



MARFORRES IGI&S

Solar Site Assessments and 3D Data for Asset Management



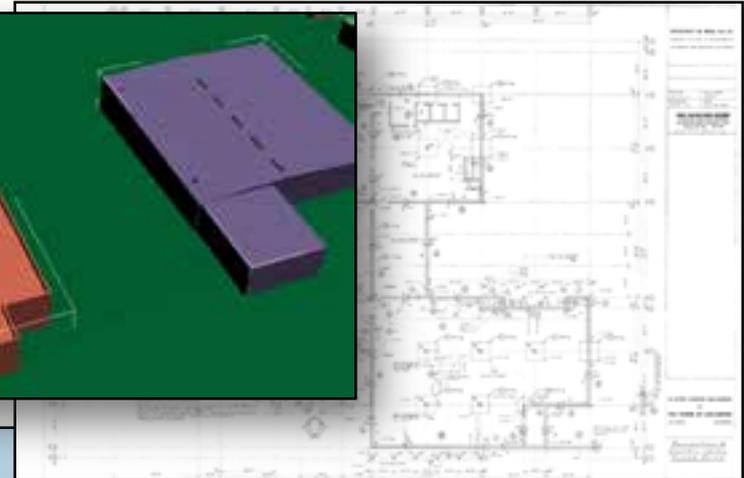
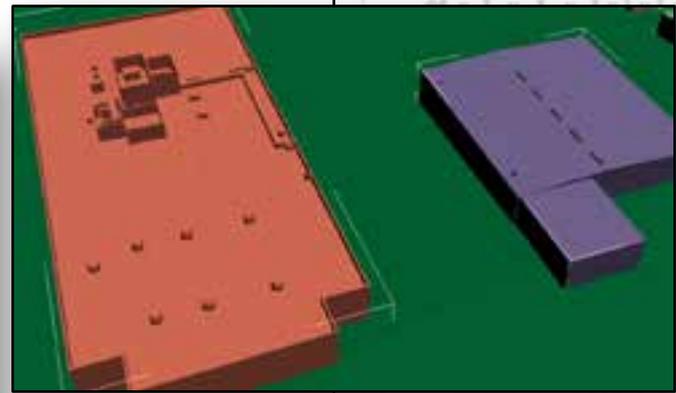
Legend
Annual Daily Average: Solar Duration
High: 12 Hours
Low: 8 Hours

Building No.	Area (sq ft)	Area (sq m)	Roof Area (sq ft)	Roof Area (sq m)	Roof Slope (Degrees)	Roof Orientation	Roof Type	Roof Material	Roof Color	Roof Condition	Roof Age (Years)	Roof Status
1	10,000	929	10,000	929	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
2	15,000	1394	15,000	1394	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
3	20,000	1858	20,000	1858	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
4	25,000	2323	25,000	2323	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
5	30,000	2787	30,000	2787	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
6	35,000	3252	35,000	3252	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
7	40,000	3716	40,000	3716	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
8	45,000	4181	45,000	4181	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
9	50,000	4645	50,000	4645	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
10	55,000	5110	55,000	5110	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
11	60,000	5574	60,000	5574	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
12	65,000	6039	65,000	6039	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
13	70,000	6503	70,000	6503	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
14	75,000	6968	75,000	6968	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
15	80,000	7432	80,000	7432	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
16	85,000	7897	85,000	7897	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
17	90,000	8361	90,000	8361	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
18	95,000	8826	95,000	8826	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
19	100,000	9290	100,000	9290	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
20	105,000	9755	105,000	9755	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
21	110,000	10219	110,000	10219	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
22	115,000	10684	115,000	10684	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
23	120,000	11148	120,000	11148	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
24	125,000	11613	125,000	11613	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
25	130,000	12077	130,000	12077	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
26	135,000	12542	135,000	12542	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
27	140,000	13006	140,000	13006	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
28	145,000	13471	145,000	13471	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
29	150,000	13935	150,000	13935	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
30	155,000	14400	155,000	14400	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
31	160,000	14864	160,000	14864	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
32	165,000	15329	165,000	15329	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
33	170,000	15793	170,000	15793	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
34	175,000	16258	175,000	16258	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
35	180,000	16722	180,000	16722	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
36	185,000	17187	185,000	17187	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
37	190,000	17651	190,000	17651	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
38	195,000	18116	195,000	18116	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
39	200,000	18580	200,000	18580	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
40	205,000	19045	205,000	19045	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
41	210,000	19509	210,000	19509	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
42	215,000	19974	215,000	19974	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
43	220,000	20438	220,000	20438	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
44	225,000	20903	225,000	20903	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
45	230,000	21367	230,000	21367	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
46	235,000	21832	235,000	21832	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
47	240,000	22296	240,000	22296	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
48	245,000	22761	245,000	22761	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
49	250,000	23225	250,000	23225	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
50	255,000	23690	255,000	23690	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
51	260,000	24154	260,000	24154	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
52	265,000	24619	265,000	24619	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
53	270,000	25083	270,000	25083	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
54	275,000	25548	275,000	25548	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
55	280,000	26012	280,000	26012	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
56	285,000	26477	285,000	26477	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
57	290,000	26941	290,000	26941	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
58	295,000	27406	295,000	27406	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
59	300,000	27870	300,000	27870	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
60	305,000	28335	305,000	28335	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
61	310,000	28799	310,000	28799	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
62	315,000	29264	315,000	29264	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
63	320,000	29728	320,000	29728	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
64	325,000	30193	325,000	30193	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
65	330,000	30657	330,000	30657	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
66	335,000	31122	335,000	31122	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
67	340,000	31586	340,000	31586	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
68	345,000	32051	345,000	32051	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
69	350,000	32515	350,000	32515	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
70	355,000	32980	355,000	32980	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
71	360,000	33444	360,000	33444	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
72	365,000	33909	365,000	33909	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
73	370,000	34373	370,000	34373	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
74	375,000	34838	375,000	34838	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
75	380,000	35302	380,000	35302	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
76	385,000	35767	385,000	35767	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
77	390,000	36231	390,000	36231	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
78	395,000	36696	395,000	36696	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
79	400,000	37160	400,000	37160	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
80	405,000	37625	405,000	37625	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
81	410,000	38089	410,000	38089	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
82	415,000	38554	415,000	38554	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
83	420,000	39018	420,000	39018	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
84	425,000	39483	425,000	39483	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
85	430,000	39947	430,000	39947	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
86	435,000	40412	435,000	40412	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
87	440,000	40876	440,000	40876	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
88	445,000	41341	445,000	41341	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
89	450,000	41805	450,000	41805	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
90	455,000	42270	455,000	42270	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
91	460,000	42734	460,000	42734	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
92	465,000	43199	465,000	43199	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
93	470,000	43663	470,000	43663	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
94	475,000	44128	475,000	44128	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
95	480,000	44592	480,000	44592	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
96	485,000	45057	485,000	45057	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
97	490,000	45521	490,000	45521	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
98	495,000	45986	495,000	45986	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
99	500,000	46450	500,000	46450	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	
100	505,000	46915	505,000	46915	10	South	Asphalt/Flt	Dark Grey	Good	15	Available	

Notes:
 1. Roof facing not shown (North is up).
 2. PV Module Installation: 300W/1700mm x 1050mm.
 3. PV Panel Area: 17.0 sq ft. 70% of the PV Panel Area is used.
 4. PV Panel Area is used for PV Module Installation.
 5. PV Panel Area is used for PV Module Installation.

Scale: 0 25.5 50 100 Feet

Roof Solar Potential
MARFORRES
Jacksonville, FL
Solar Site Assessment
CRITIGEN





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Solar Site Assessments and 3D Data for Asset Management

MARFORRES Energy Program Facilities, Marine Forces Reserve

Energy Mandates

- Energy Policy Act of 2005
- Energy Independence & Security Act of 2007
- Defense Authorization Act 2007



The Challenge – How to Meet Energy Goals?

- Congressional and DoD mandates require:
 - Smart meters in all federal buildings by October 2012
 - Reduce building energy use by 30% (relative to a 2003 baseline) and 3% per year by 2015
 - 25% of electrical energy consumed to come from renewable sources by 2025



Solution Approach

- Holistic approach meeting all mandates at “owned sites” only; within available funding:
 - Install smart meters at all “owned sites”
 - Analyze and reduce energy usage at all “owned sites”
 - Install renewable energy systems at sites where it makes sense
 - Wind Turbines and Photovoltaic (PV) systems are the best for MCRCs

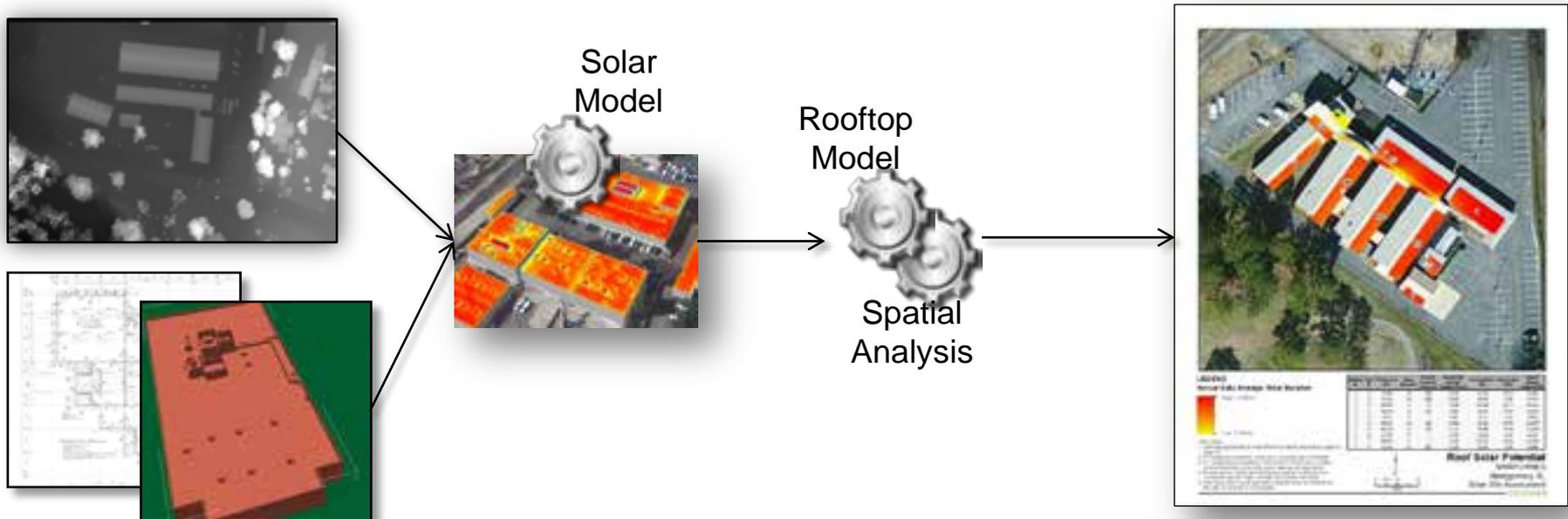


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Solar Site Assessments and 3D Data for Asset Management

Solution – Critigen Solar Mapping and Assessments

- Solar Site Assessments
 - Solar energy potential for every roof at every facility
 - Accurate solar analysis, leveraging Critigen Solar Mapping
 - Organization-wide solar potential database and reports





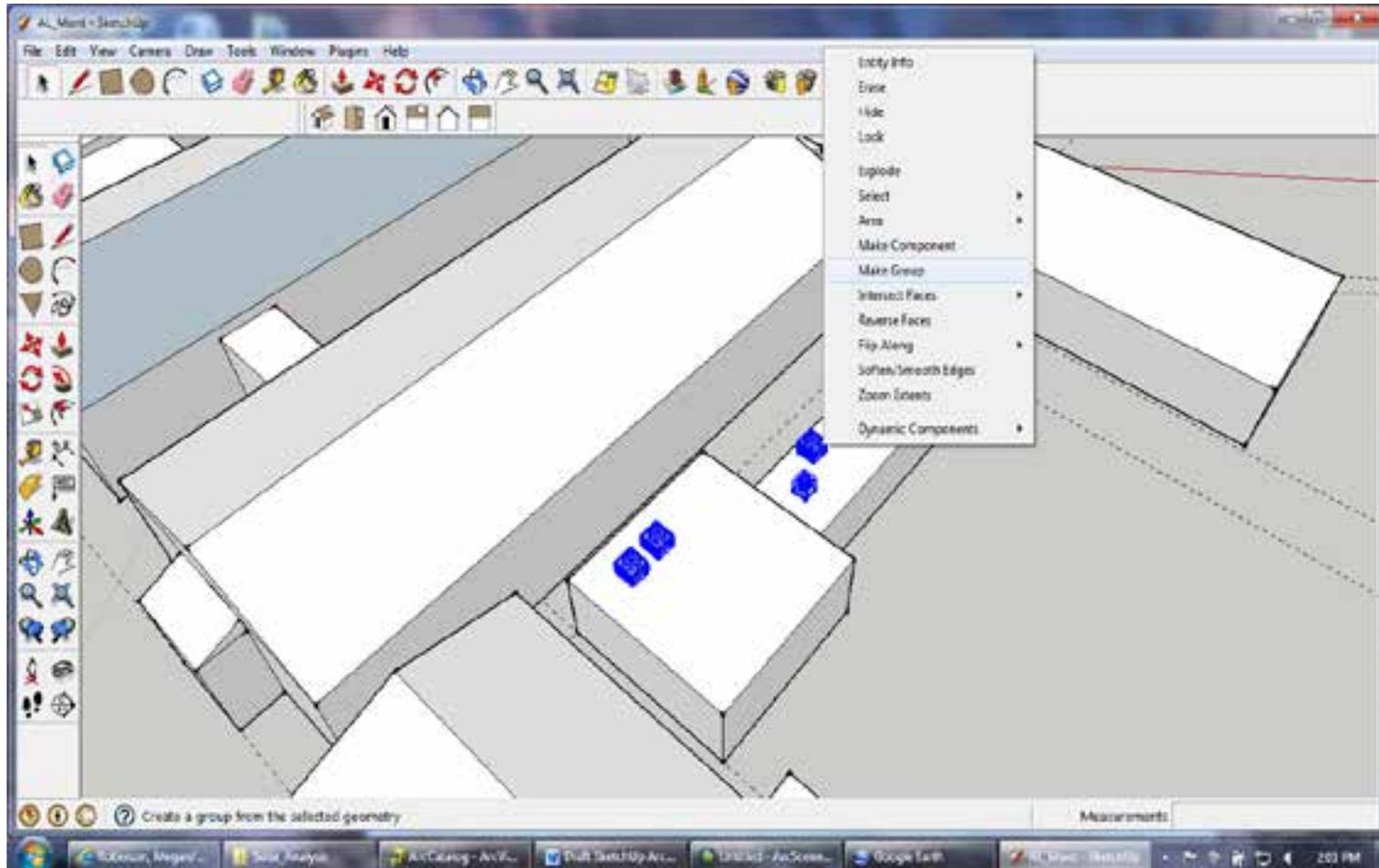
Three-dimensional modeling & conversion process

- Trimble® SketchUp
 - Engineering drawings/CAD files
 - Exported to Collada (.dae) file
- ArcGIS®
 - Create database with multipatch feature class
 - Drape aerial photo over DEM
 - Start edit session
 - Use insert tool to import Collada file
 - Rotate/adjust model



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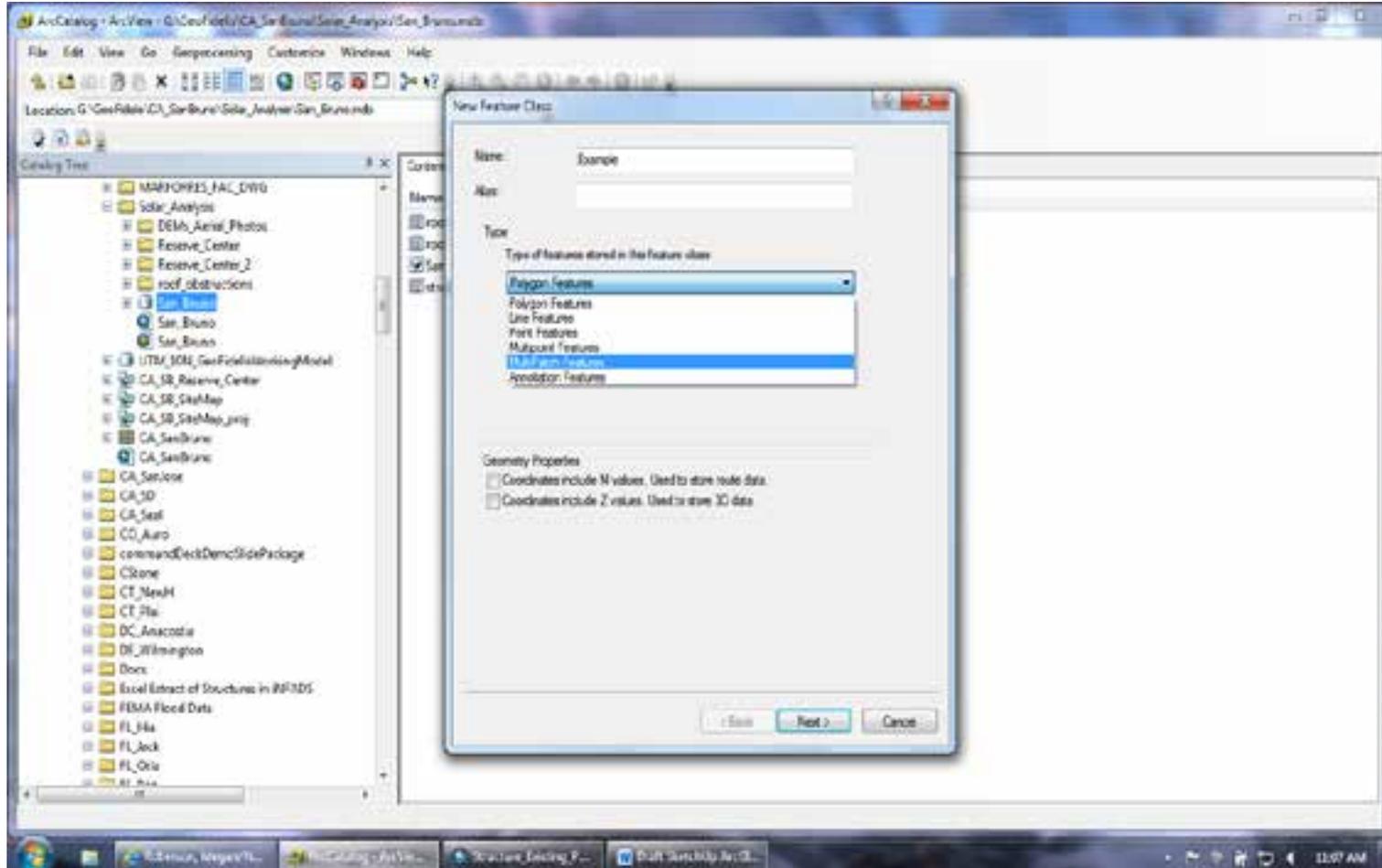
Solar Site Assessments and 3D Data for Asset Management





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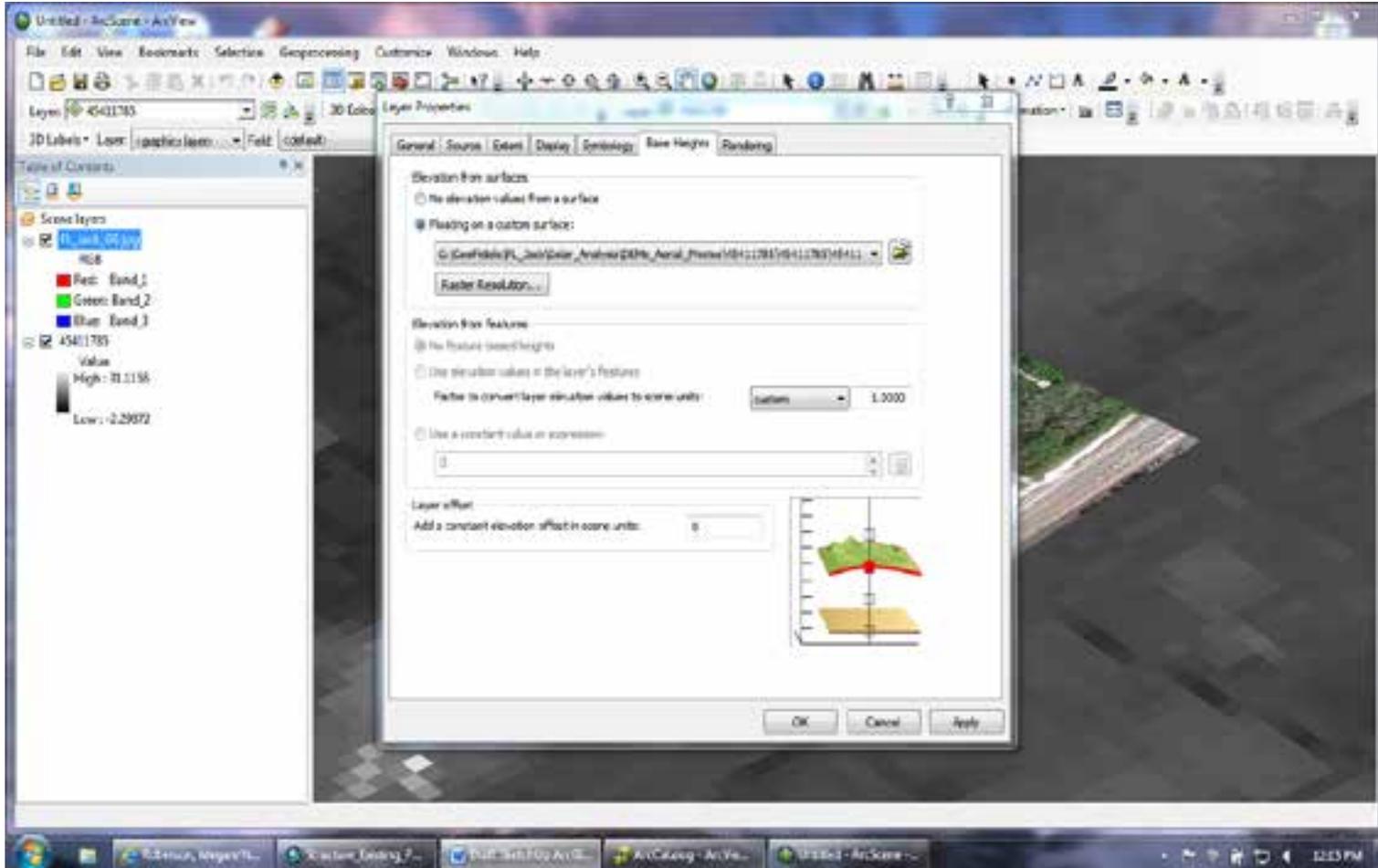
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MARFORRES IGI&S

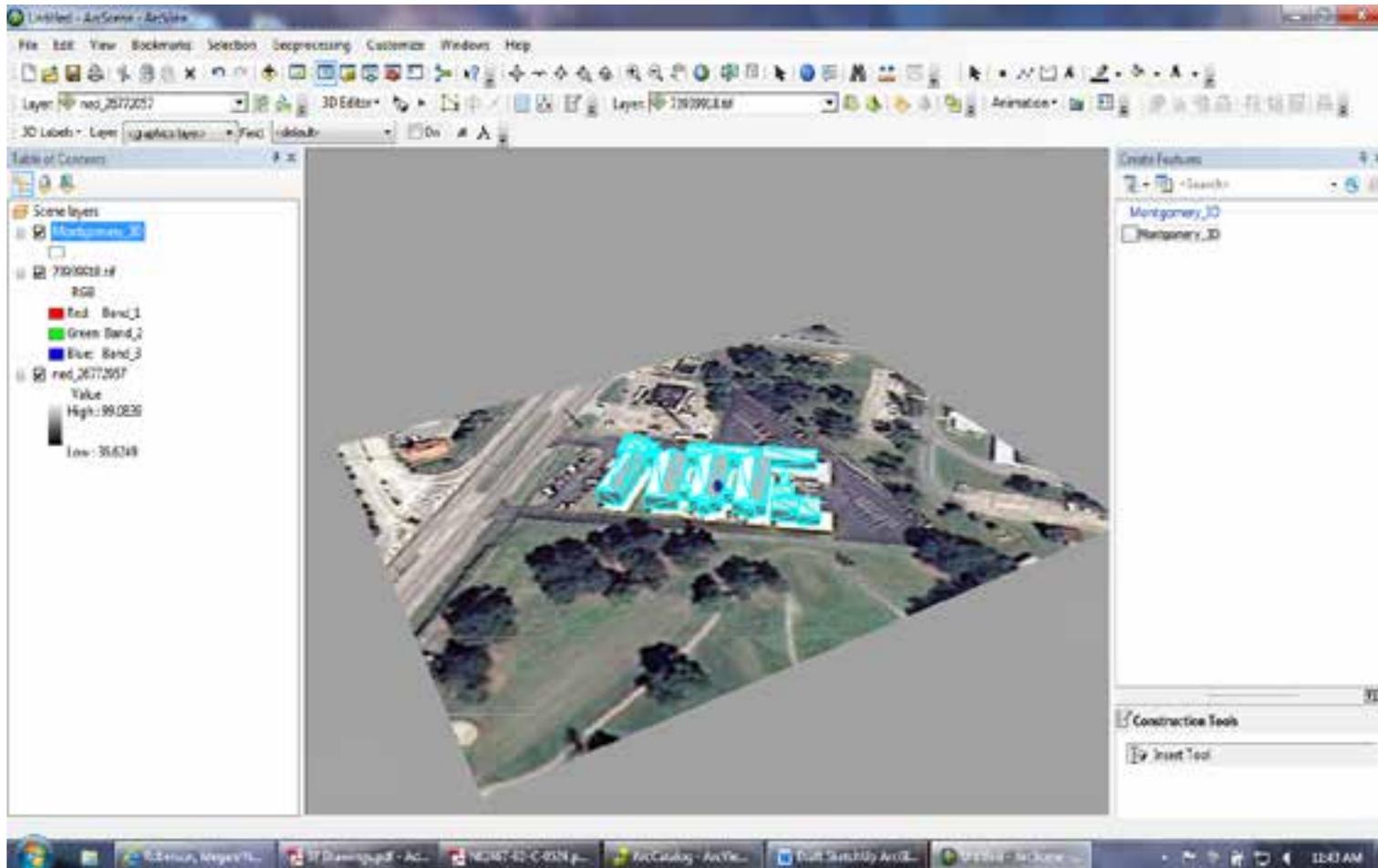
Solar Site Assessments and 3D Data for Asset Management





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Solar Site Assessments and 3D Data for Asset Management





Solar Site Assessment – Critigen Solar Model

- ArcGIS®
 - Python/Model Builder Tools and Workflow
 - Spatial Analysis and Custom 3D Tools
 - Visualization and Spatial Database
- NREL PV Watts Calculator
 - Calculator tools for increased accuracy and site specific parameters.
- Custom Designed Analysis for Site Specific Criteria

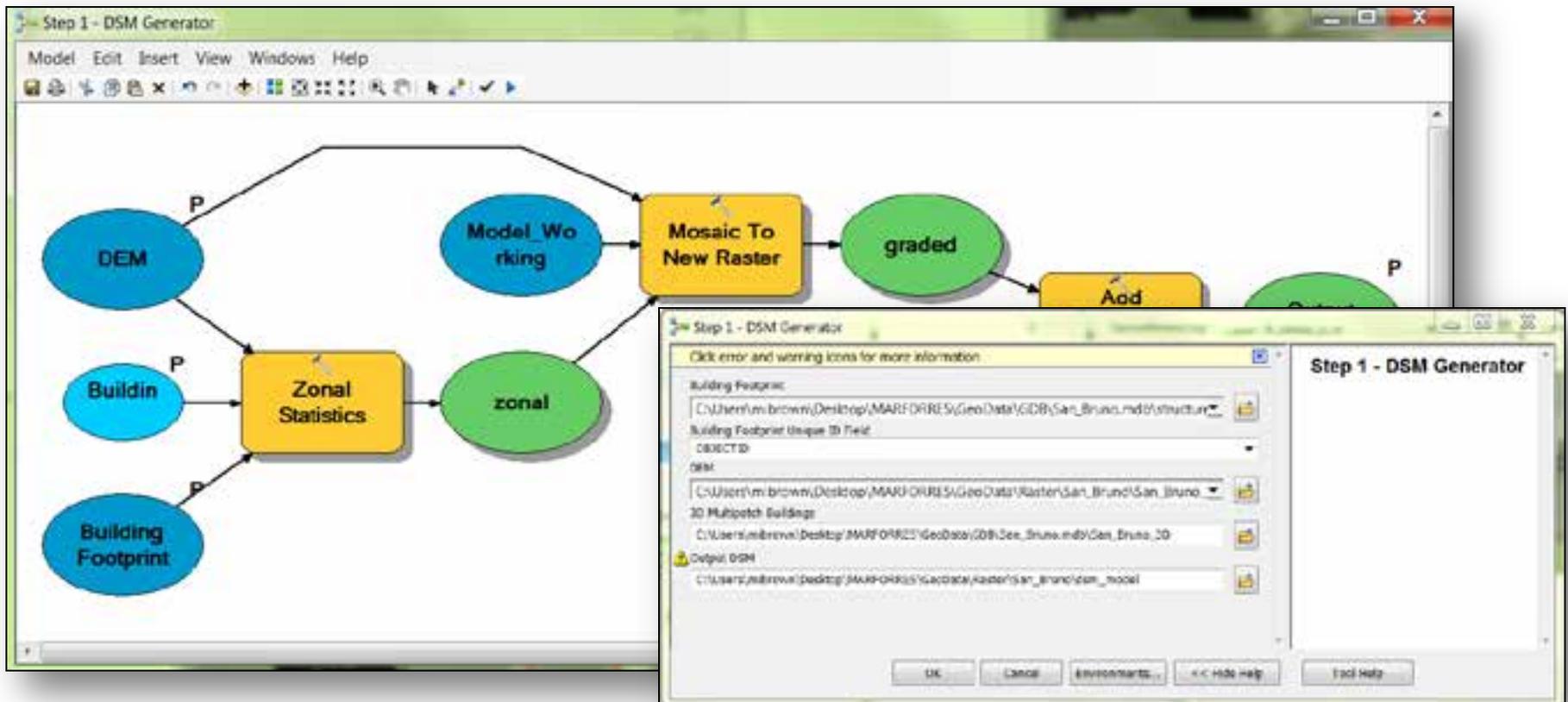


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Solar Site Assessments and 3D Data for Asset Management

Solar Site Assessment – Critigen Solar Model

- Data Formatting and Processing for Solar Analysis



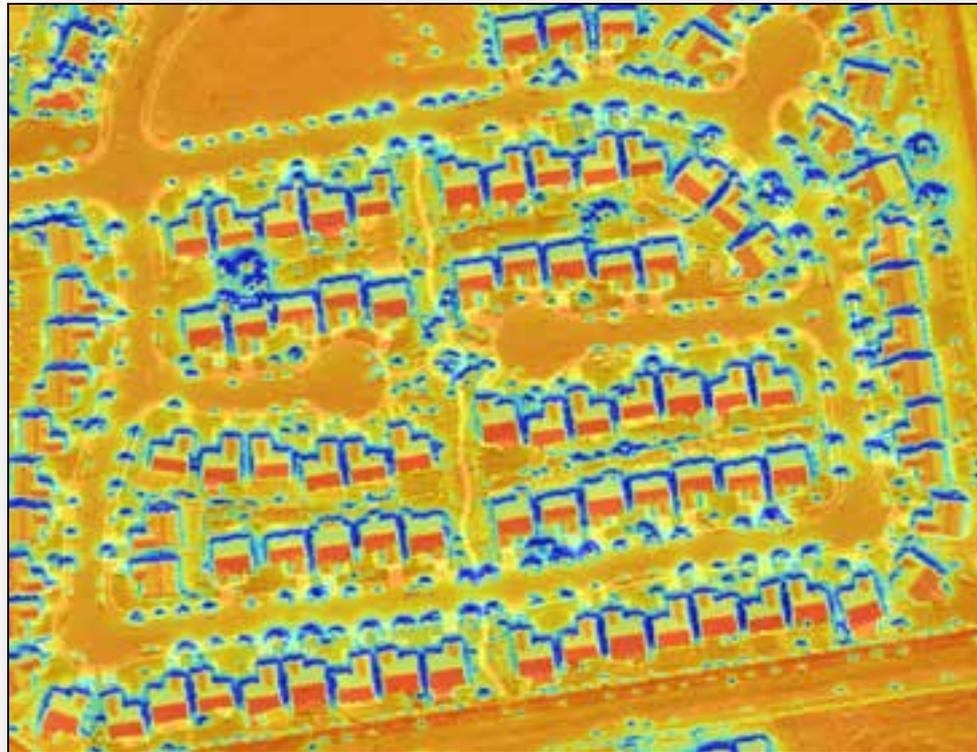


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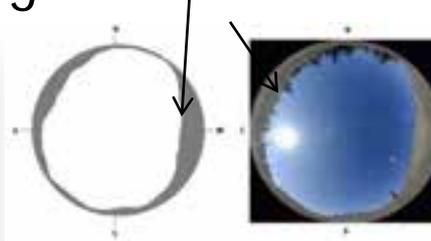
Solar Site Assessments and 3D Data for Asset Management

Solar Site Assessment – Critigen Solar Model

- Solar Shading and Radiation
- Enhanced Analysis and Processing



Shading Model
Area blocked from sun



Solar Pathfinder





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Solar Site Assessments and 3D Data for Asset Management

Solar Site Assessment – Critigen Solar Model

- Custom Criteria for Solar Analysis



Solar PV Rebate Table

Tilt/Azimuth	North west				Due West				Due South				Due East									
	300	290	280	270	260	250	240	230	220	210	200	190	180	170	160	150	140	130	120	110	100	90
0°																						
5°																						
10°																						
15°																						
20°																						
25°																						
30°																						
35°																						
40°																						
45°																						
50°																						
55°																						
60°																						

Shaded Azimuth's and Tilt Angles Qualify for Rebates



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Solar Site Assessments and 3D Data for Asset Management

Solar Site Assessment - Reports

Unique Roof Panel Report



LEGEND
Annual Daily Average: Solar Duration

Panel ID	Area (sq ft)	Area (sq m)	Annual Energy Potential (kWh)			
1	1,100	101	11,100	11,100	11,100	11,100
2	1,100	101	11,100	11,100	11,100	11,100
3	1,100	101	11,100	11,100	11,100	11,100
4	1,100	101	11,100	11,100	11,100	11,100
5	1,100	101	11,100	11,100	11,100	11,100
6	1,100	101	11,100	11,100	11,100	11,100
7	1,100	101	11,100	11,100	11,100	11,100
8	1,100	101	11,100	11,100	11,100	11,100
9	1,100	101	11,100	11,100	11,100	11,100
10	1,100	101	11,100	11,100	11,100	11,100
11	1,100	101	11,100	11,100	11,100	11,100
12	1,100	101	11,100	11,100	11,100	11,100
13	1,100	101	11,100	11,100	11,100	11,100
14	1,100	101	11,100	11,100	11,100	11,100
15	1,100	101	11,100	11,100	11,100	11,100
16	1,100	101	11,100	11,100	11,100	11,100
17	1,100	101	11,100	11,100	11,100	11,100
18	1,100	101	11,100	11,100	11,100	11,100
19	1,100	101	11,100	11,100	11,100	11,100
20	1,100	101	11,100	11,100	11,100	11,100
21	1,100	101	11,100	11,100	11,100	11,100
22	1,100	101	11,100	11,100	11,100	11,100
23	1,100	101	11,100	11,100	11,100	11,100
24	1,100	101	11,100	11,100	11,100	11,100
25	1,100	101	11,100	11,100	11,100	11,100
26	1,100	101	11,100	11,100	11,100	11,100
27	1,100	101	11,100	11,100	11,100	11,100
28	1,100	101	11,100	11,100	11,100	11,100
29	1,100	101	11,100	11,100	11,100	11,100
30	1,100	101	11,100	11,100	11,100	11,100
31	1,100	101	11,100	11,100	11,100	11,100
32	1,100	101	11,100	11,100	11,100	11,100
33	1,100	101	11,100	11,100	11,100	11,100
34	1,100	101	11,100	11,100	11,100	11,100
35	1,100	101	11,100	11,100	11,100	11,100
36	1,100	101	11,100	11,100	11,100	11,100
37	1,100	101	11,100	11,100	11,100	11,100
38	1,100	101	11,100	11,100	11,100	11,100
39	1,100	101	11,100	11,100	11,100	11,100
40	1,100	101	11,100	11,100	11,100	11,100
41	1,100	101	11,100	11,100	11,100	11,100
42	1,100	101	11,100	11,100	11,100	11,100
43	1,100	101	11,100	11,100	11,100	11,100
44	1,100	101	11,100	11,100	11,100	11,100
45	1,100	101	11,100	11,100	11,100	11,100
46	1,100	101	11,100	11,100	11,100	11,100
47	1,100	101	11,100	11,100	11,100	11,100
48	1,100	101	11,100	11,100	11,100	11,100
49	1,100	101	11,100	11,100	11,100	11,100
50	1,100	101	11,100	11,100	11,100	11,100

Notes:
1. This report is for general information only and does not constitute a solar proposal.
2. This report is based on the best available data and is subject to change.
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Roof Solar Potential
MARFORRES
Montgomery, AL
Solar Site Assessment
CRITIGEN

Building Report



LEGEND
Annual Daily Average: Solar Duration

Building ID	Roof Area (sq ft)	Roof Area (sq m)	System Size (kW)	Annual System Output (kWh)	Annual Daily Average Output (kWh)
1	700,72	64,69	100,00	1,111,111	3,042
2	23,58	2,18	3,25	37,022	102
3	1,440,38	132,75	19,54	21,434	58
4	33,78	3,12	4,58	5,188	14

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Building Solar Potential
MARFORRES
Montgomery, AL
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CRITIGEN

3D Building Report



LEGEND
Annual Daily Average: Solar Duration

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2	23,58	2,18	3,25	37,022	102
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3D Building Solar Potential
MARFORRES
Montgomery, AL
Solar Site Assessment
CRITIGEN



MARFORRES IGI&S

Solar Site Assessments and 3D Data for Asset Management

Results of Solar Assessments

- Solar potential for every facility
- Accurate material for contractors
- Efficient use of Solar PV and \$
- Actionable information
- Solar production quotes

Facility	Area (sq ft)	Potential (kW)	Production (kWh/yr)	Cost (\$/kW)	Payback (yr)
Facility 1	10000	100	150000	1000	10
Facility 2	20000	200	300000	1000	10
Facility 3	50000	500	750000	1000	10
Facility 4	100000	1000	1500000	1000	10
Facility 5	200000	2000	3000000	1000	10
Facility 6	500000	5000	7500000	1000	10
Facility 7	1000000	10000	15000000	1000	10
Facility 8	2000000	20000	30000000	1000	10
Facility 9	5000000	50000	75000000	1000	10
Facility 10	10000000	100000	150000000	1000	10





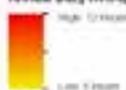
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Solar Site Assessments and 3D Data for Asset Management

Results of Solar Assessments - Installation



LEGEND
Annual Daily Average Solar Duration



Roof Area	Area (sq ft)	Annual Solar Duration (hrs)	Annual Energy Potential (kWh)				
1	10,000	1,500	15,000	15,000	15,000	15,000	15,000
2	12,000	1,800	18,000	18,000	18,000	18,000	18,000
3	15,000	2,200	22,000	22,000	22,000	22,000	22,000
4	18,000	2,500	25,000	25,000	25,000	25,000	25,000
5	20,000	2,800	28,000	28,000	28,000	28,000	28,000
6	22,000	3,000	30,000	30,000	30,000	30,000	30,000
7	25,000	3,200	32,000	32,000	32,000	32,000	32,000
8	28,000	3,500	35,000	35,000	35,000	35,000	35,000
9	30,000	3,800	38,000	38,000	38,000	38,000	38,000
10	32,000	4,000	40,000	40,000	40,000	40,000	40,000
11	35,000	4,200	42,000	42,000	42,000	42,000	42,000
12	38,000	4,500	45,000	45,000	45,000	45,000	45,000
13	40,000	4,800	48,000	48,000	48,000	48,000	48,000
14	42,000	5,000	50,000	50,000	50,000	50,000	50,000
15	45,000	5,200	52,000	52,000	52,000	52,000	52,000
16	48,000	5,500	55,000	55,000	55,000	55,000	55,000
17	50,000	5,800	58,000	58,000	58,000	58,000	58,000
18	52,000	6,000	60,000	60,000	60,000	60,000	60,000
19	55,000	6,200	62,000	62,000	62,000	62,000	62,000
20	58,000	6,500	65,000	65,000	65,000	65,000	65,000
21	60,000	6,800	68,000	68,000	68,000	68,000	68,000
22	62,000	7,000	70,000	70,000	70,000	70,000	70,000
23	65,000	7,200	72,000	72,000	72,000	72,000	72,000
24	68,000	7,500	75,000	75,000	75,000	75,000	75,000
25	70,000	7,800	78,000	78,000	78,000	78,000	78,000
26	72,000	8,000	80,000	80,000	80,000	80,000	80,000
27	75,000	8,200	82,000	82,000	82,000	82,000	82,000
28	78,000	8,500	85,000	85,000	85,000	85,000	85,000
29	80,000	8,800	88,000	88,000	88,000	88,000	88,000
30	82,000	9,000	90,000	90,000	90,000	90,000	90,000
31	85,000	9,200	92,000	92,000	92,000	92,000	92,000
32	88,000	9,500	95,000	95,000	95,000	95,000	95,000
33	90,000	9,800	98,000	98,000	98,000	98,000	98,000
34	92,000	10,000	100,000	100,000	100,000	100,000	100,000
35	95,000	10,200	102,000	102,000	102,000	102,000	102,000
36	98,000	10,500	105,000	105,000	105,000	105,000	105,000
37	100,000	10,800	108,000	108,000	108,000	108,000	108,000
38	102,000	11,000	110,000	110,000	110,000	110,000	110,000
39	105,000	11,200	112,000	112,000	112,000	112,000	112,000
40	108,000	11,500	115,000	115,000	115,000	115,000	115,000
41	110,000	11,800	118,000	118,000	118,000	118,000	118,000
42	112,000	12,000	120,000	120,000	120,000	120,000	120,000
43	115,000	12,200	122,000	122,000	122,000	122,000	122,000
44	118,000	12,500	125,000	125,000	125,000	125,000	125,000
45	120,000	12,800	128,000	128,000	128,000	128,000	128,000
46	122,000	13,000	130,000	130,000	130,000	130,000	130,000
47	125,000	13,200	132,000	132,000	132,000	132,000	132,000
48	128,000	13,500	135,000	135,000	135,000	135,000	135,000
49	130,000	13,800	138,000	138,000	138,000	138,000	138,000
50	132,000	14,000	140,000	140,000	140,000	140,000	140,000
51	135,000	14,200	142,000	142,000	142,000	142,000	142,000
52	138,000	14,500	145,000	145,000	145,000	145,000	145,000
53	140,000	14,800	148,000	148,000	148,000	148,000	148,000
54	142,000	15,000	150,000	150,000	150,000	150,000	150,000
55	145,000	15,200	152,000	152,000	152,000	152,000	152,000
56	148,000	15,500	155,000	155,000	155,000	155,000	155,000
57	150,000	15,800	158,000	158,000	158,000	158,000	158,000
58	152,000	16,000	160,000	160,000	160,000	160,000	160,000
59	155,000	16,200	162,000	162,000	162,000	162,000	162,000
60	158,000	16,500	165,000	165,000	165,000	165,000	165,000
61	160,000	16,800	168,000	168,000	168,000	168,000	168,000
62	162,000	17,000	170,000	170,000	170,000	170,000	170,000
63	165,000	17,200	172,000	172,000	172,000	172,000	172,000
64	168,000	17,500	175,000	175,000	175,000	175,000	175,000
65	170,000	17,800	178,000	178,000	178,000	178,000	178,000
66	172,000	18,000	180,000	180,000	180,000	180,000	180,000
67	175,000	18,200	182,000	182,000	182,000	182,000	182,000
68	178,000	18,500	185,000	185,000	185,000	185,000	185,000
69	180,000	18,800	188,000	188,000	188,000	188,000	188,000
70	182,000	19,000	190,000	190,000	190,000	190,000	190,000
71	185,000	19,200	192,000	192,000	192,000	192,000	192,000
72	188,000	19,500	195,000	195,000	195,000	195,000	195,000
73	190,000	19,800	198,000	198,000	198,000	198,000	198,000
74	192,000	20,000	200,000	200,000	200,000	200,000	200,000
75	195,000	20,200	202,000	202,000	202,000	202,000	202,000
76	198,000	20,500	205,000	205,000	205,000	205,000	205,000
77	200,000	20,800	208,000	208,000	208,000	208,000	208,000
78	202,000	21,000	210,000	210,000	210,000	210,000	210,000
79	205,000	21,200	212,000	212,000	212,000	212,000	212,000
80	208,000	21,500	215,000	215,000	215,000	215,000	215,000
81	210,000	21,800	218,000	218,000	218,000	218,000	218,000
82	212,000	22,000	220,000	220,000	220,000	220,000	220,000
83	215,000	22,200	222,000	222,000	222,000	222,000	222,000
84	218,000	22,500	225,000	225,000	225,000	225,000	225,000
85	220,000	22,800	228,000	228,000	228,000	228,000	228,000
86	222,000	23,000	230,000	230,000	230,000	230,000	230,000
87	225,000	23,200	232,000	232,000	232,000	232,000	232,000
88	228,000	23,500	235,000	235,000	235,000	235,000	235,000
89	230,000	23,800	238,000	238,000	238,000	238,000	238,000
90	232,000	24,000	240,000	240,000	240,000	240,000	240,000
91	235,000	24,200	242,000	242,000	242,000	242,000	242,000
92	238,000	24,500	245,000	245,000	245,000	245,000	245,000
93	240,000	24,800	248,000	248,000	248,000	248,000	248,000
94	242,000	25,000	250,000	250,000	250,000	250,000	250,000
95	245,000	25,200	252,000	252,000	252,000	252,000	252,000
96	248,000	25,500	255,000	255,000	255,000	255,000	255,000
97	250,000	25,800	258,000	258,000	258,000	258,000	258,000
98	252,000	26,000	260,000	260,000	260,000	260,000	260,000
99	255,000	26,200	262,000	262,000	262,000	262,000	262,000
100	258,000	26,500	265,000	265,000	265,000	265,000	265,000

Notes:

- 1. All data is based on the weather data for San Bruno, CA.
- 2. All data is based on the weather data for San Bruno, CA.
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Roof Solar Potential
MARFORRES
 San Bruno, CA
 Solar Site Assessment
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Solar Site Assessments and 3D Data for Asset Management

- MFR has 8 completed photovoltaic projects
 - Ø Lafayette – 225 kW
 - Ø Lemoore – 150 kW
 - Ø Camp Pendleton – 66 kW
 - Ø 29 Palms – 62 kW
 - Ø Port Hueneme – 25 kW
 - Ø Pico Rivera – 8.7 kW
 - Ø Pasadena – 5.8 kW
 - Ø Bakersfield – 3 kW
- New Photovoltaic (PV) projects being planned for:
 - Ø Brooklyn, NY
 - Ø MARCORSPTFAC NOLA
 - Ø Tampa, FL
 - Ø Maguire/Dix/Lakehurst, NJ



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Solar Site Assessments and 3D Data for Asset Management

Ancillary Benefits of Solar Assessments