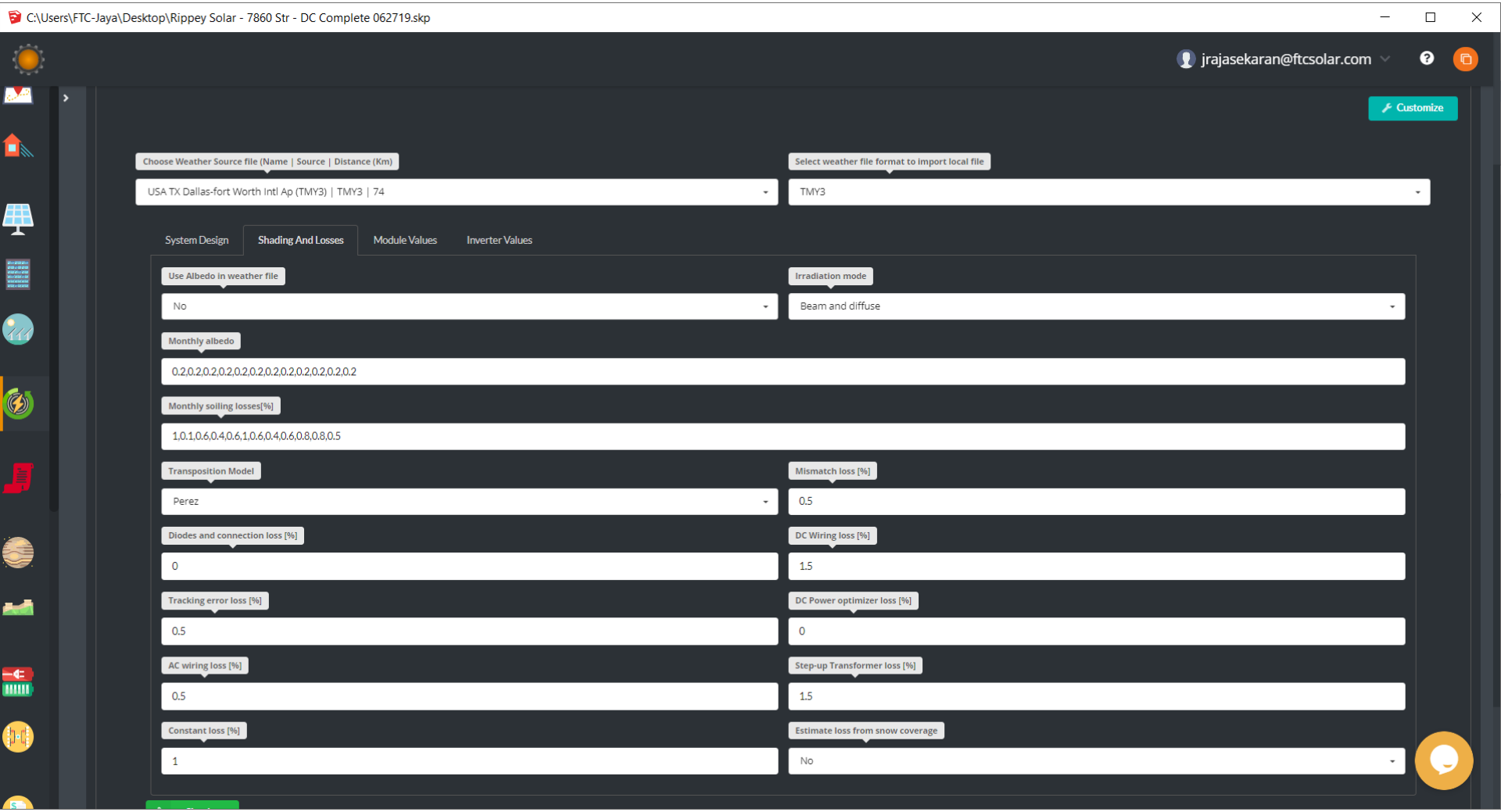


Version	Region	Generation Type	Tables/Blocks	ns_gap [m]	Add.NS Gap	ew_gap [m]	GCR	pitch [m]	Azimuth	Module	Mod Qty	Size (kW)	Inverter	Inv Qty	DC/AC Ratio	Production (kWh)	Yield (kWh/kWp)	Cost/Watt ($)	Time Sta
1.0	R_01	Auto	Voyager - 20 str cmb - 385W - 35GCR(400)	3	Every 2 rows with 20m gap	7.47	35	11.492	180	Canadian Solar CS3U-385MS 1500V	224000	86240	SMA_SC_3000-EV	23	1.25	153045264	1774.644	5974060.456	06/20/20 16:35:48
1.1	R_01	Manual	Voyager - 20 str cmb - 385W - 35GCR(372)	3	Every 2 rows with 20m gap	7.47	35	11.492	180	Canadian Solar CS3U-385MS 1500V	208320	80203.2	SMA_SC_3000-EV	21	1.27	141776928	1767.722	5556517.759	06/20/20 20:26:52
2.0	R_01	Auto	Voyager - 20 str cmb - 385W - 35GCR(407)	3	Every 4 rows with 20m gap	7.47	35	11.492	180	Canadian Solar CS3U-385MS 1500V	227920	87749.2	SMA_SC_3000-EV	23	1.27	155153904	1768.152	6078428.029	06/27/20 14:44:56
3.1	R_01	Manual	Voyager - 20 str cmb - 385W - 35GCR(393)	3	Every 4 rows with 20m gap	7.47	35	11.492	180	Canadian Solar CS3U-385MS	220080	84730.8	SMA_SC_3000-EV	23	1.23	150808544	1779.855	5869620.475	06/27/20

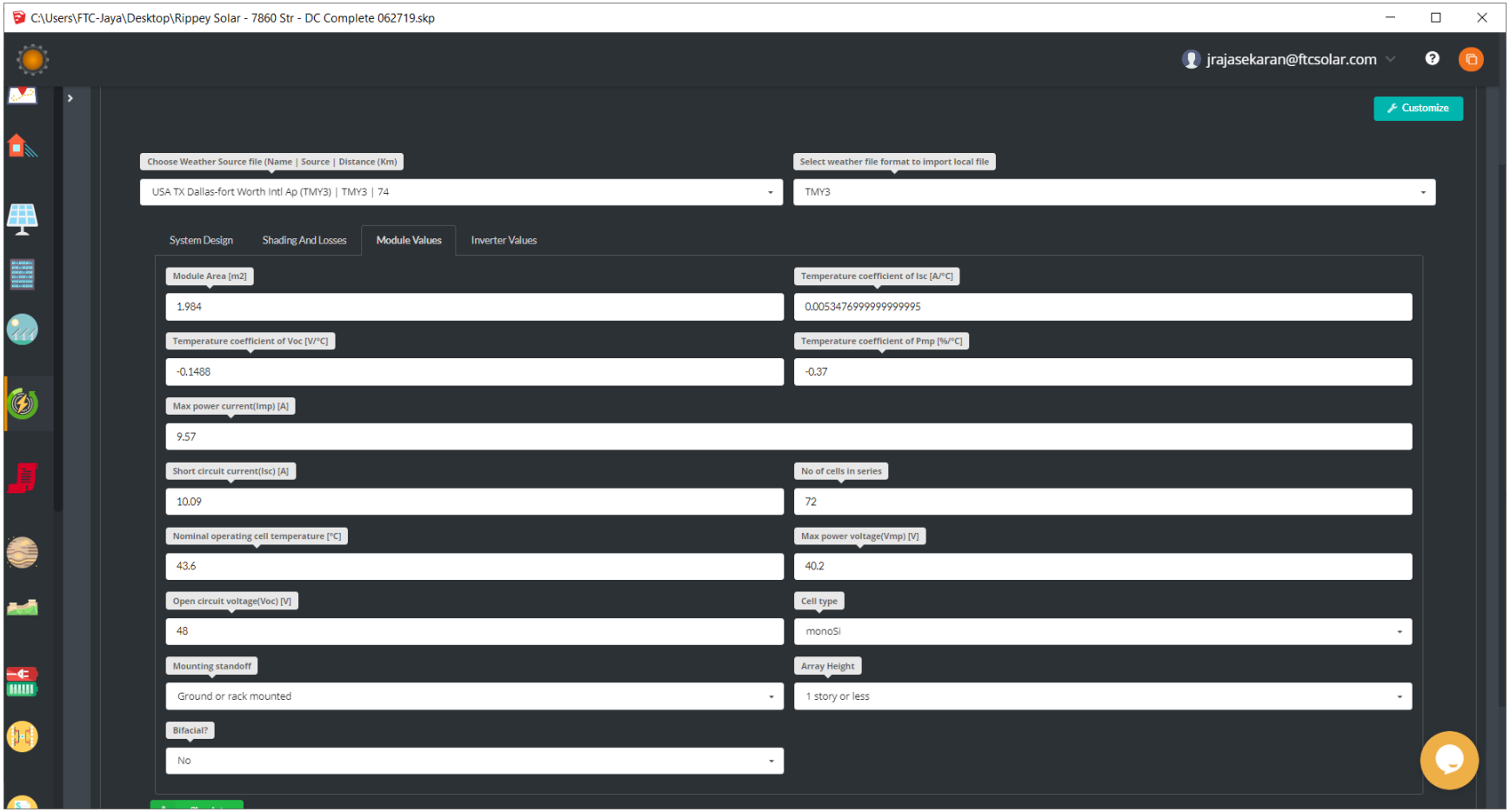
CUSTOMIZABLE INPUTS 1 – SYSTEM DESIGN



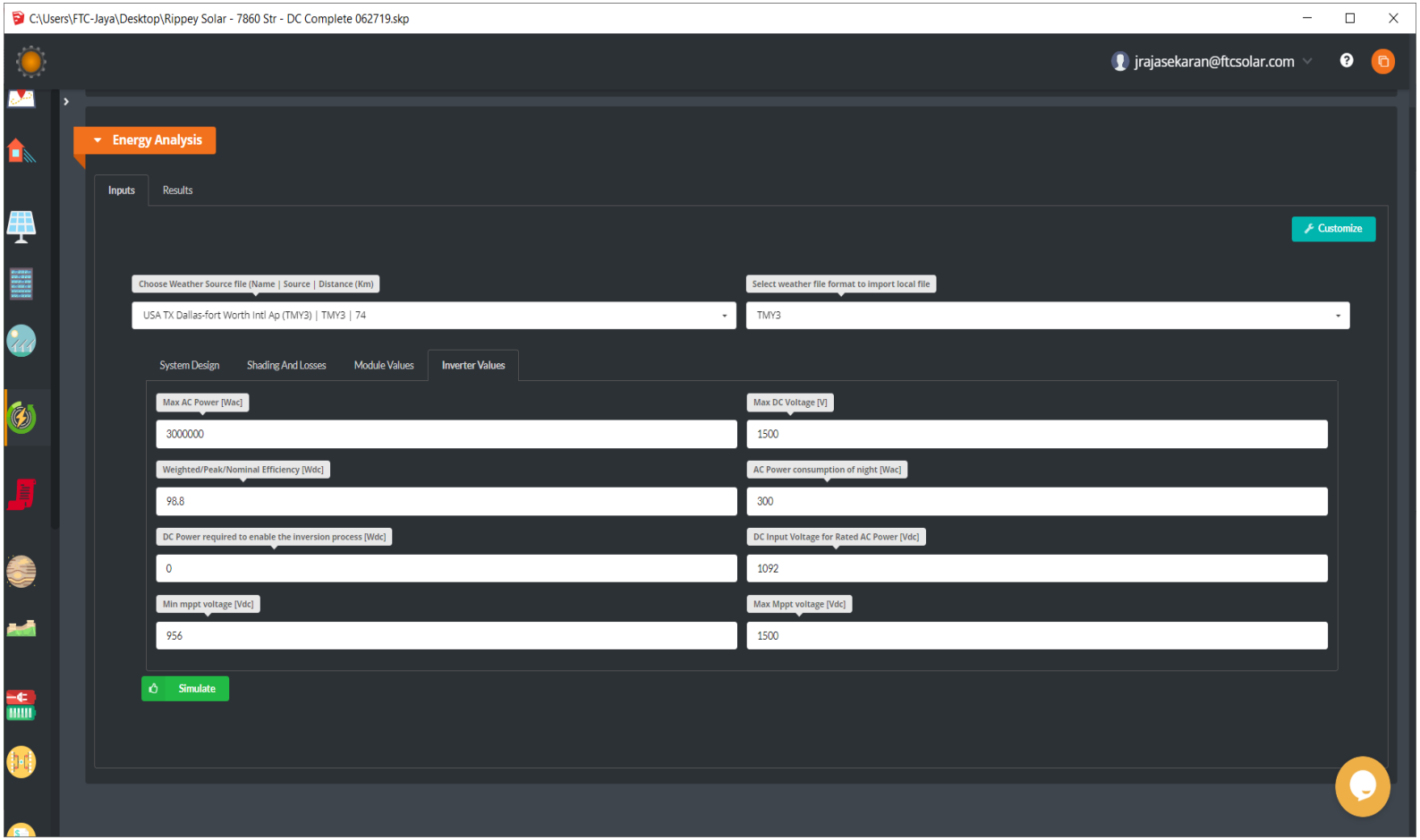
CUSTOMIZABLE INPUTS 2 – SHADING AND LOSSES



CUSTOMIZABLE INPUTS 3 - MODULE VALUES



CUSTOMIZABLE INPUTS 4 – INVERTER VALUES



REPORTS

SunDAT Production Report

Powered by NREL SAM

Site Details

Name	Rippey
Latitude	33.552701
Longitude	-97.176923
Timezone	-6
Solar North	0
Adjustment	0.478
Location	
Address	965 W Spring Creek Rd, Gainesville, TX 76240, USA
Client	Sterling & Wilson
Country	
Azimuth	180
Tilt	0

Simulation parameters

Module

Name	Canadian Solar CS3U-385MS
Manufacturer	Canadian Solar
Nominal power	385 W

Sub array

In series	
In parallel	8000
Number of modules	224000
Total Power	86240

Inverter

Simulation results:

Region Name	R_01
Performance Ratio	0.825%
Capacity Factor	20.258%
Yield	1774.644 kWh/kW
Production	153045264 kWh

Monthly Energy Data:

Month	GHI(kWh/m2)	POA(kWh/m2)	Shaded(kWh/m2)	NamePlate(kW)	Grid(kW)
January	71867	91798	91798	7549451	6772559
February	104255	142247	142247	11801171	10877811
March	134049	173801	173801	14019371	12713738
April	136517	169171	169171	13379958	11866544
May	205236	260492	260492	19734266	18122952
June	165312	204524	204524	15188120	14067438
July	210707	271225	271225	20365885	18770282
August	178391	235437	235437	17529888	16232504
September	137911	174763	174763	13330865	12320579
October	120027	158797	158797	12357664	11381743
November	105409	146826	146826	11674378	10749983
December	88066	123124	123124	10043297	9169133

Export 8760 values

Select All	☐
Global Horizontal Irradiance	☑
Beam irradiance	☑
Diffuse Irradiance	☑
Wind Speed	☐
Ambient Temperature	☑
Solar Zenith Angle	☐
Solar Altitude Angle	☐
Solar Azimuth Angle	☐
Sun Up Over Horizon	☐
Absolute Air Mass	☐
Albedo	☐
Subarray 1 Angle of incidence	☑
Subarray 1 Surface tilt	☑
Subarray 1 Surface azimuth	☐
Subarray 1 Axis rotation for 1 axis trackers	☐
Subarray 1 Ideal axis rotation for 1 axis trackers	☐
Subarray 1 POA total irradiance (nominal)	☐
Subarray 1 POA total irradiance after shading only	☐
Subarray 1 POA total irradiance after shading and soiling	☐
Subarray 1 POA beam irradiance after shading and soiling	☐
Subarray 1 POA diffuse irradiance after shading and soiling	☐
Subarray 1 Beam irradiance shading factor	☐

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QUESTIONS ?