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July 31, 2025

Kentucky State Board on Electric Generation
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Case: Wood Duck 2024-00337

To Whom It May Concern:

Enclosed in an article that was just printed on July 28, 2025 in PV Magazine, the leading solar trade platform for photovoltaic solar panels.

https://www.pv-magazine.com/2025/07/28/cea-recommendations-for-mitigating-glass-breakage

This article explains how "solar modules are getting bigger, thinner and more powerful, but from Texas to Thailand, the same problem is appearing: broken glass. Not from hail or mishandling, but from cracks that spider from frame edges, splinter near clamps and web across modules...it starts with a few panels, then dozens, hundreds, even thousands."

Michigan State Representative Cam Cavitt has talked at great lengths about glass shards and leeching of chemicals in his district. He has a video that has had over 1 million views where the potato industry has told farmers in his district they can never grow crops on land that has had a solar panel due to the leeching and glass shards.

What makes Barren County, KY think our results would be different? We have a delicate ecosystem with Karst topography, over 80 underground waterways in the project area, 2 creeks protected by WOTUS, and an underground water system that flows to Mammoth Cave and to Green River, also a protected water source. Over 80 acres of the project are in the 100-year flood plain and we have massive flooding in this area every time it rains.

If a panel breaks and/or leaks, how could we possibly conclude in any way that there will not be contamination of our fields, crops and pasture lands with tiny pieces of glass and toxins?

I ask the siting committee to review this evidence and vote to protect crops and animals for the farmers. Protect our streams and yards from glass. Protect the waterways for the cave and for our Amish community who depends on well water.

According to this article, it doesn't take a storm to break a panel. We cannot take this risk in Barren County.

Thank you for your consideration.

Sincerely,

Paula L. Pedigo

Attachment article: "CEA recommendations for mitigating glass breakage."

CEA recommendations for mitigating glass breakage

Solar modules are getting bigger, thinner, and more powerful. But from Texas to Thailand, the same problem is appearing: broken glass. Not from hail or mishandling, but from cracks that spider from frame edges, splinter near clamps, and web across modules. In cases seen by Jörg Althaus, director of engineering and quality assurance at Cle Energy Associates (CEA), it starts with a few panels – then dozens, hundreds, even thousands.

JULY 28, 2025 **PV MAGAZINE**

MANUFACTURING | MODULES & UPSTREAM MANUFACTURING | WORLD

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From pv magazine 6/25

Clean Energy Associates has investigated glass breakages at utility-scale solar sites across three continents. It has found that there isn't a single root cause, but a perfect storm: thinner glass combined wi design shortcuts, evolving materials, and field realities that stress modules beyond what was simulated in the lab.

Substructure flexibility, especially in long-span, tracker-mounted systems, introduces torsion that certification tests don't account for. Torque settings during installation also vary significantly in the field an can create unaccounted-for stress at clamp zones.

As a result, modules that pass IEC 61215 tests may still fail in actual deployment, not because they're defective, but because the certification regime doesn't fully reflect the mechanical realities of today's solar systems.

Even when everything else looks right, hidden defects can tip the balance. In several investigations, we've found tiny air bubbles or foreign particles embedded in the glass. These micro-enclosures are invisible at glance but can act like time bombs – stress concentrators that weaken the glass just enough to let a fracture propagate.

For toughened or heat-strengthened glass, surface stress is normal. However, we've seen variation in this surface stress, which indicates that not all glass is manufactured the same way. Heat strengthening processes may also vary. Without serial traceability for the glass itself, tracking these issues back to a specific batch, line, or shift is nearly impossible. That makes systemic prevention harder than it should be

Stress cocktail

The takeaway is that glass breakage isn't caused by one thing, it's caused by five or six things happening once: a slightly bent module, slightly over-torqued clamps, slightly under-supported spans, slightly thinner glass, slightly flexible racking.

Each of these might be survivable in isolation, but when combined with added temperature, wind and hail stress, it can be too much for the glass to withstand.

This isn't a mystery anymore. The next step is applying that knowledge across the industry. Addressing these risks requires a coordinated effort from designers and manufacturers to EPCs and asset owners.

CEA recommends:

- Make testing more realistic. Use project-specific mounting configurations. Include dynamic loading. Measure deflection and torque tolerances in context. Some flaws in testing may require standards to be updated. For example, torsional stress is not included currently and may be solved by added procedures not yet standardized.
- Clamp smarter. Harmonize clamp design and spacing with the actual glass and frame properties of modern modules.
- Push for better traceability. Glass deserves the same scrutiny as cells and wafers, including batch tracking and process transparency.
- Watch for micro-defects. Whether it's edge finishing, inclusions, or stress from lamination, these should be screened systematically. Include glass edge trimming and grinding as well as framing inspections in your quality assurance programs, as small impurities in frame parts can be the death of glass edges.
- Treat mounting as part of the design. It's not just about the module, it's about the system it lives in.

The promise of double-glass modules is real. Better longevity, better moisture protection, higher energy yields. But those benefits won't materialize if we keep underestimating the mechanical realities of large, thin-glass panels mounted on flexible structures.

For years, the industry relied on single-glass modules made with sturdy, fully tempered 3.2 mm glass. Bu the push toward bifacial modules, combined with the appeal of lower material costs and slimmer profiles, led many manufacturers to adopt 2.0 mm double-glass designs using heat-strengthened but not fully tempered glass on both sides.

Two sheets of 2 mm glass should match the strength of one thicker pane, on paper. In practice, modules are now more fragile. These thinner sheets don't just flex, they bend and bow like diving boards when subjected to wind loads and tracker movement. They're more sensitive to where and how they're clampe Push too hard, too close to the edge, and the stress builds invisibly. The larger the module format gets, th more pronounced these issues become. More surface area means more deflection, more vibration, and more potential for tiny weaknesses to transform into full-on fractures.

In the field

The same red flags keep appearing when CEA inspects sites with widespread breakage. Cracks tend to start near clamp points, at corners or edges where the frame exerts pressure on unsupported spans.

Modules often show no sign of external impact, just a sudden, sharp fracture that runs across the glass. Some modules arrive pre-stressed. We've seen glass curvature baked in before the panel even leaves th crate, likely introduced during lamination or framing. Large modules vibrate in the wind. On long trackers with flexible purlins, we've measured subtle but persistent shaking that amplifies structural fatigue over time.

In one case, glass fragments literally popped off a module during routine maintenance weeks after the init fracture. The cause? A combination of internal tension and poor edge grinding, with no outside force to blame.

Lab report

CEA has recreated these breakages in controlled testing and confirmed that even modules certified to pas industry module testing standard IEC 61215 can fail under real-world stress.

Dynamic mechanical load (DML) testing, which simulates wind gusts and movement, has revealed failure that static load tests do not catch. When mounted on field-realistic setups including the underlaying purlin some modules slipped from their clamps during testing or cracked after repeated flexing due to substructu deflection.

Fractography points to clamp zones as the stress epicenter, especially when clamp spacing is tight or torque settings are off. The back glass measured as thin as 1.9 mm in some samples, still within spec but barely. Marginal tolerances leave little room for site-specific quirks.

Certification gap

The current standards were designed for yesterday's modules. While dynamic testing was added to IEC 61215 in 2021, it's still not widely applied. When it is, it often doesn't replicate real-life mounting configurations that projects use in the field.

CEA has seen cases where clamp positions in lab tests differ from the field, leading to stress concentratio in completely different areas.

Solar is scaling up fast and the systems deployed today will be out there for 30 years or more. Let's make sure the glass can last that long.

About the author

Jörg Althaus is director of engineering and quality assurance services at Clean Energy Associates (CEA). An electrical engineer by training, Althaus has spent over 20 years overseeing inspections of solar equipment in deserts, typhoon zones, and factory lines across four continents. His current work focuses on identifying systemic risks in modern PV module design – especially those that hide in plain sight until the glass shatters.