PV SIMULATION IN EXCEL. INTEGRATION OF SAM SDK INTO SPREADSHEET USING ADD-IN

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SAM VIRTUAL CONFERENCE 2015
JULY 9TH, 2015

AGENDA

- Introduction
- Add-In Structure
- SSC Module Execution: SAM SDK vs Excel
- Implementation Example
- Final Solution Demonstration
- Conclusion
- Future Work

INTRODUCTION

System Advisory Model (SAM) is one of the major simulation platforms available in industry.

The SAM SDK is a collection of developer tools for creating renewable energy system models using the SSC library. The SDK allows you to create your own applications using the SSC library.

This presentation illustrates an example of SAM SDK employment by building interface between SAM SDK and Microsoft Excel.

As a result, this presentation demonstrates spreadsheet tool with different custom simulation features which utilize high performance SSC Library computation.

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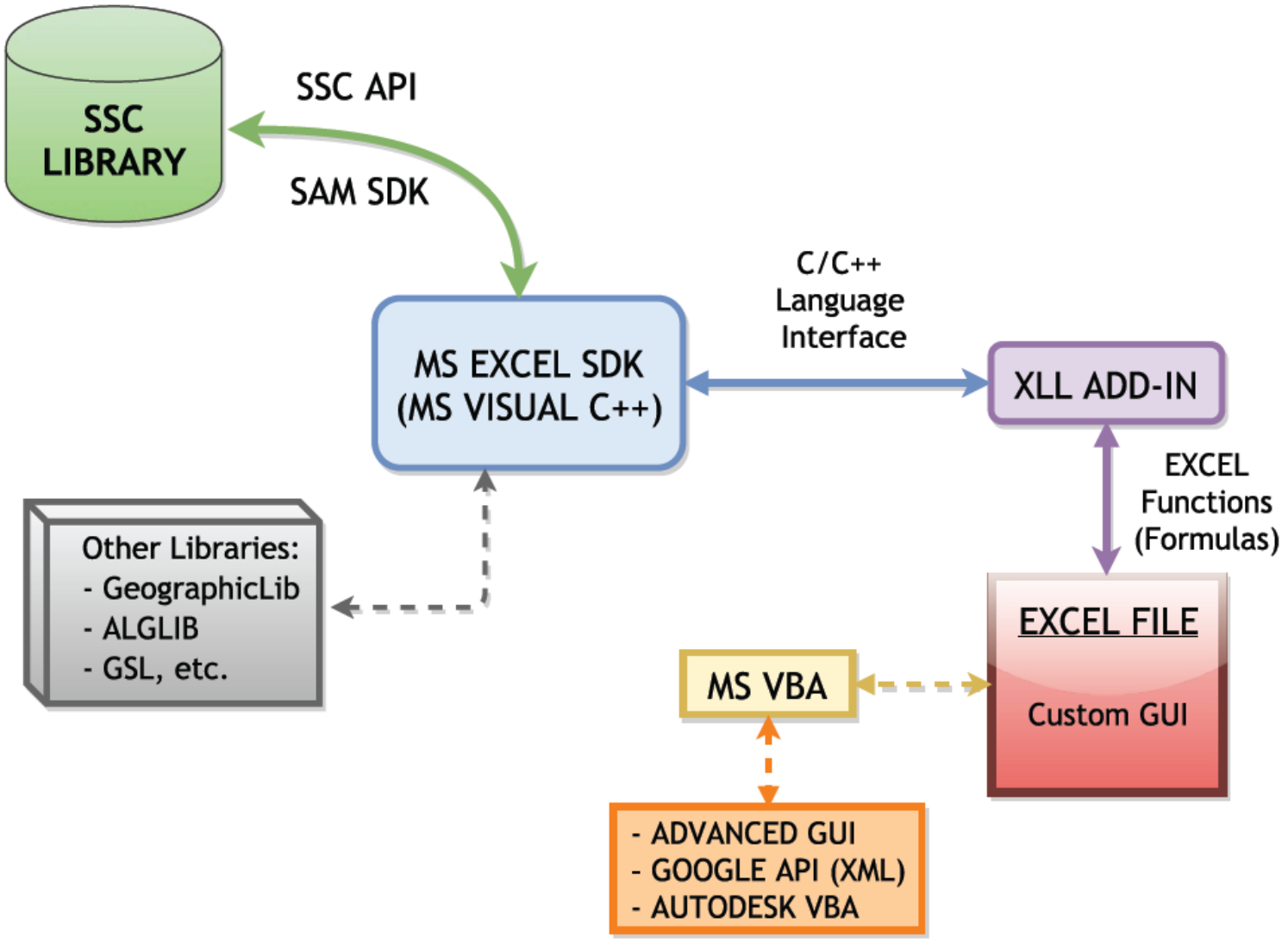
ADD-IN STRUCTURE



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SCC MODULE EXECUTION: SAM SDK

SCC Library consists of a variety of modules designed for different applications such as PV, CSP, wind, battery storage etc.

Any of them could be executed via SSC API described in SDK's User Guide.

DATA INPUT

MODULE RUN

DATA OUTPUT

```
1   var( 'system_capacity', 3.8745 );
2   var( 'solar_resource_file', '../examples/USA AZ Phoenix (TMY2).csv' );
3   var( 'use_wf_albedo', 0 );
4   var( 'albedo', [ 0.2, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2, 0.2 ] );
5   var( 'irrad_mode', 0 );
6   var( 'sky_model', 2 );
7   var( 'ac_loss', 1 );
8   var( 'modules_per_string', 9 );
9   var( 'strings_in_parallel', 2 );
10  var( 'inverter_count', 1 );
11  var( 'enable_mismatch_vmax_calc', 0 );
12  var( 'subarray1_tilt', 20 );
13  var( 'subarray1_tilt_eq_lat', 0 );
14  var( 'subarray1_azimuth', 180 );
15  var( 'subarray1 track mode', 0 );
                ----------------------------------
216 var( 'inv_pd_vdco', 310 );
217 var( 'inv_pd_vdcmax', 600 );
218 var( 'adjust:factor', 1 );
219
220 run( "pvsamv1");
221
222 outln("Annual energy : " + var("annual_energy") + " kWh");
223 outln("Capacity factor : " + var("capacity_factor") + " %");
224 outln("First year kWhAC/kWDC : " + var("kwh_per_kw"));
225
```


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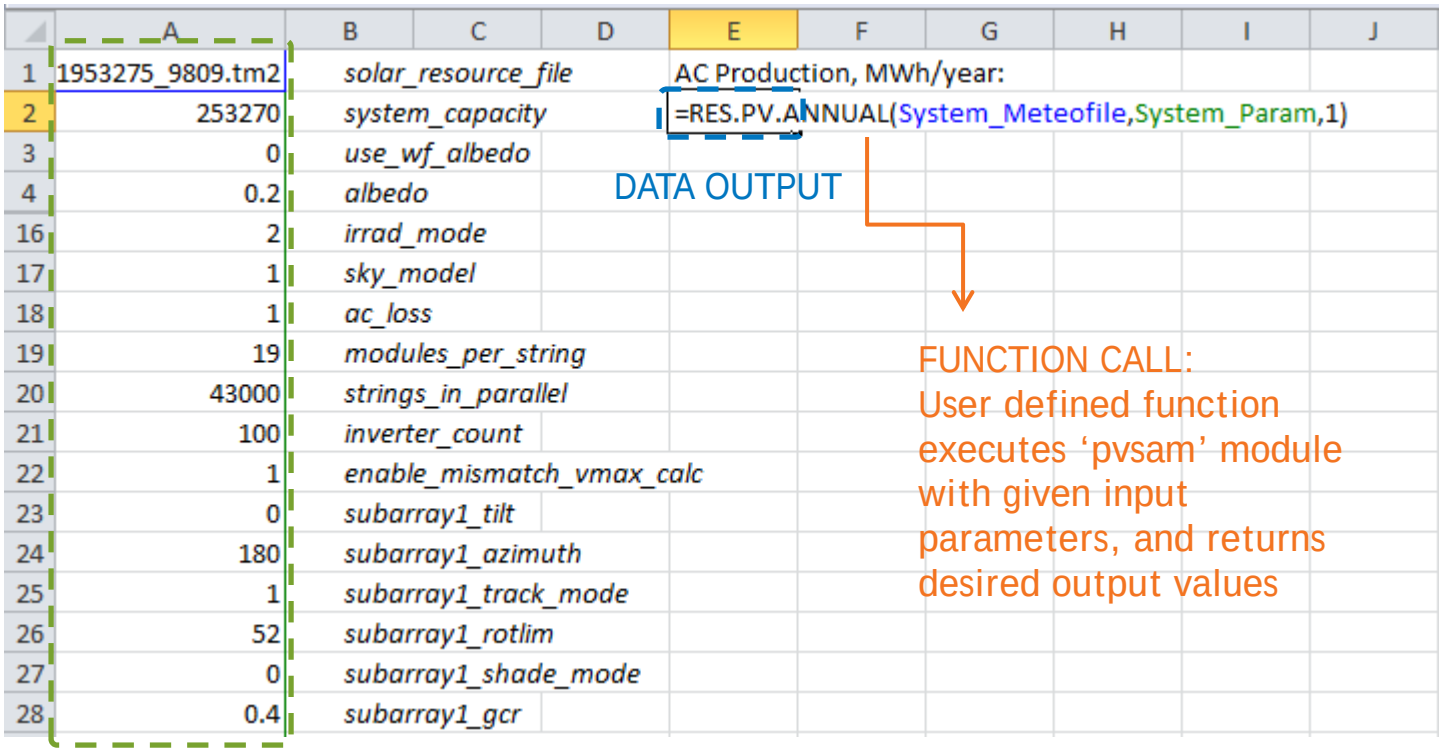
SCC MODULE EXECUTION: SAM EXCEL ADD-IN

SAM Excel Add-In could be consider as another wrapper that reads input parameters list from spreadsheet, executes 'pvsam' module using SSC API and returns results back to spreadsheet.

DATA INPUT



DATA OUTPUT

FUNCTION CALL:
User defined function executes 'pvsam' module with given input parameters, and returns desired output values

IMPLEMENTATION EXAMPLE

The following slides demonstrate an example of developed MS Excel spreadsheet tool with PV Simulation capabilities.

Intention of this tool was not to duplicate SAM desktop application, but rather customize interface in accordance with internal standards and bring modified functionality for everyday use.

Based on some feedback, this approach can not only minimize time spend on engineering in comparison with other simulation tools, but also helps to avoid some mistakes thanks to automated features.

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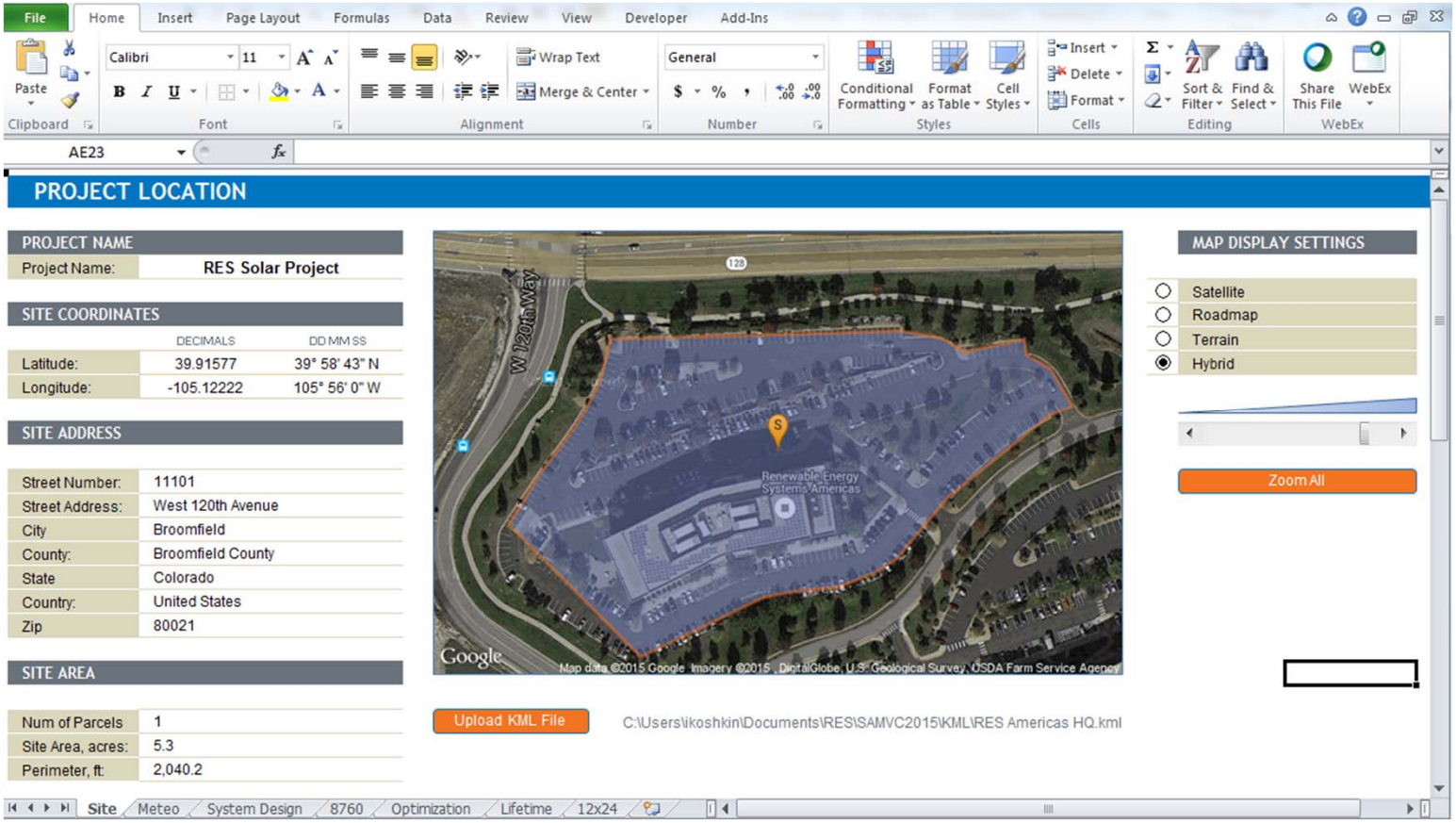
RESOLAR DEMONSTRATION

- **PROJECT SITE**

Location is defined by entering geographical coordinates or importing KML/KMZ file with project boundaries.

GUI shows location on a map, determines the exact address and calculates project area.

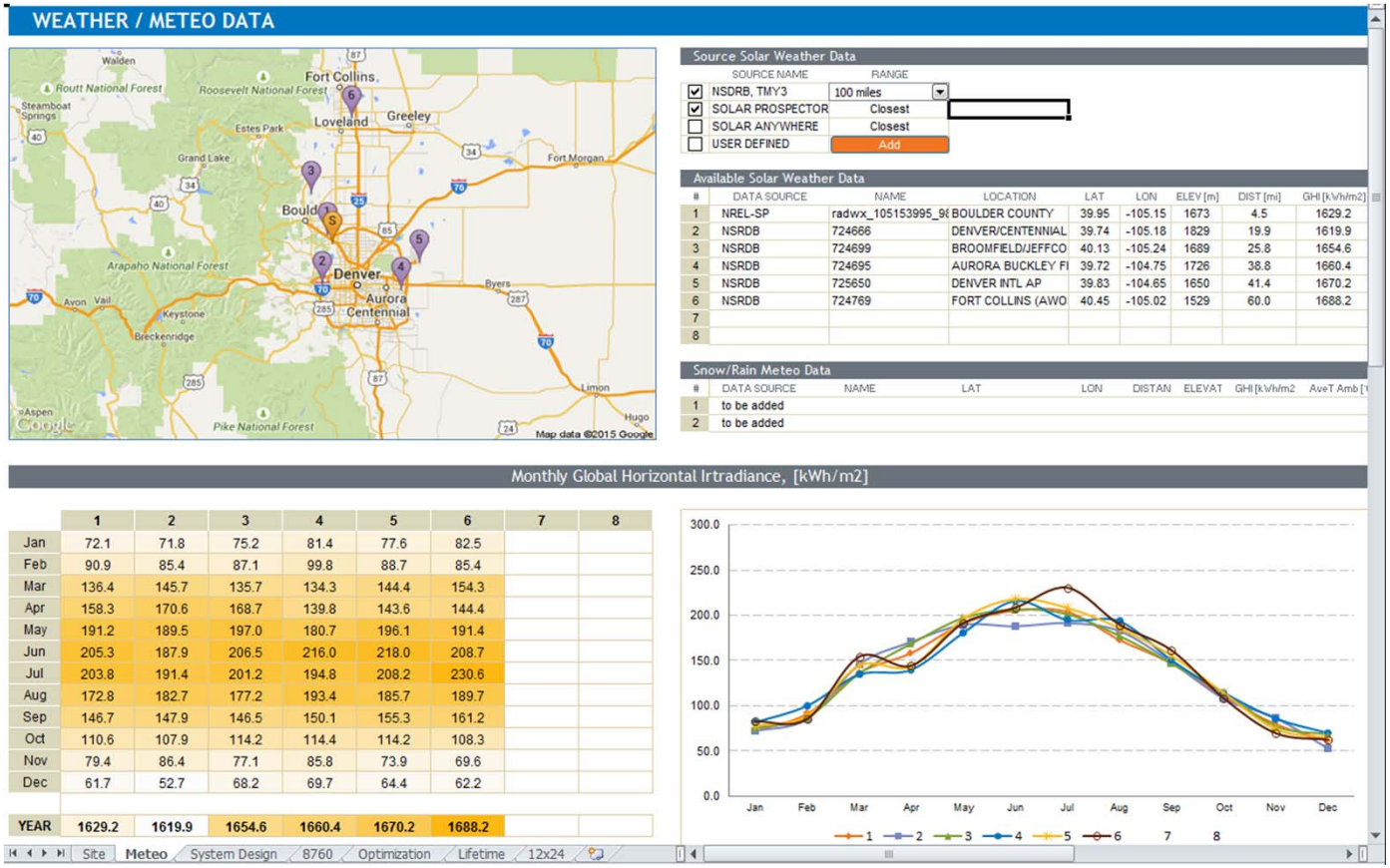


RESOLAR DEMONSTRATION

- **METEO**

Based on location, tool determines what solar resource data sets are available for analysis: NREL Solar Prospector, NSRDB or user defined custom data set.

Using SAM 'weather file reader' module, tool extracts data such as GHI, Tamb, Elevation, distance form site and provides comparison.

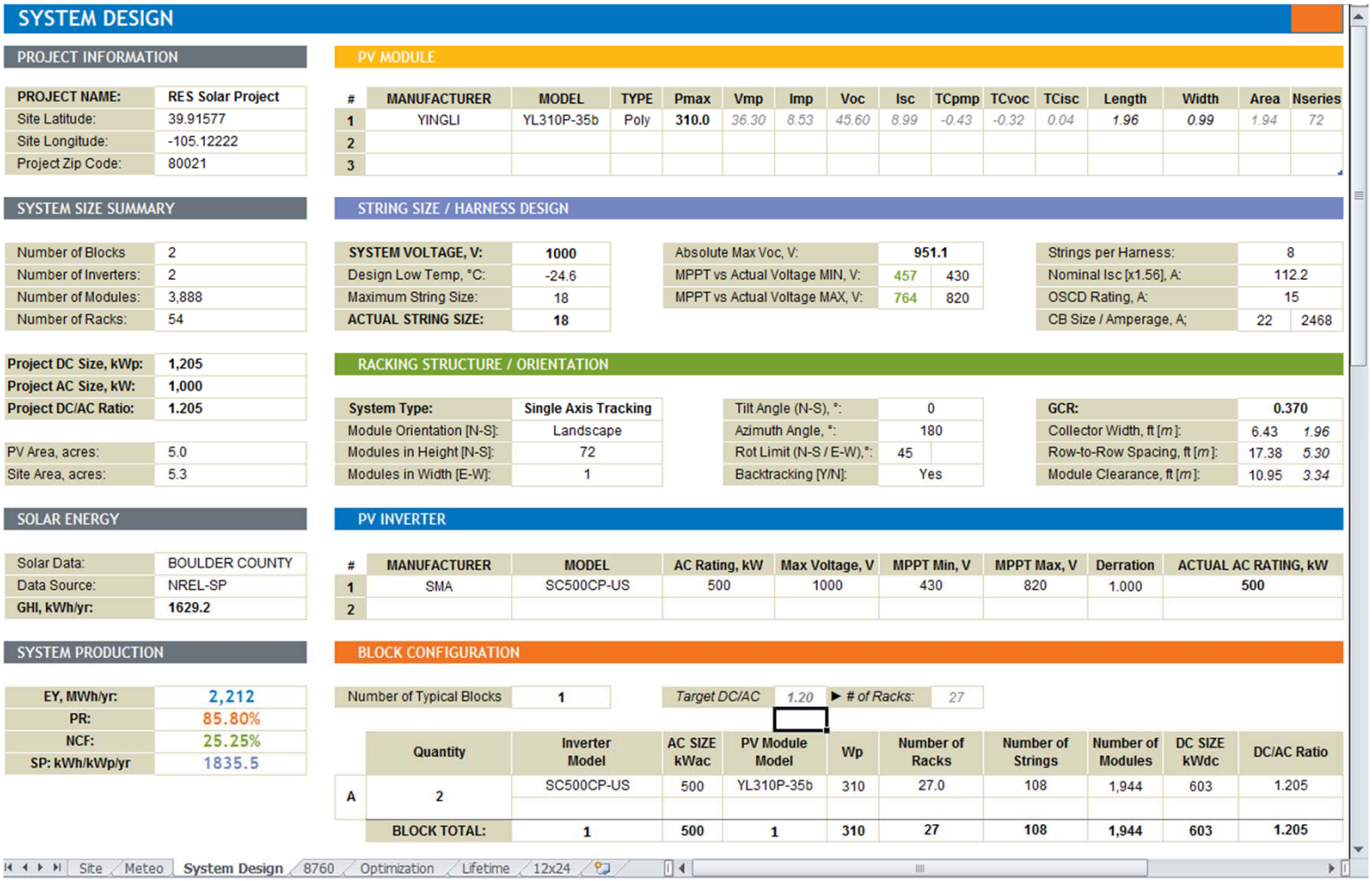


RESOLAR DEMONSTRATION

- **SYSTEM DESIGN**

System configuration is defined by user in one sheet dashboard.

Tool generates input parameters list and executes ‘pvsam’ module, provides results immediately.



SYSTEM DESIGN

PROJECT INFORMATION

PROJECT NAME:	RES Solar Project
Site Latitude:	39.91577
Site Longitude:	-105.12222
Project Zip Code:	80021

PV MODULE

#	MANUFACTURER	MODEL	TYPE	Pmax	Vmp	Imp	Voc	Isc	TCpmp	TCvoc	TCisc	Length	Width	Area	Nseries
1	YINGLI	YL310P-35b	Poly	310.0	36.30	8.53	45.60	8.99	-0.43	-0.32	0.04	1.96	0.99	1.94	72
2															
3															

SYSTEM SIZE SUMMARY

Number of Blocks	2
Number of Inverters:	2
Number of Modules:	3,888
Number of Racks:	54
Project DC Size, kWp:	1,205
Project AC Size, kW:	1,000
Project DC/AC Ratio:	1.205
PV Area, acres:	5.0
Site Area, acres:	5.3

STRING SIZE / HARNESS DESIGN

SYSTEM VOLTAGE, V:	1000
Design Low Temp, °C:	-24.6
Maximum String Size:	18
ACTUAL STRING SIZE:	18

Absolute Max Voc, V:	951.1	
MPPT vs Actual Voltage MIN, V:	457	430
MPPT vs Actual Voltage MAX, V:	764	820

Strings per Harness:	8	
Nominal Isc [x1.56], A:	112.2	
OSCD Rating, A:	15	
CB Size / Amperage, A:	22	2468

RACKING STRUCTURE / ORIENTATION

System Type:	Single Axis Tracking
Module Orientation [N-S]:	Landscape
Modules in Height [N-S]:	72
Modules in Width [E-W]:	1

Tilt Angle (N-S), °:	0
Azimuth Angle, °:	180
Rot Limit (N-S / E-W),°:	45
Backtracking [Y/N]:	Yes

GCR:	0.370	
Collector Width, ft [m]:	6.43	1.96
Row-to-Row Spacing, ft [m]:	17.38	5.30
Module Clearance, ft [m]:	10.95	3.34

SOLAR ENERGY

Solar Data:	BOULDER COUNTY
Data Source:	NREL-SP
GHI, kWh/yr:	1629.2

PV INVERTER

#	MANUFACTURER	MODEL	AC Rating, kW	Max Voltage, V	MPPT Min, V	MPPT Max, V	Derration	ACTUAL AC RATING, kW
1	SMA	SC500CP-US	500	1000	430	820	1.000	500
2								

SYSTEM PRODUCTION

EY, MWh/yr:	2,212
PR:	85.80%
NCF:	25.25%
SP: kWh/kWp/yr	1835.5

BLOCK CONFIGURATION

Number of Typical Blocks: 1 | Target DC/AC: 1.20 | ▶ # of Racks: 27

	Quantity	Inverter Model	AC SIZE kWac	PV Module Model	Wp	Number of Racks	Number of Strings	Number of Modules	DC SIZE kWdc	DC/AC Ratio
A	2	SC500CP-US	500	YL310P-35b	310	27.0	108	1,944	603	1.205
	BLOCK TOTAL:	1	500	1	310	27	108	1,944	603	1.205

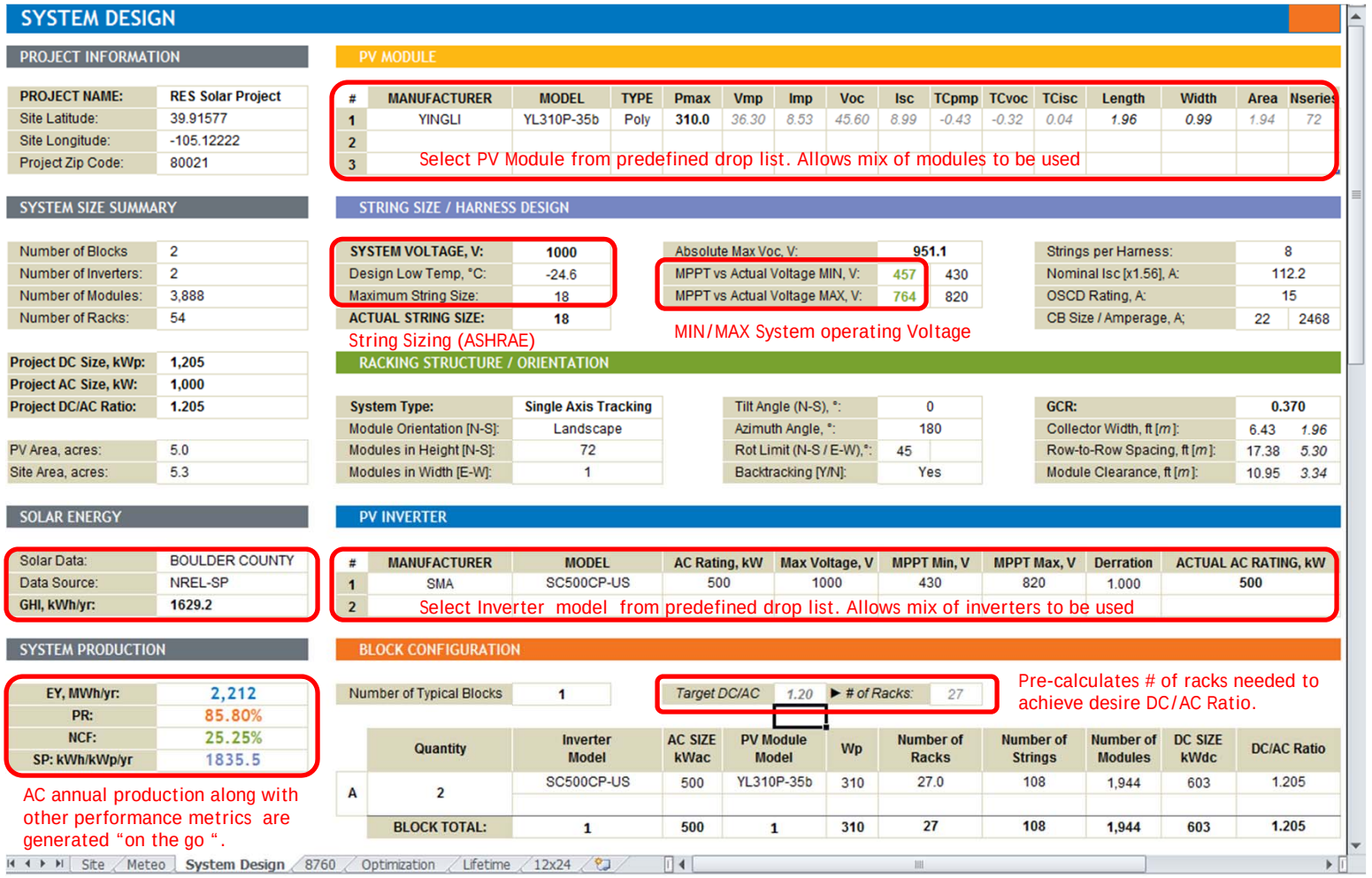
Site | Meteo | System Design | 8760 | Optimization | Lifetime | 12x24

RESOLAR DEMONSTRATION

- **SYSTEM DESIGN**

System configuration is defined by user on one sheet dashboard.

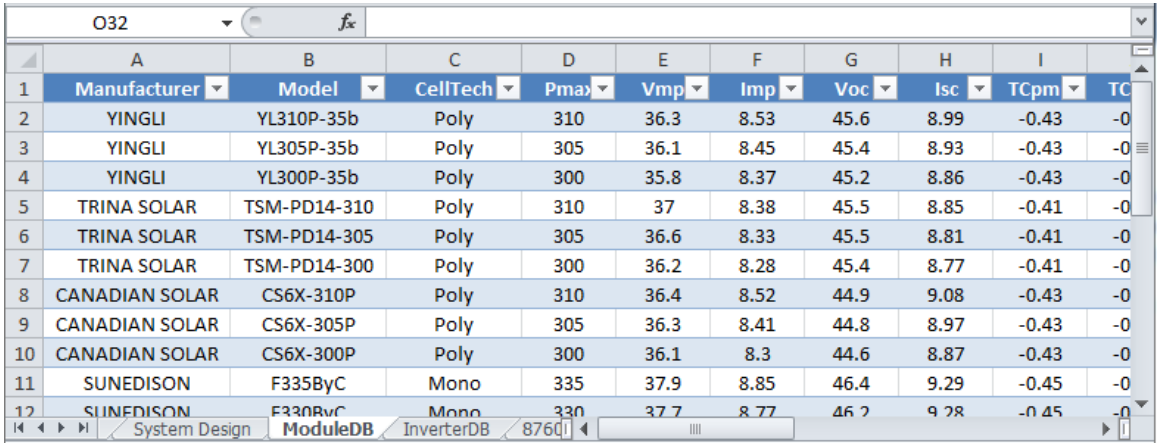
Tool generates input parameters list and executes 'pvsam' module, provides results immediately.



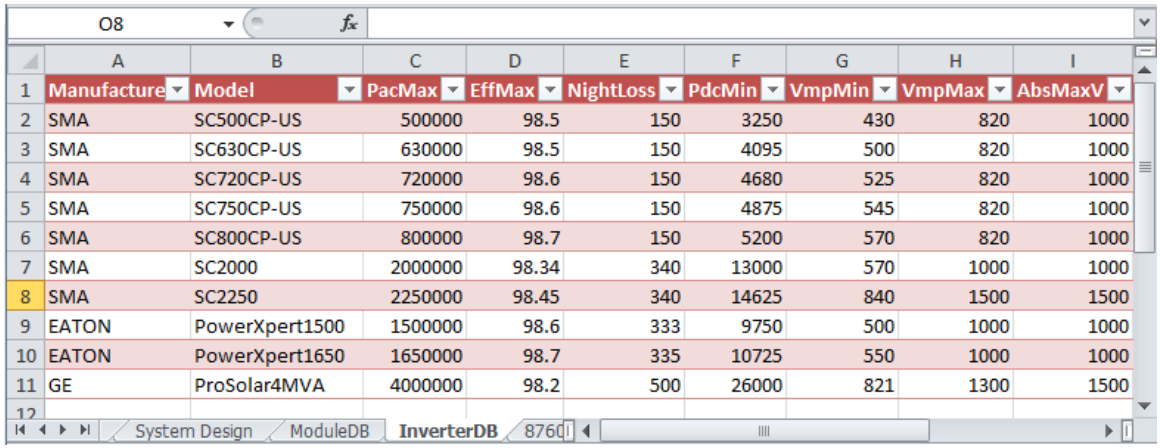
RESOLAR DEMONSTRATION

- **PV MODULES / INVERTERS DATABASE**

The most used models of PV Modules and Inverters compiled into Excel Tables with data imported from manufacturer's datasheets.



	A	B	C	D	E	F	G	H	I	
1	Manufacturer	Model	CellTech	Pmax	Vmp	Imp	Voc	Isc	TCpm	TC
2	YINGLI	YL310P-35b	Poly	310	36.3	8.53	45.6	8.99	-0.43	-0
3	YINGLI	YL305P-35b	Poly	305	36.1	8.45	45.4	8.93	-0.43	-0
4	YINGLI	YL300P-35b	Poly	300	35.8	8.37	45.2	8.86	-0.43	-0
5	TRINA SOLAR	TSM-PD14-310	Poly	310	37	8.38	45.5	8.85	-0.41	-0
6	TRINA SOLAR	TSM-PD14-305	Poly	305	36.6	8.33	45.5	8.81	-0.41	-0
7	TRINA SOLAR	TSM-PD14-300	Poly	300	36.2	8.28	45.4	8.77	-0.41	-0
8	CANADIAN SOLAR	CS6X-310P	Poly	310	36.4	8.52	44.9	9.08	-0.43	-0
9	CANADIAN SOLAR	CS6X-305P	Poly	305	36.3	8.41	44.8	8.97	-0.43	-0
10	CANADIAN SOLAR	CS6X-300P	Poly	300	36.1	8.3	44.6	8.87	-0.43	-0
11	SUNEDISON	F335ByC	Mono	335	37.9	8.85	46.4	9.29	-0.45	-0
12	SUNEDISON	F330ByC	Mono	330	37.7	8.77	46.2	9.28	-0.45	-0



	A	B	C	D	E	F	G	H	I
1	Manufacture	Model	PacMax	EffMax	NightLoss	PdcMin	VmpMin	VmpMax	AbsMaxV
2	SMA	SC500CP-US	500000	98.5	150	3250	430	820	1000
3	SMA	SC630CP-US	630000	98.5	150	4095	500	820	1000
4	SMA	SC720CP-US	720000	98.6	150	4680	525	820	1000
5	SMA	SC750CP-US	750000	98.6	150	4875	545	820	1000
6	SMA	SC800CP-US	800000	98.7	150	5200	570	820	1000
7	SMA	SC2000	2000000	98.34	340	13000	570	1000	1000
8	SMA	SC2250	2250000	98.45	340	14625	840	1500	1500
9	EATON	PowerXpert1500	1500000	98.6	333	9750	500	1000	1000
10	EATON	PowerXpert1650	1650000	98.7	335	10725	550	1000	1000
11	GE	ProSolar4MVA	4000000	98.2	500	26000	821	1300	1500
12									

RESOLAR DEMONSTRATION

- **8760**

Using parameters defined in System Design, tool runs ‘pvsam’ module to retrieve hourly simulated values.

K18 {=IFERROR(RES.PV.HOURLY(System_Meteofile_8760,System_Param_8760),"")}

SYSTEM HOURLY OUTPUT

DATE	SUN POSITION				ARRAY PLANE		IRRADIANCE		WEATHER		ENVIROMENTAL			MODULE INPUT		STRING OUTPU	
Time Stamp	Sun	Zenith	Elevation	Azimuth	Plane Tilt	AOI	GHI	POA	T ambient	Wind Speed	Soil Loss	Albedo	Shading	Cell Irrad	Cell Temp	Vmpp	Im
M/D HH/MM	Over Horizon	[Degrees]	[Degrees]	[Degrees]	[Degrees]	[Degrees]	[W/m2]	[W/m2]	[°C]	[m/s]	[%]	[Fraction]	[%]	[W/m2]	[°C]	[V]	[A
1/1/09 0:30	down				0.0	0.0	0.0	0.0	7.3	17.1	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 1:30	down				0.0	0.0	0.0	0.0	6.9	19.9	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 2:30	down				0.0	0.0	0.0	0.0	6.5	19.9	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 3:30	down				0.0	0.0	0.0	0.0	6.1	19.9	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 4:30	down				0.0	0.0	0.0	0.0	5.8	15.8	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 5:30	down				0.0	0.0	0.0	0.0	5.4	15.8	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 6:30	down				0.0	0.0	0.0	0.0	5.1	15.8	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 7:30	sunrise	87.1	2.9	123.3	-5.0	82.9	8.0	19.5	4.8	18.4	2.0%	0.20	0.00	19.1	4.9	635.4	0.
1/1/09 8:30	up	80.2	9.8	131.3	-24.0	62.9	70.0	85.2	4.4	18.4	2.0%	0.20	0.00	83.5	5.3	694.9	0.
1/1/09 9:30	up	72.5	17.5	143.0	-45.0	51.8	110.0	102.5	5.4	18.4	2.0%	0.20	0.00	100.4	6.4	696.0	0.
1/1/09 10:30	up	66.7	23.3	156.4	-42.9	57.3	304.0	367.2	6.5	12.7	2.0%	0.20	0.00	359.9	11.6	701.8	3.
1/1/09 11:30	up	63.4	26.6	171.2	-17.0	62.1	434.0	452.4	7.5	12.7	2.0%	0.20	0.00	443.4	13.7	696.4	3.
1/1/09 12:30	up	63.2	26.8	186.6	12.9	62.5	457.0	469.2	7.7	12.7	2.0%	0.20	0.00	459.8	14.1	695.2	3.
1/1/09 13:30	up	66.0	24.0	201.6	39.6	58.2	413.0	541.3	7.9	14.2	2.0%	0.20	0.00	530.5	14.7	693.5	4.
1/1/09 14:30	up	71.5	18.5	215.2	45.0	52.3	304.0	559.1	8.1	14.2	2.0%	0.20	0.00	547.9	15.2	691.9	4.
1/1/09 15:30	up	79.0	11.0	227.1	28.0	59.6	99.0	153.5	8.1	14.2	2.0%	0.20	0.00	150.4	10.0	693.6	1.
1/1/09 16:30	sunset	86.4	3.6	236.0	7.0	80.7	11.0	16.3	8.1	15.6	2.0%	0.20	0.00	16.0	8.3	631.5	0.
1/1/09 17:30	down				0.0	0.0	0.0	0.0	8.1	15.6	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 18:30	down				0.0	0.0	0.0	0.0	7.5	15.6	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 19:30	down				0.0	0.0	0.0	0.0	7.0	20.4	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 20:30	down				0.0	0.0	0.0	0.0	6.5	20.4	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 21:30	down				0.0	0.0	0.0	0.0	6.5	20.4	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 22:30	down				0.0	0.0	0.0	0.0	6.5	16.6	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/1/09 23:30	down				0.0	0.0	0.0	0.0	6.6	16.6	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/2/09 0:30	down				0.0	0.0	0.0	0.0	6.3	16.6	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/2/09 1:30	down				0.0	0.0	0.0	0.0	6.1	19.0	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/2/09 2:30	down				0.0	0.0	0.0	0.0	5.9	19.0	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/2/09 3:30	down				0.0	0.0	0.0	0.0	6.1	19.0	2.0%	0.20	0.00	0.0	0.0	0.0	0.
1/2/09 4:30	down				0.0	0.0	0.0	0.0	6.3	17.9	2.0%	0.20	0.00	0.0	0.0	0.0	0.

Site | Meteo | System Design | 8760 | Optimization | Lifetime | 12x24

RESOLAR DEMONSTRATION

- **12x24**

Using parameters defined in System Design, tool runs ‘pvsam’ module to retrieve monthly simulated values.

F17 {=IFERROR(RES.PV.12x24(System_Meteofile,System_Param),"")}

12x24

SYSTEM ENERGY YIELD - 12x24 [MWh/year]

Hour	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5	0.0	0.0	0.0	0.4	3.1	6.9	3.9	0.6	0.0	0.0	0.0	0.0
6	0.0	0.0	1.5	9.1	12.7	20.0	16.6	11.9	5.4	0.9	0.0	0.0
7	0.3	4.2	12.7	18.6	18.4	25.0	21.3	20.4	19.1	13.5	4.2	0.4
8	10.7	15.7	17.5	20.8	21.1	24.5	23.9	24.9	22.6	22.9	15.7	10.0
9	15.9	17.0	21.9	21.6	21.7	23.8	25.0	26.2	23.1	21.8	17.0	15.1
10	15.7	17.6	22.1	22.0	21.4	23.4	25.1	22.7	20.6	18.9	16.3	13.8
11	14.6	16.0	21.2	20.0	22.6	23.5	24.5	21.1	20.8	18.5	13.5	12.9
12	14.4	15.1	21.3	20.5	23.5	21.6	22.4	20.3	19.4	15.9	15.3	11.7
13	13.8	15.0	20.2	18.9	23.7	18.2	18.4	17.5	19.2	15.5	16.1	12.5
14	13.5	16.8	20.2	18.5	20.3	18.5	17.0	14.6	18.1	17.4	15.8	13.8
15	12.9	15.3	19.7	14.8	17.3	19.2	15.5	15.5	15.6	15.7	8.3	9.3
16	1.8	8.3	17.2	16.5	17.9	18.8	13.9	13.9	13.1	4.9	0.4	0.2
17	0.0	0.2	3.6	8.6	13.1	13.7	11.3	7.5	2.7	0.0	0.0	0.0
18	0.0	0.0	0.0	0.3	2.0	4.8	3.7	0.8	0.0	0.0	0.0	0.0
19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Site | Meteo | System Design | 8760 | Op

Ready 100%

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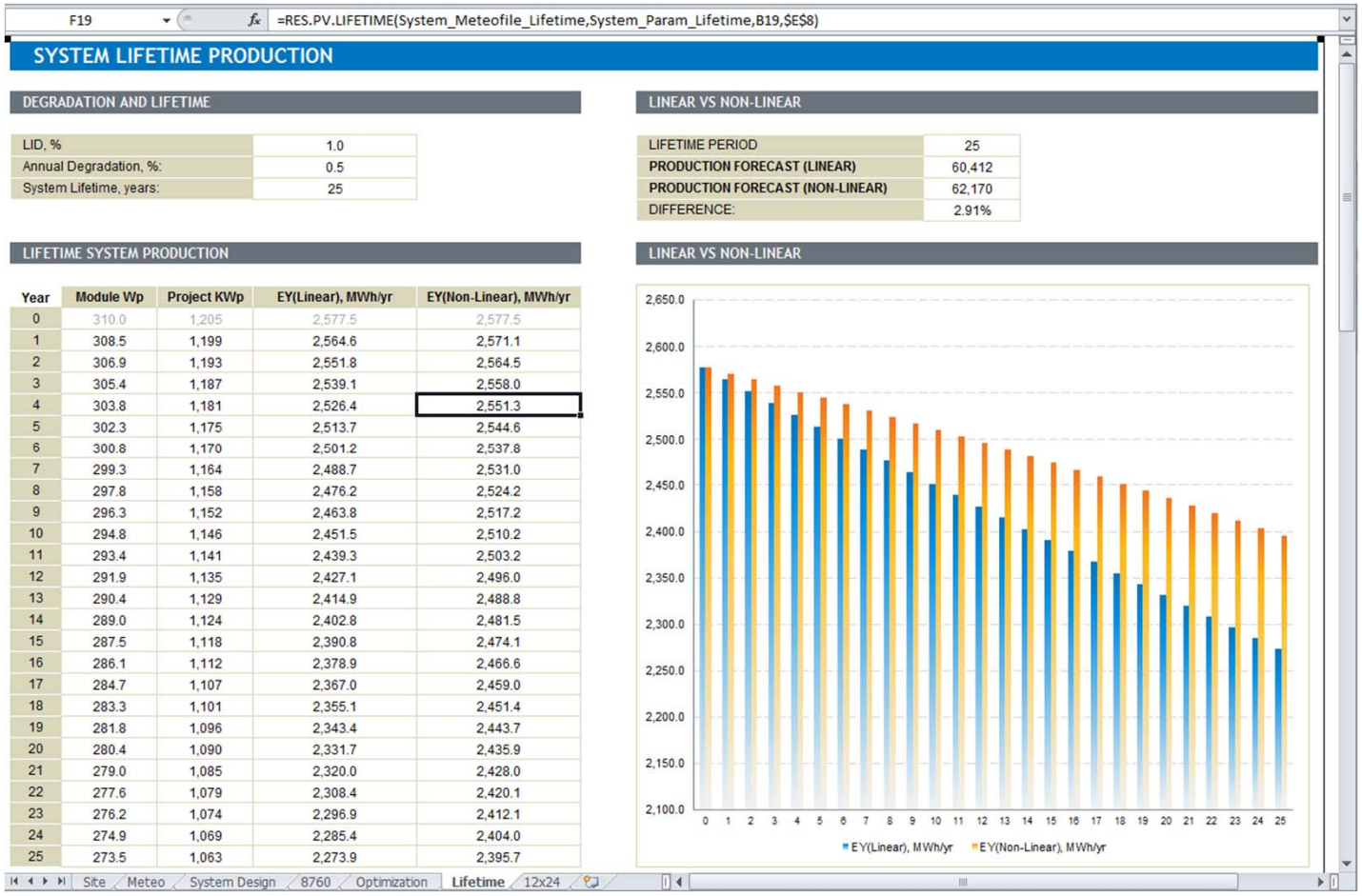
RESOLAR DEMONSTRATION

- **SYSTEM LIFETIME**

For each consecutive year tool runs 'pvsam' module applying specified degradation rate to Module Nameplate. This approach takes into account system loss behavior associated with DC rating reduction (Inverter Clipping, Ohmic Losses etc.)



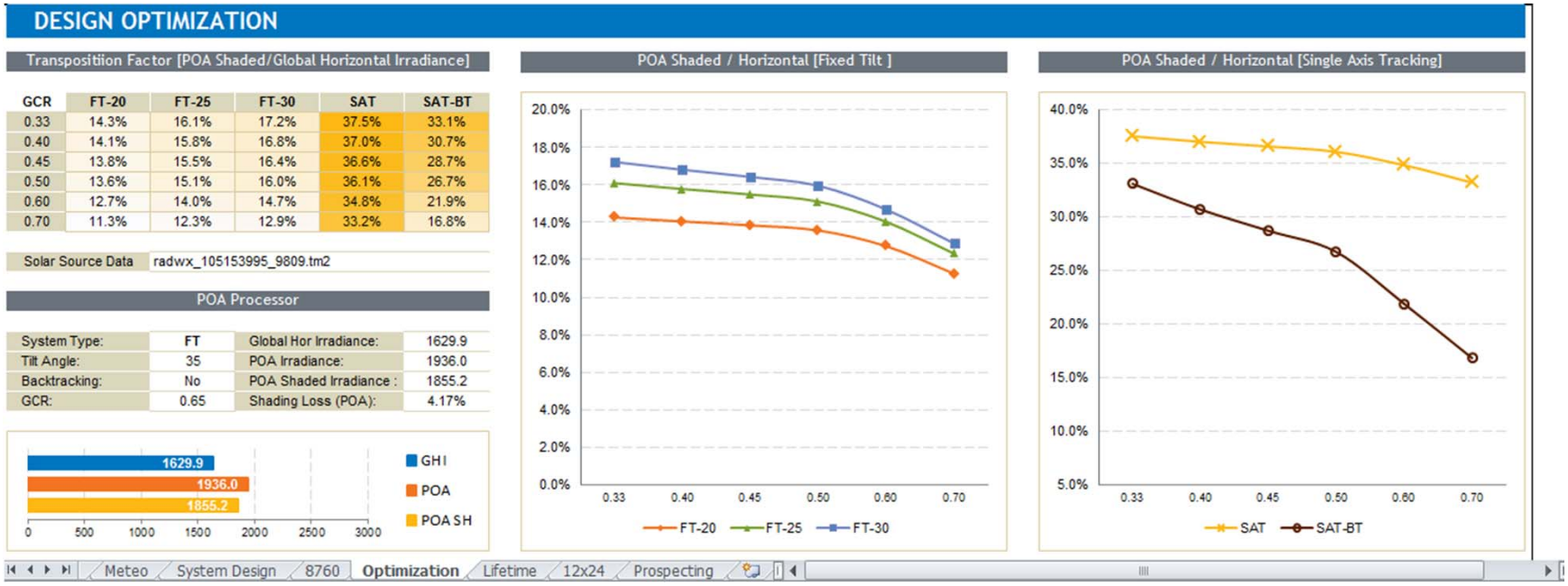
Year	Module Wp	Project KWp	EY(Linear), MWh/yr	EY(Non-Linear), MWh/yr
0	310.0	1,205	2,577.5	2,577.5
1	308.5	1,199	2,564.6	2,571.1
2	306.9	1,193	2,551.8	2,564.5
3	305.4	1,187	2,539.1	2,558.0
4	303.8	1,181	2,526.4	2,551.3
5	302.3	1,175	2,513.7	2,544.6
6	300.8	1,170	2,501.2	2,537.8
7	299.3	1,164	2,488.7	2,531.0
8	297.8	1,158	2,476.2	2,524.2
9	296.3	1,152	2,463.8	2,517.2
10	294.8	1,146	2,451.5	2,510.2
11	293.4	1,141	2,439.3	2,503.2
12	291.9	1,135	2,427.1	2,496.0
13	290.4	1,129	2,414.9	2,488.8
14	289.0	1,124	2,402.8	2,481.5
15	287.5	1,118	2,390.8	2,474.1
16	286.1	1,112	2,378.9	2,466.6
17	284.7	1,107	2,367.0	2,459.0
18	283.3	1,101	2,355.1	2,451.4
19	281.8	1,096	2,343.4	2,443.7
20	280.4	1,090	2,331.7	2,435.9
21	279.0	1,085	2,320.0	2,428.0
22	277.6	1,079	2,308.4	2,420.1
23	276.2	1,074	2,296.9	2,412.1
24	274.9	1,069	2,285.4	2,404.0
25	273.5	1,063	2,273.9	2,395.7

RESOLAR DEMONSTRATION

- **OPTIMIZATION**

Flexibility of user defined functions allows various parametric scenarios i.e.:

- GCR vs Plane Orientation vs Shading Impact



RESOLAR DEMONSTRATION

- **PROSPECTING**

Having a list of coordinates, it is a matter of copy/paste to get system production for multiple locations.

M64

SOLAR PROSPECTING

SYSTEM ENERGY YIELD

##	Latitude	Longitude	Label	Solar Resourse	EY, MWh/yr	PR, %	NCF, %	kWh/kWp/yr
1	34.9546168434	-77.7642968145	Pink Hill, North Carolina	_077753495_9809.tm2	4,257.7	83.5%	24.30%	1,728.0
2	35.0511927434	-77.8448808342	Albertson, North Carolina	_077853505_9809.tm2	4,345.7	83.8%	24.80%	1,763.7
3	35.0510023075	-77.8422960080	Albertson, North Carolina	_077853505_9809.tm2	4,345.7	83.8%	24.80%	1,763.7
4	35.0575156435	-77.5903799249	Pink Hill, North Carolina	_077553505_9809.tm2	4,271.6	83.5%	24.38%	1,733.7
5	35.0078957843	-77.5625676263	Trenton, North Carolina	_077553505_9809.tm2	4,271.6	83.5%	24.38%	1,733.7
6	33.4656286321	-88.9031954602	Starkville, Mississippi	_088953345_9809.tm2	4,332.5	83.7%	24.73%	1,758.4
7	33.5047809730	-88.8029829624	Starkville, Mississippi	_088853355_9809.tm2	4,280.9	82.6%	24.43%	1,737.5
8	33.4782197097	-88.7405305321	Starkville, Mississippi	_088753345_9809.tm2	4,305.6	83.6%	24.58%	1,747.5
9	33.4774212144	-88.7378155644	Starkville, Mississippi	_088753345_9809.tm2	4,305.6	83.6%	24.58%	1,747.5
10	33.4696975219	-88.5959175471	Columbus, Mississippi	_088553345_9809.tm2	4,295.8	82.8%	24.52%	1,743.5
11	33.4318493595	-88.5575481512	Columbus, Mississippi	_088553345_9809.tm2	4,295.8	82.8%	24.52%	1,743.5
12	33.4540025154	-88.5658605502	Columbus, Mississippi	_088553345_9809.tm2	4,295.8	82.8%	24.52%	1,743.5
13	34.2555239168	-88.6963867605	Tupelo, Mississippi	_088653425_9809.tm2	4,258.0	83.5%	24.30%	1,728.1
14	34.3778877334	-88.8589502050	Blue Springs, Mississippi	_088853435_9809.tm2	4,279.4	83.8%	24.43%	1,736.8
15	34.4193042565	-89.0177755352	New Albany, Mississippi	_089053445_9809.tm2	4,293.6	83.7%	24.51%	1,742.6
16	34.4858037402	-89.0716932696	New Albany, Mississippi	_089053445_9809.tm2	4,293.6	83.7%	24.51%	1,742.6
17	34.3797551786	-89.0209988863	Ecru, Mississippi	_089053435_9809.tm2	4,317.8	83.5%	24.64%	1,752.4
18	34.2624493419	-89.0690687394	Pontotoc, Mississippi	_089053425_9809.tm2	4,285.6	83.7%	24.46%	1,739.4
19	34.3505128521	-89.5344366016	Oxford, Mississippi	_089553435_9809.tm2	4,339.7	83.7%	24.77%	1,761.3
20	34.2631754884	-89.5694054453	Oxford, Mississippi	_089553425_9809.tm2	4,310.7	83.7%	24.60%	1,749.5
21	32.7664566564	-89.1156924201	Philadelphia, Mississippi	_089153275_9809.tm2	4,245.0	83.5%	24.23%	1,722.9
22	32.5779852424	-89.3264781687	Walnut Grove, Mississippi	_089353255_9809.tm2	4,350.5	83.2%	24.83%	1,765.7

System Design | 8760 | Prospecting | Optimization | Lifetime

CONCLUSION AND FUTURE WORK

During this presentation it has been demonstrated some basic benefits of SAM Software Development Kit:

- Ease of use,
- High performance,
- Flexibility.

Thank to a wide range of SAM functionality and often update releases, some additional ideas could be outlined here for future improvements of SAM EXCEL SDK:

- Detailed system BOM in combination with SAM financial model,
- Inverters shading visualization in CAD based on Sun position extracted from SAM,
- Battery Energy Storage + PV integrated solution

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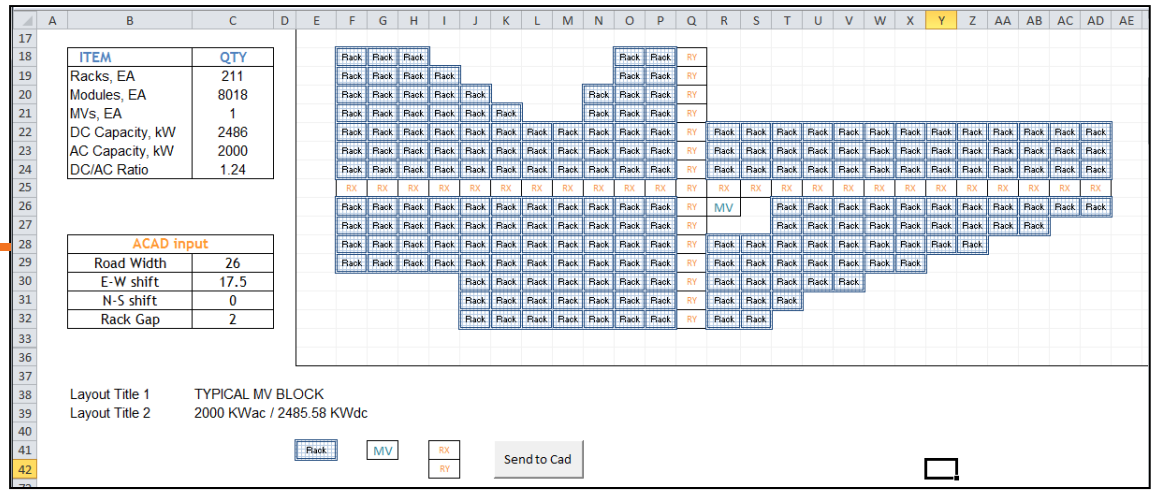
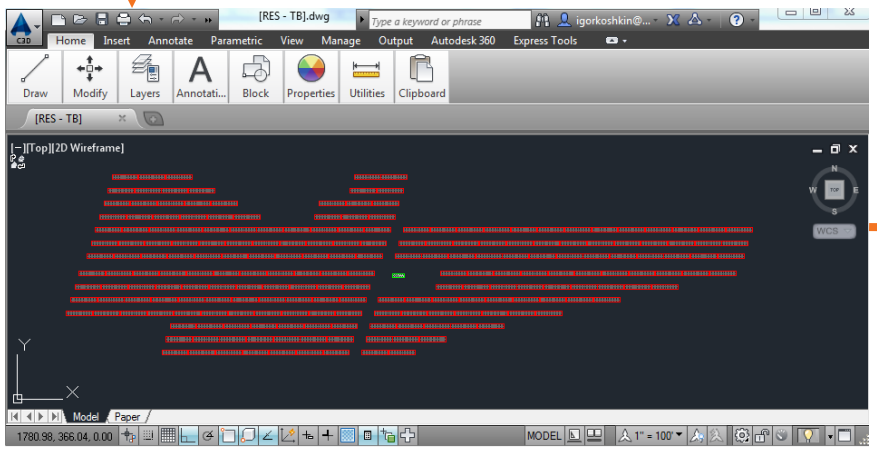
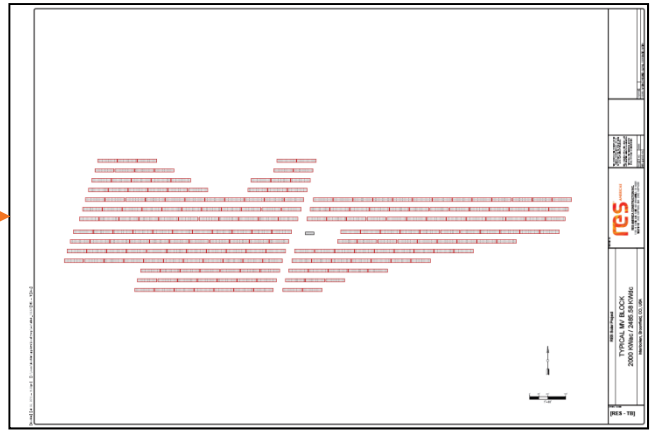
AUTOCAD LAYOUT GENERATION

Different kind of feature is system layout generation in CAD. Using simple interface, user can specify desired placement of racks and offsets. Based on System Design parameters tool recreates layout in CAD maintaining main system parameters such as tilt angle, module/rack dimension and row-to-row spacing.







Thank you!

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