

Building Wind Resiliency on the Frontlines: Lessons from Mayreau

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The Caribbean is one of the most demanding proving grounds for solar energy, where high winds and corrosive environments make long-term performance an extraordinary challenge. On the small island of Mayreau, repeated Category 4–5 hurricanes have revealed both vulnerabilities and opportunities in solar design.

For the past eight years, Azimuth Advisory Services (AAS) has provided boots-on-the-ground forensic analysis only weeks after major hurricane landfalls. Those lessons learned have culminated in the Solar Under Storm I (2017), II (2020), and III (2025) reports on solar resiliency, co-authored and funded by RMI.



The Challenge

Following the devastating Category 5 hurricanes Irma and Maria in 2017, a solar site on Mayreau was constructed using the guidance of Solar Under Storm I, establishing a testbed for resiliency based on the earliest set of recommendations. That system performed admirably through multiple years of exposure, until Category 4 Hurricane Beryl in 2024 introduced the next-generation failure mode.

Azimuth Advisory Services was dispatched by sailboat to analyze these outcomes in the field. The most critical failure observed at the Mayreau site was low-cycle fatigue in module frames. While industry-standard testing emphasizes ultimate strength, field performance showed that as manufacturers reduce aluminum use to cut costs and weight, frame cross-sections have become thinner and more flexible, reducing tolerance to cyclic stresses and accelerating crack initiation at bolted joints.

While flat washers are designed to spread a uniform load, module-frame connections rarely behave uniformly under stress. Under wind-induced deflection, the frame tends to roll, turning the washer into a knife-edge that digs into the thin aluminum

frame. Over time, this localized stress concentration has led to significant module loss in the field, even under moderate wind speeds.

Figure 1



Figure 1. Cyclical Fatigue Loading Failure Seen on Mayreau – Photo Credit: Azimuth Advisory Services





The Resolution

In response to this challenge, AAS collaborated with partners to develop and test a stainless-steel reinforcement that replaces the conventional flat washer with an engineered fastener tailored for solar performance. Rigorous modeling and testing confirmed that Stormplate reduced load transfer into the module frame by 50% and extended cycle life by more than 450 times.

Figure 2

Fatigue Life 2 Elements from Edge A (Cycles)			
Model	Applied Load		
	1068 Pa 40% Rated	1335 Pa 50% Rated	1602 Pa 60% Rated
1.1mm Thick Extrusion	198,427	14,730	607
1.5mm Thick Extrusion	2,298,817	283,000	38,958
RSW StormPlate™ SP0 1.1mm Thick Extrusion	4,144,299	1,015,000	283,169

Figure 2. Results of fatigue cycles performance from non-linear FEA analysis

The updated fastener, StormPlate®, geometry spreads clamping pressure more evenly across the module frame, preventing localized stress concentrations that typically drive crack propagation. In addition, Stormplate provides reinforcement against frame tear-through by flexing in concert with the module frame. This “Goldilocks” balance delivers enough stiffness to strengthen the connection without creating new stress risers, while still offering the compliance needed to meaningfully extend fatigue life.

Figure 3



Figure 3. The StormPlate® SP1 engineering fastener



The Outcome

These advancements form part of a broader framework AAS is advancing to ensure solar is not only cost-competitive but storm-hardened. By commercializing targeted product innovation from field forensic analysis, we’re shifting the industry’s focus from “can the system survive a storm?” to “can the system continue to thrive after multiple storms?” Although only a 100 kW system, Mayreau was re-powered in summer 2025, ready for round three and prepared for nature’s next test.

