Effect of Intra-row Placement of Pyranometers on Capacity Tests

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Placement of Pyranometers within a row can impact measured POA Irradiance

- Previous research has demonstrated that annual plane of array (POA) irradiance can vary up to 3% depend on the East Edge, Center, or West edge alignment of pyranometers within a single-axis tracking row that performs backtracking[1], and as much as 16% within a single day
- This study evaluated an operating project in West TX that does not backtrack. The project has POA pyranometers distributed through the site that align with the East, Center, and West of the module (Fig. 1). The goal was to observe how using the different sensors would affect the results of ASTM2848 capacity tests
- This research is of particular importance as designing a non-backtracking site with exclusively Center aligned pyranometers can pose operational challenges due to numerous hours with interrow shading



Figure 1: The evaluated project has 9 POA pyranometers distributed through the site, with some aligned with the East (left), Center (middle), and West (right) of the module

Comparison of Measured Plane of Array Irradiance

- A direct comparison of annual POA irradiance between East, Center, and West-aligned pyranometers is difficult, as expected interrow shading in a non-backtracking system will results in variance, which can disguise biases.
- However, an evaluation of measured POA between the E, C, and W system confirms that West sensors are more likely to err high in the mornings and East sensors to err high in the afternoon (Fig 2, 3).

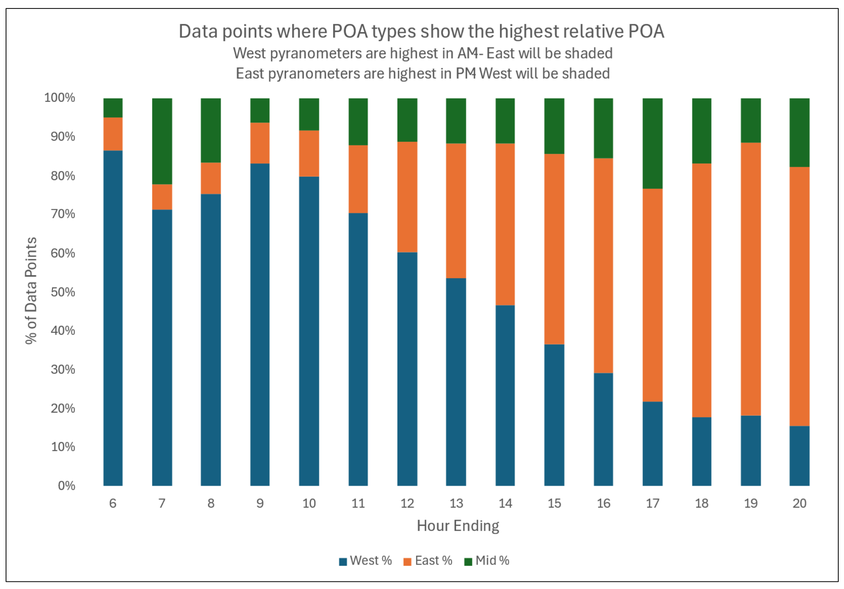


Figure 2: Pyranometers aligned with the West edge are more likely to show higher irradiance in the morning than peers, and pyranometers aligned with the East edge show higher afternoon irradiance

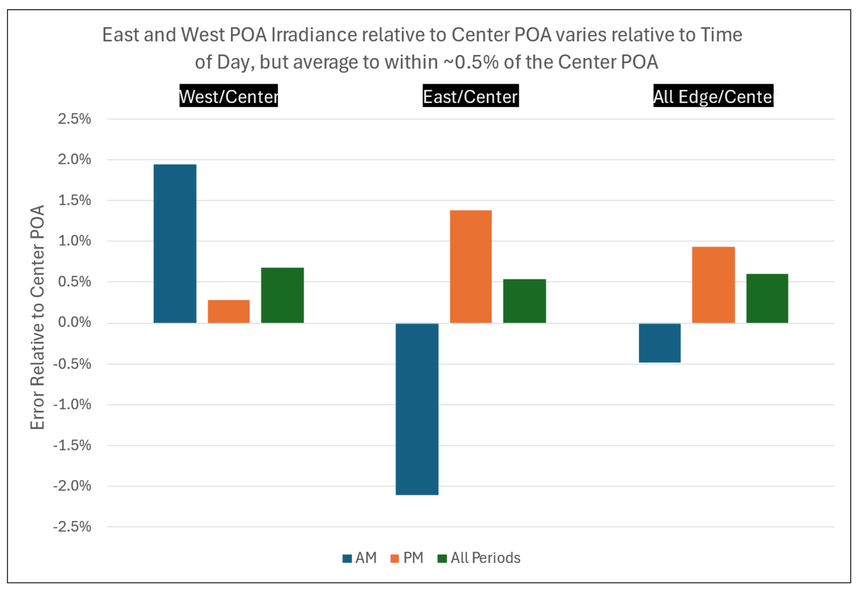
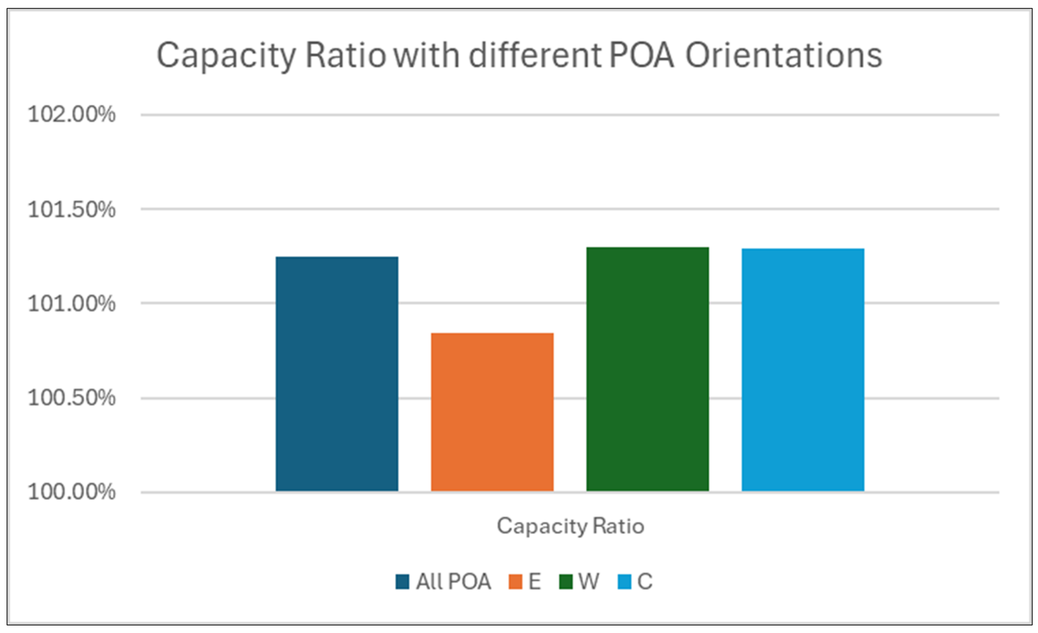


Figure 3: The difference relative in "edge" irradiance to center irradiance is often symmetrical, and averages to within 0.5% over the course of a capacity test period

Impacts of Measured POA Irradiance on Capacity Test Results



Capacity Ratios Relative to only using Center POA		
All POA	E	W
-0.04%	-0.45%	0.01%

Figure 4: Relative Capacity Ratio using POA sensors from edge orientations are within 0.5% of the Center orientation, and within 0.1% when using all sensors

- ASTM2848 Capacity Tests were performed over a 2-week period using POA data from sensors in in the East, Center, and West orientations separately, as well as all sensors together.
- Results showed the relative capacity ratio of the tests using only edge sensors to be within 0.5% of the Center orientation.
- The test ratio using all combined sensors was within 0.1% of the result when using only the Center orientation.
- The results of this study indicate that measured capacity ratio over a multi-week capacity test is not significantly impacted by intra-row POA pyranometer placement.
- Additional benefits of this configuration on operational KPIs are currently under investigation

1. Improving Performance Ratio Calculations by Optimizing Front POA Irradiance Sensor Position, PVPMC 2024, M. Korevaar, D. Ntel