

A large, stylized graphic element on the right side of the page. It is a vertical, arrow-shaped shape pointing downwards, filled with a photograph of a sunset or sunrise sky. The sky is filled with soft, wispy clouds in shades of blue, purple, and orange, with a bright sun visible on the right side, creating a lens flare effect. The overall color palette is warm and vibrant.

VIEWS FROM THE FRONT LINES:

**KEY INSIGHTS FROM
SECOND ANNUAL RENEWABLE
ENERGY UNDERWRITER SURVEY**



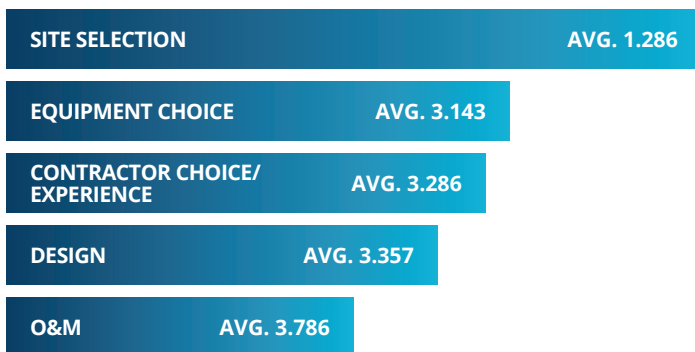
Cirrus’s mission is to connect the players involved in the renewable energy insurance and risk management value chain. Properly incorporating underwriting insights in early-stage project development is essential to ensure resilient, profitable projects are developed. Cirrus seeks to amplify how insurers view projects relative to current trends in siting, claims and technology innovations and move that information “up in time” to help guide development decisions.

For our Second Annual Key Renewable Energy Underwriter Insights whitepaper, Cirrus again asked underwriters to advise, update, and rank their feedback on how elements of design, construction, operations, and loss history impact their underwriting decisions, specifically focusing on solar, wind, and battery energy storage operations (BESS).

This year, we received responses from 15 underwriters across 10 insurers - an increase of 150% over our prior report. Included here are some key takeaways from this updated survey.

GENERAL TAKEAWAYS

When asked to rank the most important factors to ensure long-term insurability for renewables in the U.S., underwriters indicated that Site Selection is still at the top of the overall list, with 80% of respondents selecting this factor as the most important, the same percentage as the 2023 respondents.



This graph shows the relative average rank of each factor.

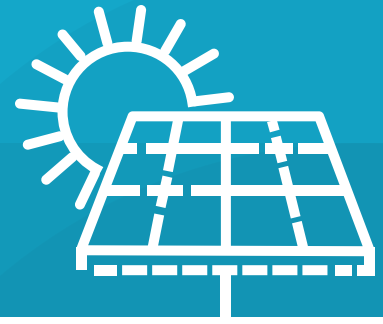
However, several of the underwriters indicated that the importance of any one factor varies by the type of project. For example, Site Selection was at the top of the list for Solar projects due to the ongoing impact of large hail claims and the lack of confidence among underwriters that enough can be done to protect solar projects in high-hazard hail regions. Underwriters raised concerns about “unmodelled weather events” and “clients (lenders) not accepting that these events are increasing in frequency.”

Equipment Choice (EC) and Operations & Maintenance (O&M) jump to the top of the list for Wind projects due to concerns about blade liberations, tower collapses, and equipment breakdown failures. One underwriter said, “It seems every couple of years a manufacturer is experiencing a mass defect event across a single platform. We really need more transparency from manufacturers when they’re changing something.”

Design jumps to the top for BESS due to the importance of proper container spacing for risk mitigation. One underwriter brought up additional concerns about BESS systems “being damaged by fire protection systems that false alarmed due to dust or smoke,” and another was worried about claims for “new BESS technologies we have not seen yet but with a total loss potential looming over Renewable Energy portfolios.”

Another issue called out in multiple responses this year, as compared to the first annual survey, is the importance of main equipment redundancy, specifically main power transformers and inverters. Underwriters expressed concern about long replacement lead times resulting in very high Business Interruption (BI) claims.

The following sections highlight feedback from underwriters for solar, wind, and energy storage projects, with consideration for design, construction, and operational phases. In this year's survey, we asked underwriters to rank the various risk factors and mitigation measures provided from last year's survey by order of importance.



SOLAR PROJECTS

Underwriters were presented with a list of 16 options taken from the responses to the first annual survey to rank in terms of how impactful they were in mitigating risks and affecting their underwriting decisions for solar projects. The list below shows how the Top 10 factors stack up.

01

Prepare and adhere to a detailed vegetation management plan.

02

Have Main Power Transformer redundancy at large sites.

03

Properly elevate panels, inverters, and substations above the flood plain.

04

Have adequate glass thickness and racking tilt capabilities in critical hail regions.

05

Make sure fasteners and racking are appropriate for given wind and weather conditions.

06

Have a comprehensive weather monitoring system at the site with a remote operations center.

07

Provide evidence of successful implementation of weather monitoring system to trigger stow position to mitigate storm damage.

08

Avoid storm surge prone areas due to concerns about saltwater impacting equipment.

09

Have a risk management plan for assets in lay down areas prior to installation.

10

Employ a remote operations center that can place panels in stow position.

The ranked responses show that proper risk mitigation measures to address natural catastrophe (NAT CAT) exposures are still top of mind for underwriters.

The ranked responses show that proper risk mitigation measures to address NAT CAT exposures are still top of mind for underwriters. Main equipment redundancy to avoid lengthy BI claims was also a main concern. In addition to the factors provided for ranking from last year's survey, underwriters provided commentary regarding additional risks and mitigation measures they consider for Solar projects, again focused on NAT CAT exposures and proper O&M procedures.

General: One underwriter indicated that a good O&M agreement, proper inverter selection and strong manufacturer warranties remain key considerations.

Wildfire: In the view of one underwriter, the market may only be one or a few large wildfire losses away from tightening up terms on that peril. The legality of tightening terms is untested in some circumstances and jurisdictions, which is why it is lagging to date. Another underwriter said they like to see fire breaks built into and around the perimeter of the site (including roads), policies around employee smoking and the presence of fire extinguishers, such as equipping four wheelers with them, and a third mentioned using utility poles made of non-combustible materials.

Severe Convective Storm (SCS): One underwriter said that there is almost no amount of risk mitigation that can be applied for the most severe storms. SCS limits, retentions, and rates are the most important factors that should be considered in mitigating exposure. However, another underwriter mentioned that third-party hail risk assessments validating mitigation measures are still important, and another suggested timing the majority of critical installation outside of SCS season to increase the likelihood that the designed mitigation measures can be employed if hail strikes.

Windstorm: One underwriter mentioned that piles need to be properly installed per the advice of geotechnical reports because all other wind remediation measures are irrelevant if the piles do not hold in the wind. This underwriter said that a program to track and mitigate pile refusal prior to reaching target depth is necessary to make sure that they hold as intended.

Flood: One underwriter said there must be flood mitigation during construction as well, including proper laydown areas and panel storage outside of flood-prone areas prior to installation.



WIND PROJECTS

Underwriters were presented with a list of 13 options taken from the responses to the first annual survey to rank in terms of how impactful they were in mitigating risks and affecting their underwriting decisions for wind projects. The list below shows how the Top 10 factors stack up.

01

Have Main Power Transformer redundancy at large sites.

02

Use lightning protection system to properly ground lightning strikes.

03

Implement proper storage and tie-down of major components pending installation.

04

Time the majority of critical installation outside of windstorm season.

05

Have proper drainage at the site and along roadways.

06

Have a contingency plan for flooding following windstorm events that may affect foundations and access roads.

07

Elevate critical equipment at least two feet above base flood elevation.

08

Prepare and adhere to a detailed vegetation management plan.

09

Provide detailed transmission line inspection reports.

10

Provide Main Power Transformer (MPT) replacement plans and blade replacement plans.

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Main equipment redundancy was at the top of the list for Wind projects, as well as risk mitigation measures to address Lighting, Wind, and proper procedures during installation. In addition to the factors provided for ranking from last year's survey, underwriters provided commentary regarding additional risks and mitigation measures they consider for Wind projects, particularly focused on contracts and design/construction issues.

Contracts: Several underwriters highlighted the importance of strong contractual allocation of risk. For example, they like to see full-scope full-wrap FSAs, Original Equipment Manufacturers (OEMs) held contractually accountable for the performance of lightning protection systems, and good O&M service agreements including unscheduled maintenance and availability guarantees.

Design/Construction: One underwriter indicated that turbines should be type certified for manufacturing and another mentioned that third-party services should be used to monitor construction progress. Another underwriter said that dehumidifiers and heaters should be installed within nacelles and another mentioned blade quality control as key design/construction attributes.

Loss Mitigation: Underwriters highlighted a few factors that would mitigate losses should they occur, such as availability of specialist cranes and maintaining critical spare parts such as blades, gearboxes and transformers. They also indicated the importance of including meaningful maintenance costs in overall OPEX, including for the maintenance of blades.



BESS PROJECTS

Underwriters were presented with a list of 11 options taken from the responses to the first annual survey to rank in terms of how impactful they were in mitigating risks and impacting their underwriting decisions for BESS projects. The list below shows how the Top 10 factors stack up.

01

Ensure sufficient spacing of at least 12 feet between containers.

02

Place Generator Step-up Units (GSU) and BESS units on elevated concrete pads.

03

Ensure proper drainage and grading at site.

04

Use a container-based rather than building-based design.

05

Construct projects with complete or substantial graveled/rocked yards.

06

Operate auxiliary power systems that support container cooling units.

07

Ensure the ground surrounding containers is bare, with fire breaks/roads around the perimeter.

08

Ensure modules are approved by UL 4950 for cell, rack, and module.

09

Ensure adequate IP rating of at least IP66 for containers and enclosures of electrical equipment .

10

Design project so that containers, enclosures, inverters, and substations outside of flood plains.

The ranking in this year's survey made clear that proper container spacing continues to be the primary concern for BESS projects, as well as risk mitigation measures to address Flood and fire concerns.

The rankings in this year's survey made clear that proper container spacing continues to be the primary concern for BESS projects, as well as risk mitigation measures to address Flood and fire concerns. In addition to the factors provided for ranking from last year's survey, underwriters provided commentary regarding additional risks and mitigation measures they consider for BESS projects, particularly focused on design/construction issues and Earthquake concerns.

Design: One underwriter specified that more spacing is better, but to date they have been comfortable with eight feet+ when it comes to containerized systems. Another underwriter said they like to see the battery cabinets in a separate room from the switchgears and Battery Management System (BMS), and that the switchgear and BMS room needs fire protection as well. This underwriter also highlighted the need for smoke and fire protection in the battery cabinets, and off-gas detection from a thermal runaway event.

Earthquake: One underwriter said that it is important to demonstrate the project meets earthquake design standards with damping if required and that thermal runaway is not triggered by shock for containers and MPTs/GSUs anchored in earthquake prone areas. Another underwriter expressed concern over the difference between earthquake and ensuring fire damage in the policy language, which could make earthquake losses difficult to adjust. They mentioned managing earthquake exposure via line size more than earthquake limit.

OEMs: One underwriter mentioned additional issues of concern including selection of battery chemistry, OEM provider, integrator selection, as well as fire protection and testing certificates such as UL9540A on cell, module, and enclosure level. Another underwriter said strong warranties are also key.

HOW LOSS HISTORIES IMPACT UNDERWRITING DECISIONS AND RISK MANAGEMENT PRACTICE

It is important to note that the renewable energy property industry is still too young for there to be meaningful statistical loss trends that drive underwriting (as opposed to auto insurance, for example). Therefore, isolated incidents can have meaningful impacts on underwriting as insurers react to events in real time. The incidents referred to here reflect underwriter feedback regarding trends they are seeing or expecting, but they might not qualify as statistical trends. However, loss histories are key considerations for individual underwriters, and provide them with instruction on how to manage future risks while learning from their experiences.

When asked how many **Recent Claims** (past 12 months) underwriters have had for Solar, Wind, and BESS, Wind and Solar claims far outpaced BESS claims.

- Wind claims were the most frequent, with **33.5% of respondents saying** they had seen over 25 claims in the past 12 months, **25% saying** they had seen 11-25 claims, **33.5% saying** they had seen 1-10 claims, and **8% saying** they had seen zero claims.
- Solar claims were also common, with **25% of respondents saying** they had seen over 25 claims in the past 12 months, **17% saying** they had seen 11-25 claims, **50% saying** they had seen 1-10 claims, and **8% saying** they had seen zero claims.
- BESS claims were the least frequent, with **75% of respondents saying** they had seen 1-10 claims over the past 12 months, and **25% saying** they had seen zero claims.



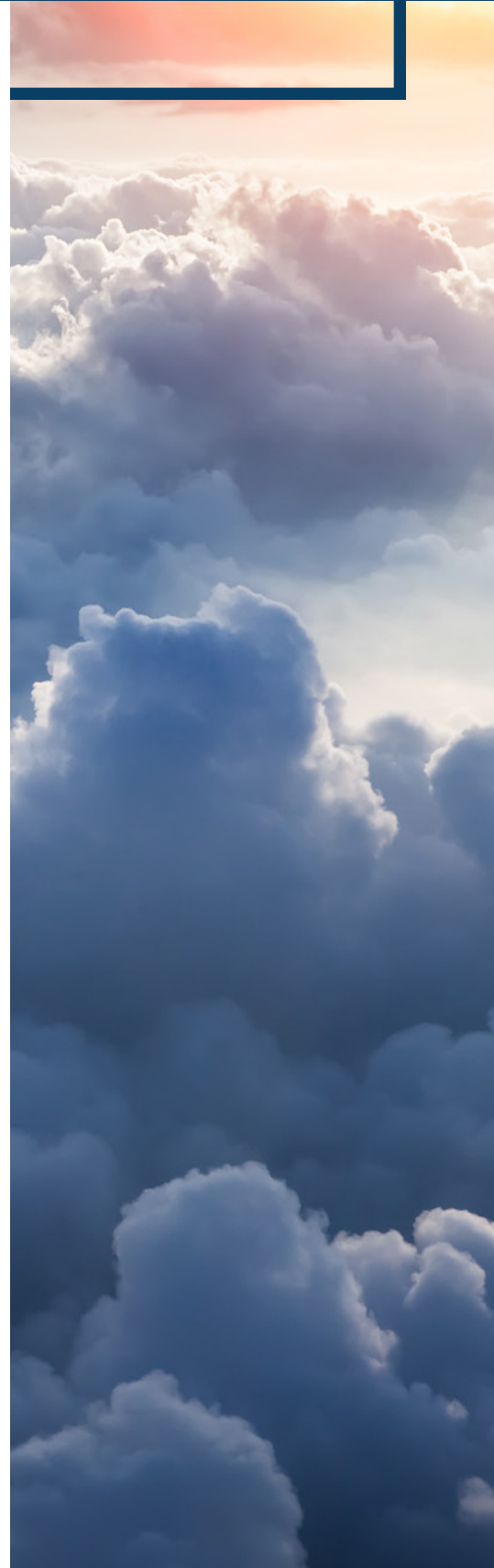
These results track with data gathered from last year’s survey, which showed Wind claims were the most frequent, followed by Solar and then BESS.

When asked what the **Average Claim Amount** (\$USD) per occurrence for recent claims (past 12 months) for Solar, Wind and BESS was, Solar claims were larger on average than Wind or BESS.

- Solar claims were the largest, with **36% of respondents saying** the average claim size over the past 12 months was \$10-\$50 million, **18% saying** the average claim size was \$1-\$10 million, and **46% saying** the average claim size was less than \$1 million.
- For Wind claims, **73% of respondents said** that the average claim size over the past 12 months was \$1-\$10 million, and **27% said** the average claim size was less than \$1 million.
- For BESS claims, **55% of respondents said** that the average claim size over the past 12 months was \$1-\$10 million, and **45% said** the average claim size was less than \$1 million.



Note: Individual events might be counted multiple times, as underwriting companies share risks with each other.



These results show an increase in average claim amounts from last year's survey, particularly for Solar projects. Last year, only one respondent said their average claim amount was over \$20M (specifically for BESS projects). All other respondents indicated their average claims were under \$20M across all three asset classes.

When asked what **Loss History** or **Claim Trends** underwriters have seen in the past 12 months that have changed their underwriting position, requirements, or appetite, most responses focused on Severe Convective Storm/Hail losses and inadequate installation and/or faulty O&M workmanship. There were some positive comments about the reduced losses for BESS, but still a lot of concern about increased extreme weather events and technology issues in general.

Underwriters expressed concern that owners should be more vigilant about the quality of work being provided by O&M providers, specifically with respect to vegetation management, and suggested monitoring compliance with standards to ensure work is completed.

This section includes additional specific comments about Loss History and Claim Trends from the past 12 months.

SOLAR

1. Increased frequency and severity of extreme weather events (e.g. hail, wildfire, flood/inundation). SCS claims in regions that have very rarely experienced these events.
2. NAT CAT exposure continues to deliver large losses including wildfire.
3. Lack of solar resilience when it comes to all forms of natural perils.
4. The majority of solar NAT CAT losses were unmodelled weather perils and therefore haven't been limited or priced for. For at least one underwriter, poor modelling means they need higher base rates and limits on every site to limit the volatility they have seen in their loss ratio over the last few years.

BESS

1. Generally, coverage is improving but could change rapidly, as it will only take one or two big losses to put carrier's books over 100%.
2. There is not yet standardization in terms and conditions.
3. More markets are becoming more confident in writing standalone BESS.
4. Markets continue to see BESS losses, although they tend to be isolated to single containers at a time.
5. One of the biggest underwriter concerns is a mass defect event for single or multiple BESS manufacturers, although we have not yet seen such an event.
6. Damage to batteries due to malfunction of the auxiliary equipment (fire protection, coolant leak, etc.) is of heightened concern compared to the past.

They highlighted that when they see basic errors in a construction loss record, it could infer poor workmanship across the site.

There was also continued frustration regarding the propensity of SCS claims at solar sites, noting low wind speeds triggering losses due to poor workmanship and lack of progress on hail mitigation measures following large losses.

Business Interruption (BI) also continues to be a big concern. Underwriters noted increased demand for equipment following a series of storms and events and increasing reliance on shared grid/interconnection facilities creating claim bottlenecks. They have been mitigating some of these potential losses via moderated line size.

WIND

1. Wind energy losses of note in recent history seem to be tied to upsizing machines and having them come to market quickly, only to discover inherent issues once a high volume of machines have been sold/installed (locking pins, lightning protection system (LPS) issues, two-piece blades.)
2. Replacement times have significantly increased. Items usually with a three-month lead time are taking 12 months. This is prompting deductible increases.
3. Repeated lighting/blade claims.

GENERAL

1. There was a notable uptick in claims driven by wildfire or fires breaking out onsite because of dry vegetation. This is not limited to California – underwriters saw wildfire claims in Mississippi in 2023. Underwriters noted that in some cases such losses were exacerbated by clients not adhering to their own vegetation management programs.
2. BI – Equipment Breakdown is a leading cause of loss in this industry, whether it is inverters or transformers, and there have been delays in supply increasing lead times, giving rise to full indemnity period BI claims.
3. Mechanical/electrical breakdown losses in the solar space are increasing, notably in increased frequency/size of inverter claims.
4. Aggregation is becoming a major issue as more installations come online – underwriters will need to manage line size accordingly.
5. There is a perception among some underwriters that contractors are too thin with respect to timelines and not properly accounting for normal weather delays; underwriters expressed concern with perceived corner-cutting on execution vs. design.

WHAT'S UP NEXT?

Cirrus Advisers will conduct the third annual Renewable Energy Underwriter Survey in Q3 2024 to track any changes or developing trends.

We will continue to share insights from this survey with the renewable energy community to connect underwriters with developers and owners in support of our shared interest in building more resilient renewable energy projects.

OUR MISSION

Helping the renewable energy industry more accurately design, build, budget and finance projects with insurability in mind, thereby enabling a more resilient and profitable global energy transition.

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OUR GOAL

To connect project developers, sponsors, insurers and the project finance community with risk assessment tools that align all parties on the risks of every project.

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