TrueCapture™ Outperforms Modeled Energy Yield Projections in ICF's Analysis

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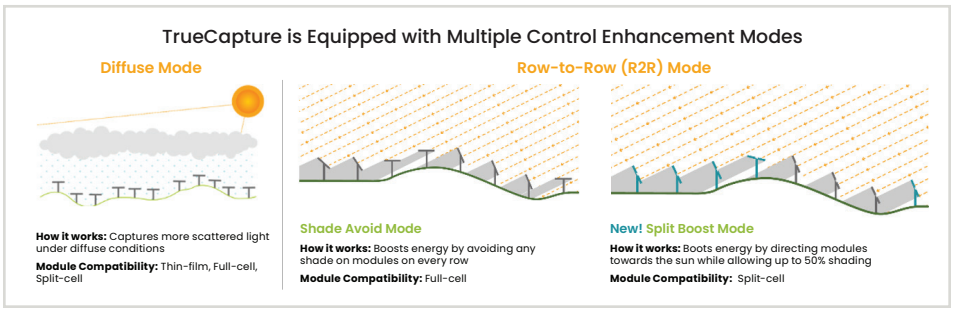
Independent engineering assessment validates increased energy harvest with Nextracker's yield optimization software, demonstrating real annual gain outperforming model projections on average by 136 percent.

Utility-scale solar developers and asset owners turn to the most comprehensive simulation tools at their disposal, such as PVsyst and other leading solar generation software, to model electricity production, predict energy losses, and ultimately try to predict financial performance. Modeling can be a risky business, however. Any error in the performance model, no matter how small the difference between estimated production and actual production, can add substantial risk over a project lifecycle lasting 35 years or more.

Since projects almost never perform precisely as modeling software expects them to perform, the million-dollar question is: how likely are projects to outperform the model, delivering greater-than-expected financial results?

Nextracker commissioned ICF, a Virginia-based provider of independent engineering and owners engineering services for renewable and thermal generation, to conduct its own performance review of four utility-scale solar power generation projects to study Nextracker's TrueCapture™ yield optimization software. Paired with the NX Horizon™ solar tracker system, TrueCapture combines advanced sensors, weather forecasting, and machine-learning technologies to boost performance by continuously optimizing the tracking algorithm of each individual row in response to site features and changing weather conditions.

In their analysis, ICF concludes that across the four project sites tested (two in the Southeastern US, one in the Central United Kingdom, and one in Southern Australia), TrueCapture delivered gains for each application, minimizing inter-row shade losses on undulating terrain and capturing more energy when atmospheric conditions create periods of high diffuse irradiance. Overall, ICF observed an average of 136 percent of measured annual gain compared to PVsyst model outputs for the four sites.



Along with the European-based Enertis Applus+ IE report (June 2023) that found 1-2 percent energy gains from TrueCapture's Split Boost Mode for half-cell modules, the new ICF analysis adds to a growing collection of independent engineering studies proving TrueCapture's system control capabilities.

ICF Testing and Verification Methodology for TrueCapture

ICF separately analyzed TrueCapture's effect on inter-row shading and diffuse light conditions using data provided by Nextracker and third-party data. Inputs included a year of operational data, topography data from the US Geological Survey, and bankable satellite-based weather and irradiance data from Clean Power Research. ICF performed the analysis in 2023 using system performance data and weather data collected between 2021 and 2022.

ICF used PVsyst to model production with and without elevation, incorporating system design details in site drawings, topography data, and weather data. For sites with inter-row shading, losses due to terrain ranged from 0.85 percent to 1.19 percent, in line with expectations for sites with moderately undulating terrain.

ICF modeled TrueCapture performance in diffuse light conditions by modeling the tracker system as a batch simulation of fixed-tilt systems across the full range of motion for a 60-degree tracker, in one-degree increments, to find an optimal angle for energy production, and used the optimal angle to simulate optimal tracking production in diffuse light. ICF then compared optimal tracking production in diffuse light to standard backtracking, which seeks to simply adjust tracking in the early morning and late afternoon to minimize shading. TrueCapture aims to achieve optimal tracking production in diffuse light conditions.

ICF applied generation estimates from the optimal tracking production scenario and the standard backtracking scenario to PVsyst. It determined that for sites seeking to optimize output in diffuse light conditions, potential gains ranged from 0.42 percent to 0.99 percent. These values align with expectations for regions with moderate cloud cover.

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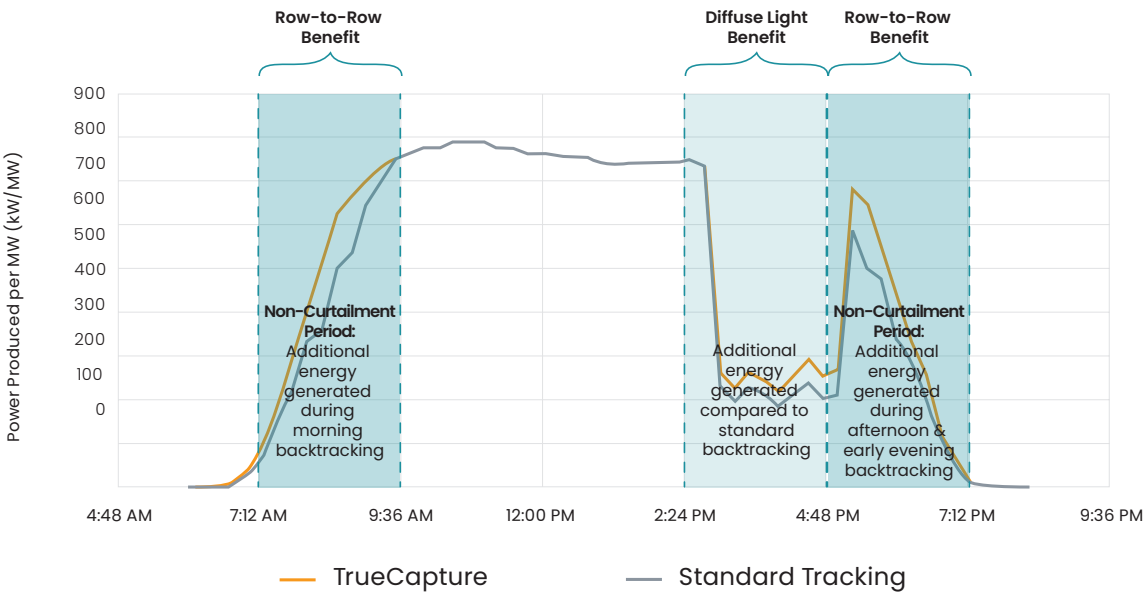
How does TrueCapture optimize energy production?

TrueCapture combines advanced sensors, weather forecasting, and machine learning to produce a self-adjusting tracker control and yield optimization system. Energy gains from TrueCapture can reach up to 4 percent — and you can download our white paper on **TrueCapture smart solar tracker yield optimization software** here to learn more about the technology's field-proven validation for boosting utility solar plant performance.

TrueCapture uses a proprietary row-to-row algorithm to offset inter-row shade losses that occur when tracking rows shade neighboring rows. The algorithm adjusts trackers' angle of incidence to reduce inter-row shading losses in full-cell modules. The row-to-row algorithm also includes Split Boost optimization for half-cell modules. Unlike traditional tracking systems that avoid any shading on the modules, Split Boost permits up to 50 percent shading on the lower half of the modules for better results than standard backtracking.

TrueCapture vs. Standard Backtracking

1 MW Energy Production Standard Tracking vs TrueCapture



As shown in the chart, TrueCapture gains widen the "shoulders" of a solar plant's power production curve compared to standard tracking.

During periods of high diffuse irradiance, the optimal orientation of the modules may not be directly pointed at the sun but closer to horizontal to capture additional diffuse irradiance. Nextracker's optimization software uses measured irradiance data in 10-minute intervals to estimate the optimal orientation of the tracking system. Nextracker develops a specific set of curves for each project and uses measured irradiance to orient the modules to the optimal tilt angle.

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Investment pays off to reduce risk and realize financial gains

System underperformance is one of the most significant risk factors associated with solar project development in a market devoid of project sites with vast stretches of flat and sunny land. It is essential that solar developers and asset owners fully understand the underlying issues impacting system performance versus implementing guesswork or simply hoping their projects will do better. Several root causes of underperformance, including inter-row shading and standard backtracking in diffuse light conditions, are well studied and understood. Nextracker has not only dedicated R&D development work to optimize performance in these conditions, but validated and commercialized technology solutions that generate more energy and boost performance.

Nextracker's own research, published in PV Tech, has shown that on an annual basis, the financial impact of terrain shade loss alone can range between **$100,000 and 200,000 at a representative 100 MW site** in the US.

Contact us for more details about the ICF analysis and to learn how TrueCapture can optimize energy production for your projects: **insidesales@nextracker.com**

You can also read our case study **here** to find out how TrueCapture boosts PV plant performance for our customers.

Defne Gun *is the Senior Manager, Business Development and Performance for Advanced Software at Nextracker, which includes TrueCapture™ and NX Navigator™. With her extensive background in solar performance engineering, Defne leads the technical team responsible for facilitating product development, ensuring performance validation, and driving market adoption for Nextracker's emerging software solutions.*

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