



VDE AMERICAS

When hail hits photovoltaics

Severe hailstorms in North America have resulted in large financial losses for solar project stakeholders. VDE Americas has developed an award-winning approach to identify, quantify, and mitigate hail catastrophe perils.

Best known for oil and gas production, Texas is also a global leader in renewables. Long the top wind power producer, Texas is presently the second-largest solar market in the United States. The success of the Texas renewables market has national and international implications. World leaders are counting on the U.S. to do its part to mitigate a global climate crisis—and the U.S. cannot achieve its climate-risk mitigation goals without Texas solar. Whether these efforts succeed could hinge on the solar industry's ability to weather West Texas hailstorms.

“Hail risk to solar projects is on the increase due to a perfect storm of market and technology changes,” observes John Sedgwick, president of VDE Americas. “PV modules are becoming less hail-resistant over time as manufacturers push the value-engineering envelope with larger format products often with thinner front glass. Meanwhile, project development is increasing in hail-prone locations such as West Texas.” Installing less-hail-resistant PV modules in more-hail-prone regions requires comparative test programs, science- and engineering-based hail risk assessment methodologies, and bet-

ter mitigation practices. VDE's North American businesses are global leaders on these fronts.

Industry stakeholders have learned the hard way that core PV module safety and performance standards do not differentiate product designs based on long-term durability. In May 2019, a now-infamous West Texas hailstorm damaged some 400,000 PV modules. Insurance Insider reported that the insured losses associated with this single event exceeded \$70 million.

The Renewable Energy Test Center (RETC), a subsidiary of VDE, was among the first responders to help industry stakeholders navigate the resulting crisis of confidence. “The vast majority of PV modules are unscathed by the pass/fail impact tests required for certification,” notes Cherif Kedir, RETC's president and CEO. “To understand hail resilience, we need to investigate impact resistance at the threshold of damage, just over this threshold, and at material failure. This is the basic idea behind our beyond-certification testing for hail.” RETC's Hail Durability Test (HDT) program expands on the ballistic-impact tests found in International



As PV module manufacturers seek economies of scale, using thinner glass in ever-larger formats, large solar farms are more susceptible to damage from severe hailstorms like these.

Electrotechnical Commission (IEC) standards for flat-plate PV modules. By doing so, the program provides stakeholders with comparative test results that differentiate product and system designs based on hail resilience or vulnerability. In parallel with RETC's HDT product development, VDE Americas began a years-long effort to understand hail risk in large-scale solar assets. "One of our large tax-equity customers asked us to calculate its hail-risk exposure across a GW-scale portfolio of solar projects," recalls Sedgwick. "At the time, I thought this was a 2- or 3-week project. Instead, it has been a three-plus-year voyage of discovery led by multiple PhDs, including one of the world's leading experts on hail forecasting."

Collaborating with Dr. John Allen, a professor of meteorology at Central Michigan University, VDE Americas developed hazard analysis and mapping tools that assess hail risk based on product-specific resiliency characteristics, site-specific weather data, and operator-specific mitigation strategies. Importantly, these tools model hail risk at a local scale typical of an operating solar farm.

"We use statistical methodologies to account for hail return intervals and natural variances in kinetic energy associated with hailstone shape, density, and size," explains Dr. Peter Bostock, co-founder of VDE Americas. "Our results incorporate RETC's HDT data to account for module glass thickness. We also account for the fact that intelligently controlled single-axis trackers can implement defensive

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JOHN SEDGWICK
President of VDE Americas



stow strategies to reduce impact energies." In addition to identifying and quantifying hail risk, VDE Americas is also able to characterize the financial value of risk mitigation approaches. These bespoke engineering assessments allow the industry to design and deploy more resilient PV power systems, ensuring that these assets remain financeable and insurable. Demonstrating the importance of this ground-breaking work, a VDE Americas-led team was one of 20 selected to advance as semifinalists in Round 6 of a Solar Prize competition administered by the U.S. Department of Energy.

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