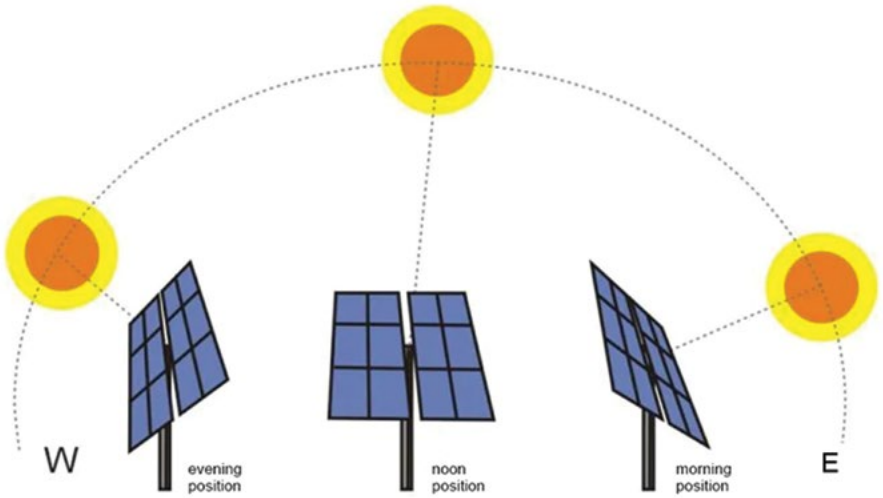
# Innovative wind mitigation strategies for 2-axis solar panel trackers

By FTC Solar, Inc

FTC Solar, Inc. founded in 2017 and headquartered in Austin, Texas, is a fast-growing global provider of solar tracker systems, technology, software, and engineering services. Recently listed on the US stock market (Nasdaq: FTCI), FTC Solar has experienced tremendous growth over the last few years as the world pivots towards more sustainable renewable energy power generation sources. Solar energy is projected to be 30% of all electricity sources in the next 30 years and is part of many nation's electricity generation strategies. Currently, FTC Solar has deployed more than 2.5 Gigawatts of solar trackers globally, supported by 31 manufacturing partners across the Middle East, India, Australia and Southeast Asia. FTC Solar covers everything from Lean Construction Management, Design Automation Software and Portfolio Management Software as well as tracker installation. Solar trackers significantly increase energy production at solar power installations by dynamically optimising a solar panel's orientation to the sun. Managing the effect of wind forces that cause structural damage and solar panel modules being scattered across an array that typically make news headlines after a storm or high wind scenario is important to the industry. But even at lower wind speeds, modules can suffer invisible damage such as microcracks causing the array's performance to drop dramatically; something that FTC Solar is aiming to address with their solutions.




*Schematic dual axis solar panel representation*

A new FTC Solar damping system has been designed and verified jointly with wind tunnel tests at RWDI (Rowan Williams Davies & Irwin Inc.) in Canada where static and dynamic wind loads on single-axis trackers were carried out to assess aeroelastic stability of a new tracker system. While some industry 2P (vertical two-panel configuration) trackers struggle to mitigate the stress effects from wind that may happen at low wind speeds due to vortex shedding and torsional galloping, FTC Solar conducted extensive wind tunnel testing at RWDI and CAE modelling to develop a unique dampener design to deliver a dampening ratio three times higher than traditional systems. Validated by the RWDI Wind Tunnel Tests, the tracker utilises a robust design of wind mitigation that produces long-term reliability. The RWDI wind tunnel analyses helped to verify the aeroelastic stability of the new trackers. FTC Solar collaborated with RWDI and Engineered Power Solutions (EPS) on both data analysis and wind tunnel testing to independently validate the product's structural stability. FTC Solar first conducted code-base methods used commonly in engineering to understand static wind forces based on design parameters at the site, wind speed, exposure, and similar factors. Initial sensor-based testing was performed with models of the Voyager 2P system to measure static wind loads and how they affect the structures. FTC Solar's innovative Voyager+ tracker design therefore provides compelling performance and reliability benefits with excellent installation and speed advantages.

As the solar energy industry drives toward Large Format Modules of 550W or more, traditional one module-in-portrait tracking systems have difficulty supporting these new large 'sails' while two in-portrait designs have already had this experience of scaling to larger surface areas. Because the static and dynamic wind loads are much greater on these structures, with these large formats, there is an ongoing need for improved tracking designs. The FTC Solar design team developed Voyager+ to tap into the benefits of 2P designs with proper management of wind loads and the seamless integration of large, complex solar modules - resulting in a zero-stow design. The FTC Solar Voyager+, a new 2P-design solar tracker that optimises energy capture while simultaneously reducing the manpower and equipment needed for installation was released in September 2021. The tracker's ability to enhance energy production levels with 46 percent fewer foundation piles and to achieve nearly two percent higher energy density than 1P alternatives makes it a revolutionary product for utility-scale solar projects. FTC has therefore developed a highly damped system design by eliminating common system flaws in design and identifying preventive measures necessary to eliminate the risk of aeroelastic instability. This new Voyager+ wind mitigation strategy helps increase solar array reliability and unlocks lower material costs. It will also help to minimise storm damage in the tracker industry for winds up to 120mph (193kph) as validated by tests.

In terms of simulating mechanical performance of tracking systems, FTC Solar's engineers worked with Hexagon's multibody dynamics and structural analysis software to simulate dynamic structural stress scenarios possible during operation of solar panel tracker systems. Simulation software allowed for scenarios of particular concern to solar farm owners that might include extreme damping in order to deal with strong wind gusts and storm conditions whipping across a solar field. Single-axis tracker installations can be known to experience structural failures or damage to the solar modules and this has spread concern and caution among solar farm project developers. Torsional instability, which causes the modules to oscillate in a self-exciting fashion, is usually the culprit. FTC Solar engineers' unique approach protects both the solar modules and the solar tracker from damage. The new FTC Solar damping system dissipates the wind forces by deploying a lot of stiffness or damping offering clear advantages over other mitigation strategies such as horizontal stow. It also leads to lower material costs and higher system reliability.

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