

Introduction to HelioScope

F[⏻]LSOM LABS

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HelioScope 101

Similar to Typical Performance Models:

- Use standard weather inputs (TMY3, etc.)
- Hourly 8760 production analysis
- Return system AC energy (inverter AC out)

Different from Typical Performance Models:

- Component-Driven
- Design-Integrated
- Cloud-Based

Design C

[Design Details](#)

[Upload Wiring](#)

Mechanical

Electrical

Tools

[« wiring zones](#)

[wiring detail »](#)

Default Wiring Zone (283.9KWp)

Clear

Generate Wiring

Description

Inverter (DC/AC 1.14)

Count

Trunk Gauge

Bus Gauge

Combiner Poles

String Gauge

String Length

Stringing

Indiana St

Indiana St

CAL STEAM
A WOLSELEY
company

Mariposa St

Mariposa St

400

Minnesota St

Minnesota St

Fileq

Structure of the Model

Condition Set Parameters:

- Weather
- Shade patterns (if applicable)
- Soiling assumptions
- Mismatch assumptions
- Cell-temp model
- Transposition model

Design Parameters:

- Module specifications
- Inverter specifications
- Module orientation
- Electrical design

The screenshot shows a 'Simulations Matrix' interface. The table has a 'Designs' column on the left and 'Condition Sets' columns on the right. The 'Condition Sets' columns are 'Condition Set B', 'Condition Set C', and 'Condition Set D', each with a red house icon. There is also a 'New Condition Set' button. The 'Designs' rows are 'Small roof', 'Design D', 'Design C', 'Baseline Design B', and 'Baseline Design A', each with a red house icon. At the bottom of the 'Designs' column is a 'New Design' button. The cells contain 'Simulate' (orange) or 'Report' (blue) buttons.

		Condition Sets			
		Condition Set B	Condition Set C	Condition Set D	New Condition Set
Designs	Small roof				
	Design D				
	Design C				
	Baseline Design B				
	Baseline Design A				
	New Design				

Design A

Design Details

Upload Wiring



Mechanical



Electrical



Tools

[« back to list](#)

Field Segment Details

Potential Modules: 736 (176.6kW)



Undo

Update Field Segment

Description

Trina TSM-240PA05, Trina (240W, F...

Azimuth °

Tilt °

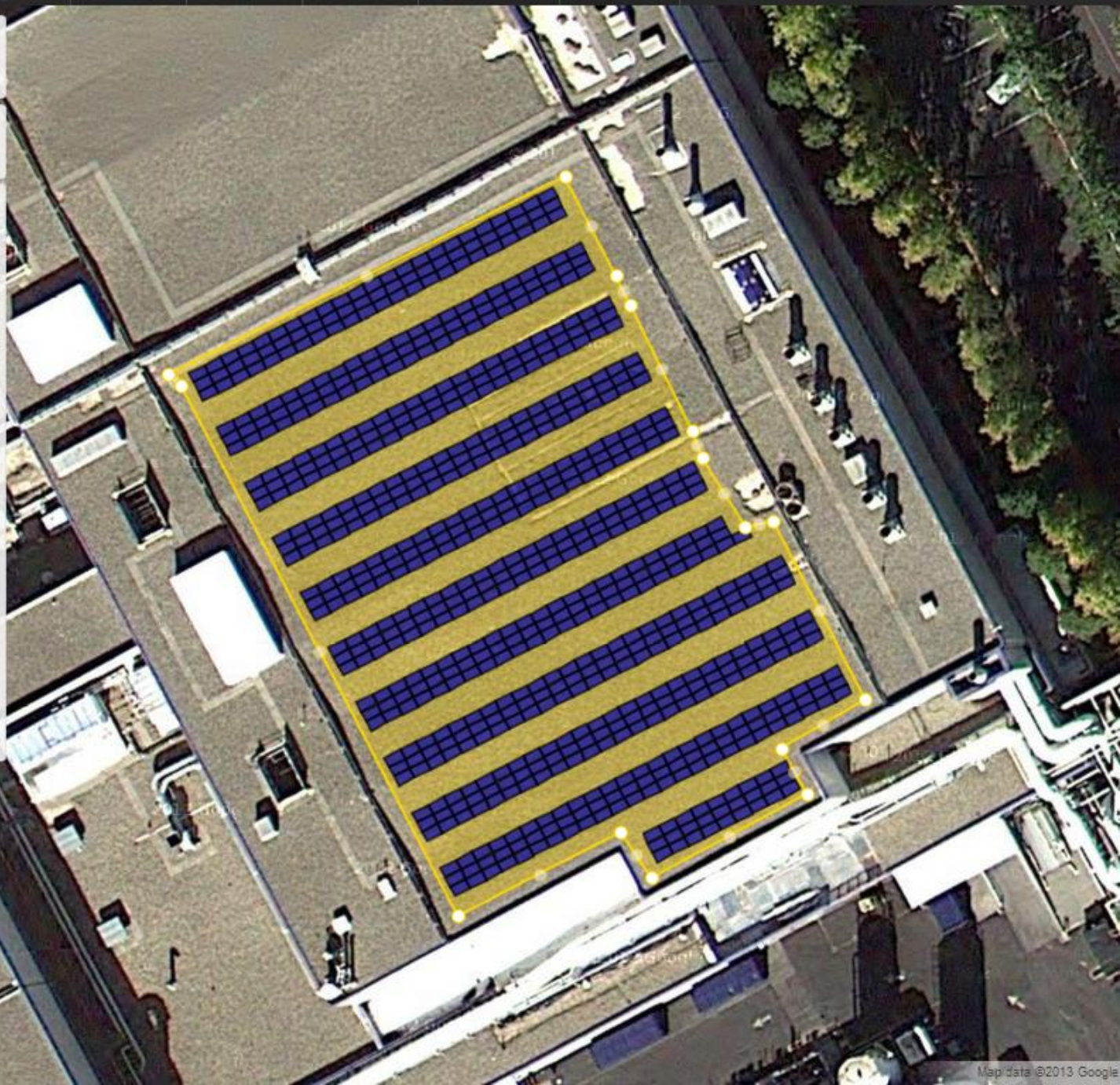
Orientation

Racking

Bank Depth

Row Spacing m

Module Spacing m



Design A

Design Details

Upload Wiring



Mechanical



Electrical



Tools

« wiring zones

wiring detail »

Default Wiring Zone (176.6KWp)

Clear

Generate Wiring

Description Default Wiring Zone

Inverter (DC/AC 1:18)

Count

PVP 75KW-600, Advanced E...

2

Trunk Gauge MCM500

Bus Gauge GA2

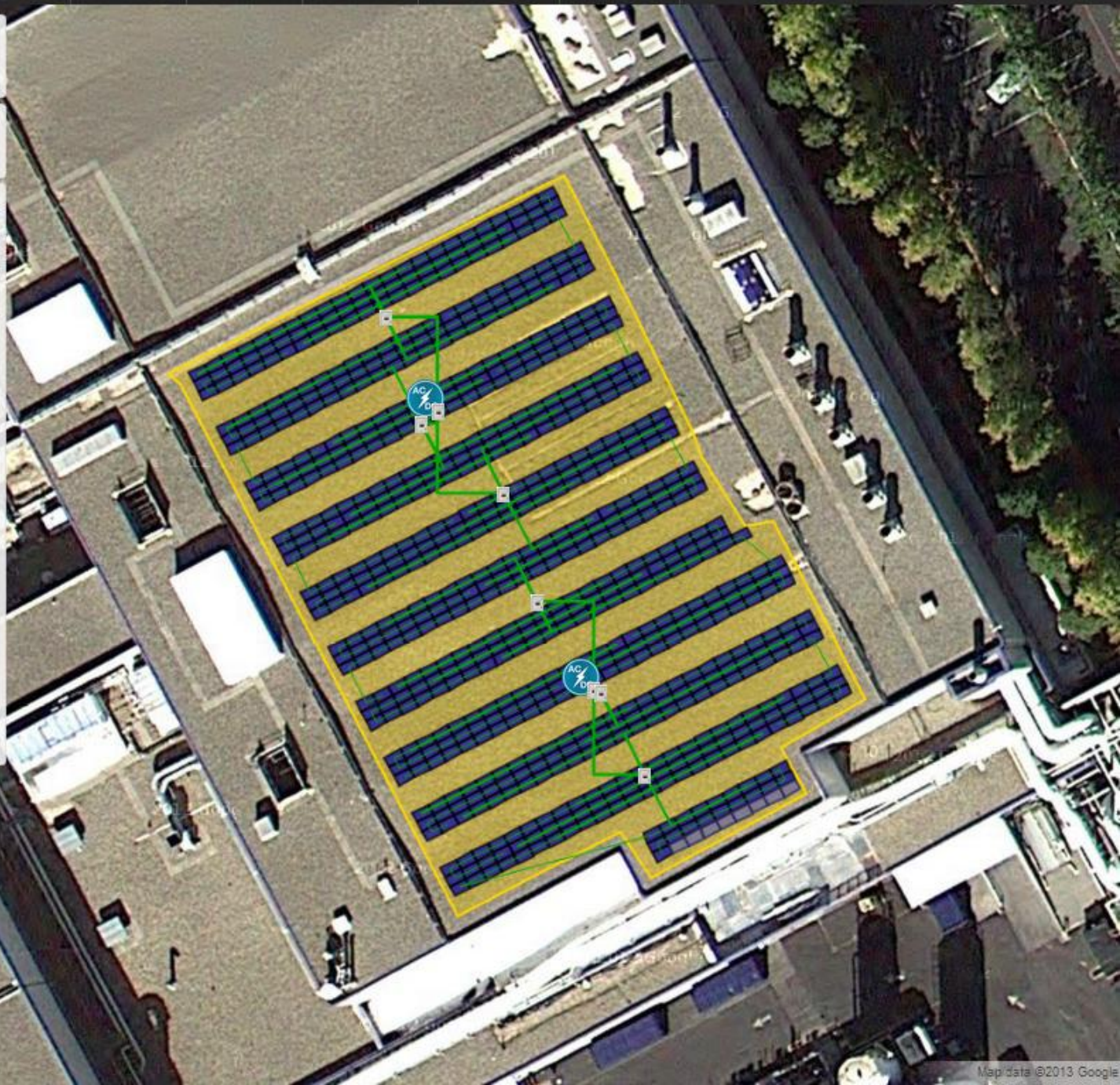
Combiner Poles 12

String Gauge GA10

String Length 13

Stringing Alone Racking

- Select an Optimizer (Optional) -



Design A

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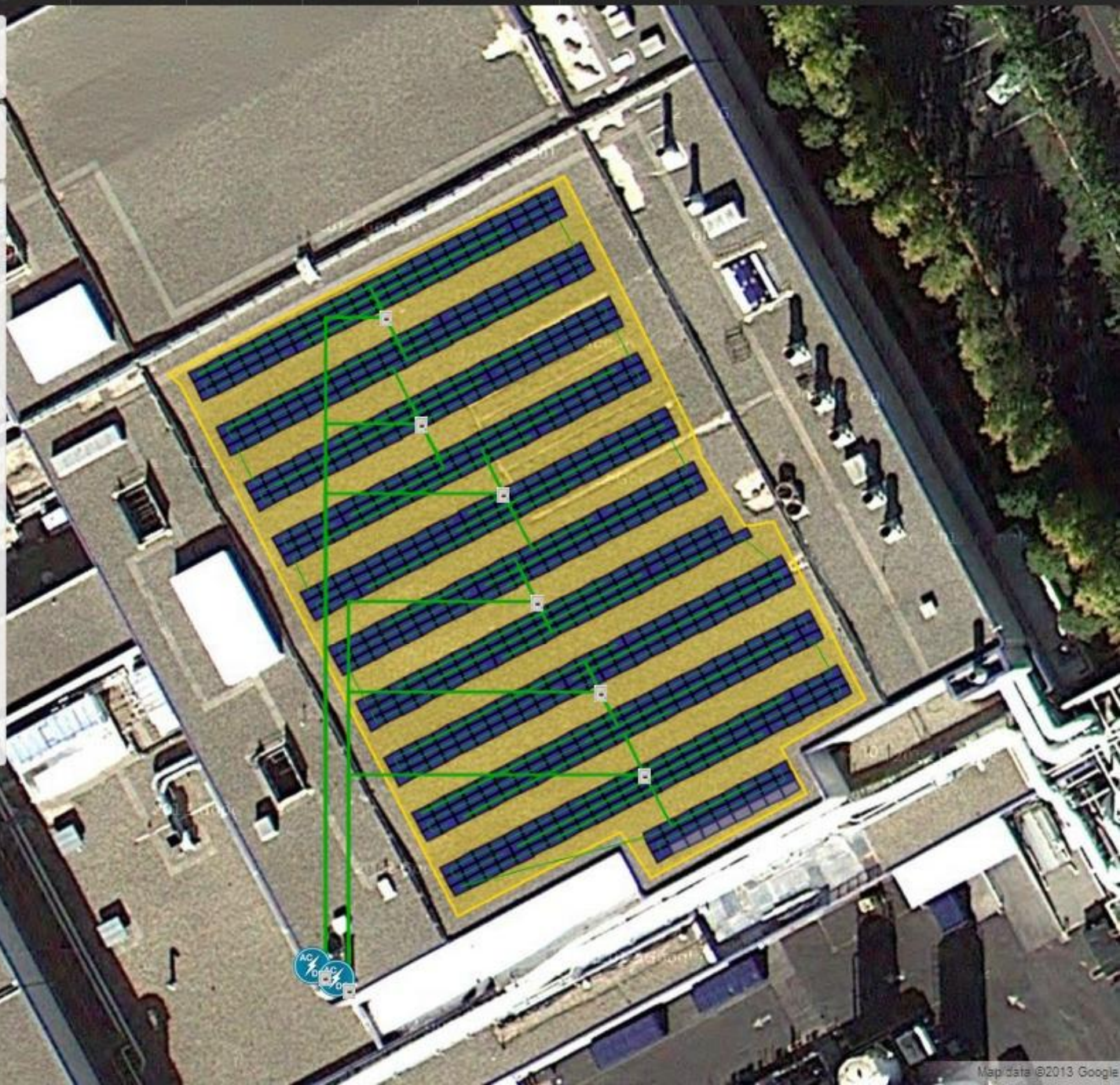
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Design A

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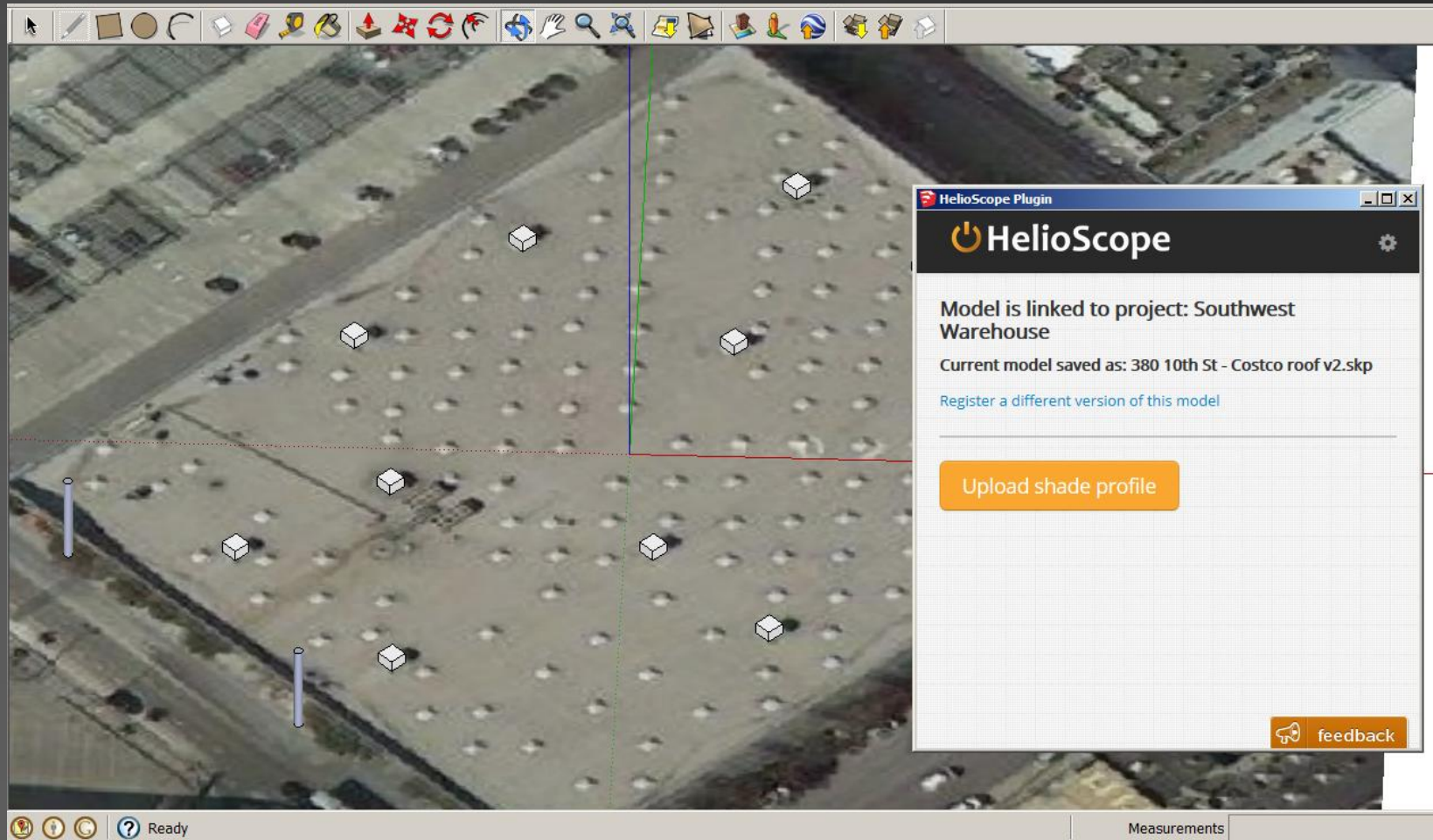
Stringing Alone Racking

- Select an Optimizer (Optional) -

Cross-bank Shade Is Done Based On The Three-Dimensional Geometry Of The Module Bank



Shade Patterns are Generated from SketchUp



Advanced Users can Choose between Perez or Hay Models for Transposition, and between Sandia or Linear Diffusion for Cell Temperature

The image shows a software interface for configuring simulation conditions. The main window is titled "New Condition Set" and contains several sections:

- Description:** A text input field containing "Conditions Description".
- General Information:** A section with several dropdown menus:
 - Weather Source:** "Select a weather station" (The Meteorological data used for the simulation)
 - Sketchup Shading Scene:** "Select a shade profile" (The near shadings file to be used, influences only be)
 - Horizon Profile:** "Select a horizon profile" (The far shading)
 - Transposition Model:** A dropdown menu with "Perez Model" selected, and "Hay Model" and "Perez Model" as visible options. (al diffuse to POA)
- Monthly Soiling Factors:** A section with a button.
- Cell Temperature Model:** A section with a dropdown menu set to "Sandia Model" (The temperature model used to calculate cell temperature based on irradiation).
- Additional Sources of Mismatch:** A section with a button.

An inset window titled "Cell Temperature Model" provides detailed configuration for two racking types:

Parameter	Fixed Tilt Racking	Flush Mount Racking
Cell Temperature Model	Sandia Model	Sandia Model
Constant Thermal Loss Factor (a)	-3.560	-2.810
Wind Thermal Loss Factor (b)	-0.0750	-0.0455
Difference between module and cell temperature	3.00	0.00

Each parameter in the inset window includes a text description of its function.

Mismatch is Handled as a Statistical Property Rather than a Loss Assumption

New Condition Set

Description: Conditions Description

General Information

Monthly Soiling Factors

Cell Temperature Model

Additional Sources of Mismatch

Irradiation Variance	5.00 %	Temperature Spread	4.00 °C
Standard Deviation Around Expected Irradiance (Normal Distribution).		Total degree spread centered around the modeled cell temperature	
Min Module Tolerance	-2.50 %	Max Module Tolerance	2.50 %
Minimum deviation from specified maximum power point (linear distribution)		Maximum deviation from specified maximum power point (linear distribution)	

Close New Conditions Set

Reports



Sharing is Native

The screenshot displays the HelioScope web application interface. At the top, the HelioScope logo is on the left, and the user name 'Paul Grana' is on the right. A navigation bar below the logo contains icons for Home, Projects (highlighted), Designs, Conditions, Reports, and Documentation. The main content area shows the project details for 'Biltmore Santa Clara' at '2151 Laurelwood Rd, Santa Clara, CA'. On the left, there are three sections: 'Common Actions' with buttons for 'New Design', 'New Conditions', and 'Add Shading'; 'Overview' with a table of project metadata; and 'Project Location'. On the right, there are three sections: 'Existing Designs' with a table showing 'Design A' at '215,280.0 kW' and action buttons; 'Existing Condition Sets' with a message 'No Condition Sets defined, create a new condition set now'; and 'Users (You are an administrator)' with a 'Share' button and a table showing 'Paul Grana' as the 'Owner'. A 'feedback' button is located in the bottom right corner.

HelioScope Paul Grana

Home Projects Designs Conditions Reports Documentation

Biltmore Santa Clara / Project Details

Biltmore Santa Clara

 2151 Laurelwood Rd, Santa Clara, CA

Common Actions




- New Design
- New Conditions
- Add Shading

Overview

Project	Biltmore Santa Clara
Address	2151 Laurelwood Rd, Santa Clara, CA
Description	
Owner	Paul Grana
Last Modified	2013-05-01 01:42:04
Location	(37.386541,-121.963107) (GMT -8)

Project Location

Existing Designs

Design	Nameplate Power	Actions
Design A	215,280.0 kW	  

Existing Condition Sets

Description Weather Actions

No Condition Sets defined, [create a new condition set now](#)

Users (You are an administrator) [Share](#)

User	Role	Actions
Paul Grana	Owner	

[feedback](#)

We Fully Document All Equations Used in HelioScope

HelioScope
Paul Grana

Home
Projects
Designs
Conditions
Reports
Documentation

OVERVIEW

SYSTEM MODEL

- Inverters
- Combiners
- Wires
- Distributed Electronics

MODULE MODEL

- Single-Diode Model
- PVSyst Diode Model
- Temperature Model

ENVIRONMENT MODEL

- Meteorological Data
- Irradiance Calculations
- Irradiance Adjustments
- Near Shading
- Other Mismatch

CONCLUSIONS

Near Shading

When modules are arranged in multiple rows, each row limits the share of the sky available to the row behind it; this limits the available diffuse light throughout the year. Using the angle from the collector to the top edge of the collector in front of it (γ), the formula becomes:

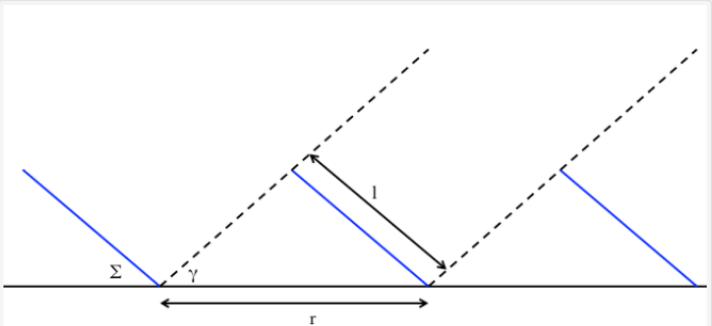
$$D_{iso}^p = \frac{1}{2\pi} \int_{\gamma}^{\pi - \Sigma_C} \int_0^{\pi} \sin^2(\phi) \cdot \sin(\theta + \Sigma_C) d\phi d\theta = \frac{1 + \cos(\Sigma_C + \gamma)}{2}$$


Diagram of Angles for Shed Calculations

This is used for any commercial or utility system with rows of raked modules, without specific geometric data. However, as a result of using detailed design data for the system, the exact module locations are known, which allows us to add back in additional irradiation for modules on the edge of the array:

$$D_{iso} = \frac{1 + \cos(\Sigma_C + \gamma)}{2} + \frac{1}{2\pi} \int_0^{\gamma} \left(\int_0^{\phi_{max}} \sin^2(\phi) \cdot \sin(\theta + \Sigma_C) d\phi + \int_{\phi_{min}}^{\pi} \sin^2(\phi) \cdot \sin(\theta + \Sigma_C) d\phi \right)$$

Similarly, for the reflected factor, the only portion of the ground available for reflected light is the ground between the rows of panels. If the angle from the module to the ground beneath the top edge of the collector in front of it is ϵ , then the reflected radiation adjustment becomes:

$$R_{iso} = \frac{1}{2\pi} \int_{-\Sigma_C}^{\epsilon} \int_0^{\pi} \sin^2(\phi) \cdot \sin(\theta + \Sigma_C) d\phi d\theta$$

feedback

Our Path Forward

- HelioScope is currently in beta
- Commercial launch planned this summer
- We have many next steps – Paul Gibbs will discuss tomorrow

Thank You

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