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31 October 2024

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Navigating Climate Disruptions: Solar Tracker Technologies for a Resilient Future



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CPP



Welcome!

Do you have any questions?  

Send them in via the Q&A tab.  We aim to answer as many as we can today!

You can also let us know of any tech problems there.

We are recording this webinar today. 

We'll let you know by email where to find it and the slide deck, so you can re-watch it at your convenience.  

| Who we are



We are manufacturers

PVH is a leading manufacturer and provider of advanced racking solutions for the global utility-scale solar PV market. Specializing in solar trackers and fixed-tilt systems, **we engineer our products to ensure the lowest installation costs** while delivering exceptional customer support throughout every project phase. As the top supplier of solar trackers across Europe, the Middle East, Africa, and Australia, we've delivered over 29 GW to PV plants worldwide. Our factories in Europe, USA and the Middle East enable us to serve more than 500 PV plants globally, including 180 projects exceeding 50 MW each.



500+

PV plants supplied
in 5 continents

20+

GW of annual
production capacity

180+

PV plants above 50 MW

29+

GW supplied worldwide

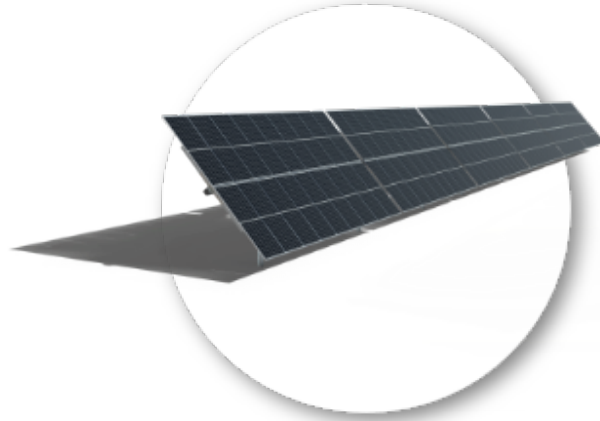
| Product Portfolio

AXoneDUO INFINITY



Our one-in-portrait solution, with high adaptability to any terrain or module, and the lowest number of motors and controllers per string in the market.

MONOLine 2P



Our two in portrait solution, redesigned for XXL modules, which offer a better adaptability to the terrain. With a unique stow strategy to make it the most robust 2P tracker in the market.

SOLARFIX



Our cost-effective fixed-tilt racking, 100% module configuration adaptability, quick assembly and with very high mounting tolerance, so that production ratios are always as high as possible.

Why PVH



Manufacturers End-To-End Solutions

We streamline manufacturing processes, cutting costs and timelines while upholding top quality. This integrated approach lets us swiftly meet client needs and adapt to market changes.



Domestic Content

We prioritize local content in our operations, actively supporting local businesses, hiring local talent, and sourcing materials from nearby suppliers.



In-house technology & Innovation

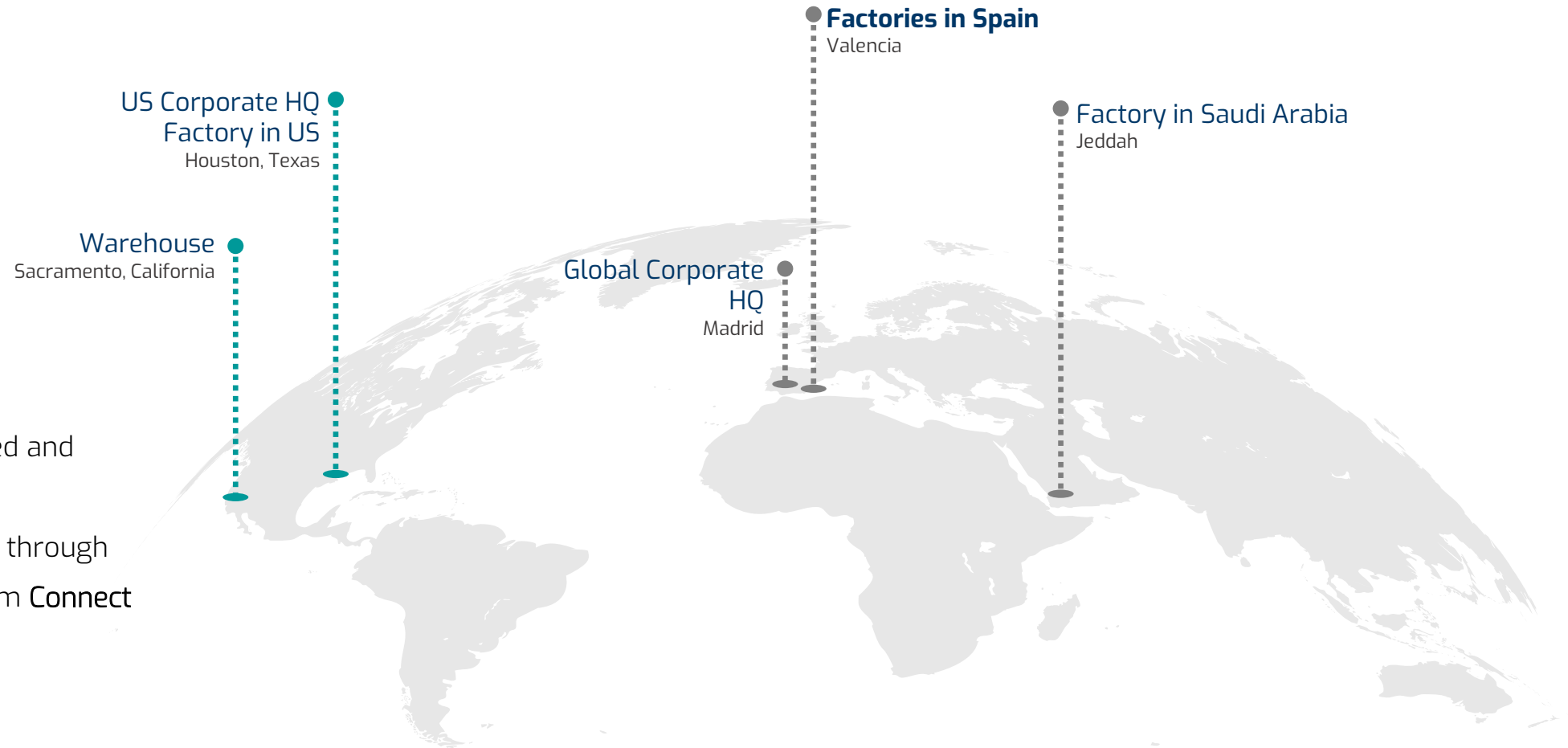
Our advanced software platforms enhance operational efficiency, improve product performance, and enable innovative functionalities that set us apart from the competition.



Quality & Reliability

We uphold strict quality control to ensure every product meets the highest standards, giving our clients unwavering confidence.

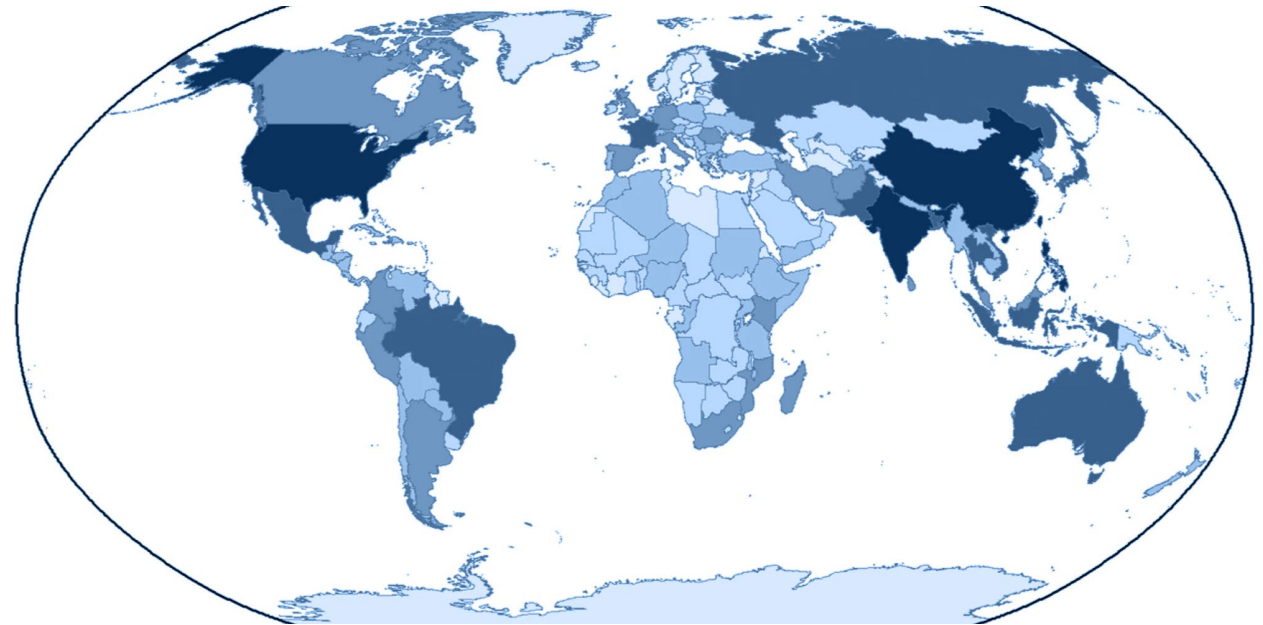




- ✓ Short lead time
- ✓ Our products are shipped and arrive in sequence
- ✓ Deliveries can be traced through PVH proprietary platform **Connect**

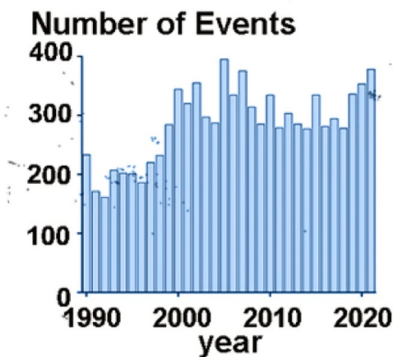
The Urgency of Climate Resilience in Solar Projects

- Solar PV Plants face growing risks from Extreme weather events despite robust designs
- Increased frequency, severity, and duration of weather events impact the global PV industry.
- The photovoltaic sector is evolving rapidly with larger modules and thinner frames and glass.
- Advanced protection strategies are essential to safeguard solar energy production from these challenges

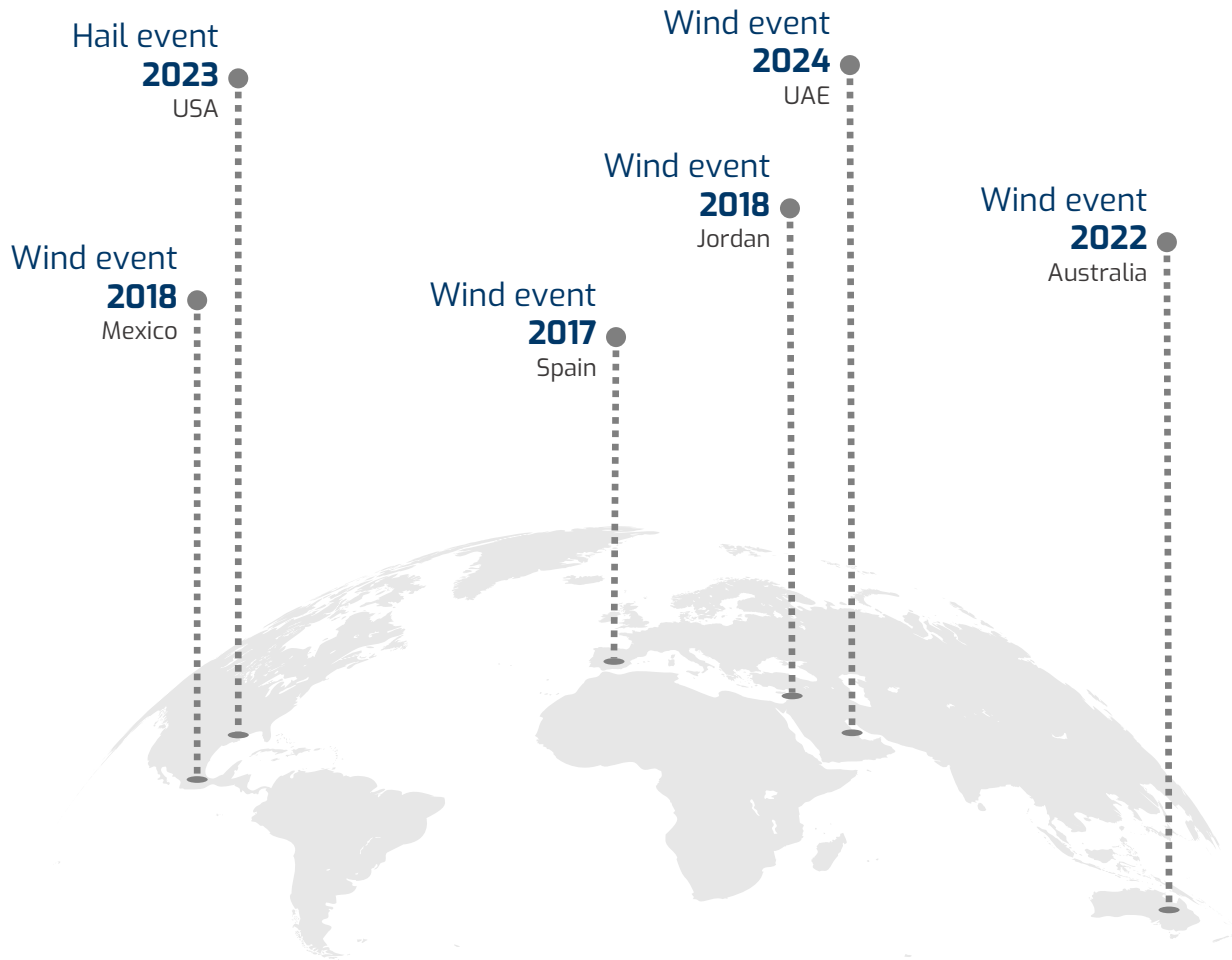


Your projects will be at risk in these following situations

- Wind events when power plants are under construction
- Wind Direction changes during weather events
- Rapid increase on wind speed



The Reality of Weather Risks in Solar PV



No Zero-Risk Locations

Every solar PV installation faces some level of weather-related risk, regardless of its location.

Increasing Catastrophes

Natural disasters are becoming more intense, frequent, and destructive, amplifying risks to solar installations.

Economic Impact

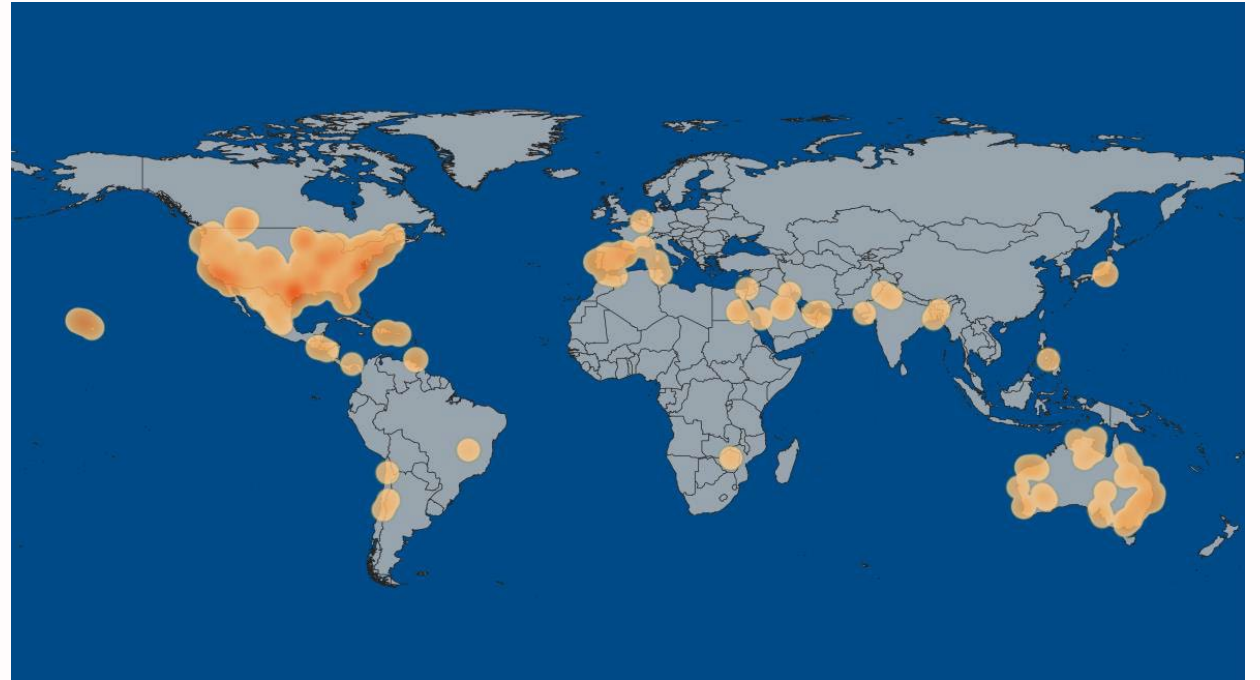
Weather-related events significantly affect insurance claims and overall project economics in the solar industry.

The Rising Threat of Weather-Related Disasters



Introduction to CPP Wind Engineering

- Established in 1981
- Wind tunnels
 - 2x Windsor, CO
 - 1x Sydney, Australia
 - 1x Kuala Lumpur, Malaysia
- Expertise in in wind loading on structures and wind environment
 - Have performed site specific wind studies around the world
- Employees contribute to ASHRAE, ASCE 7, NBCC, AS/NZS as well as other solar specific guidelines



CELEBRATING

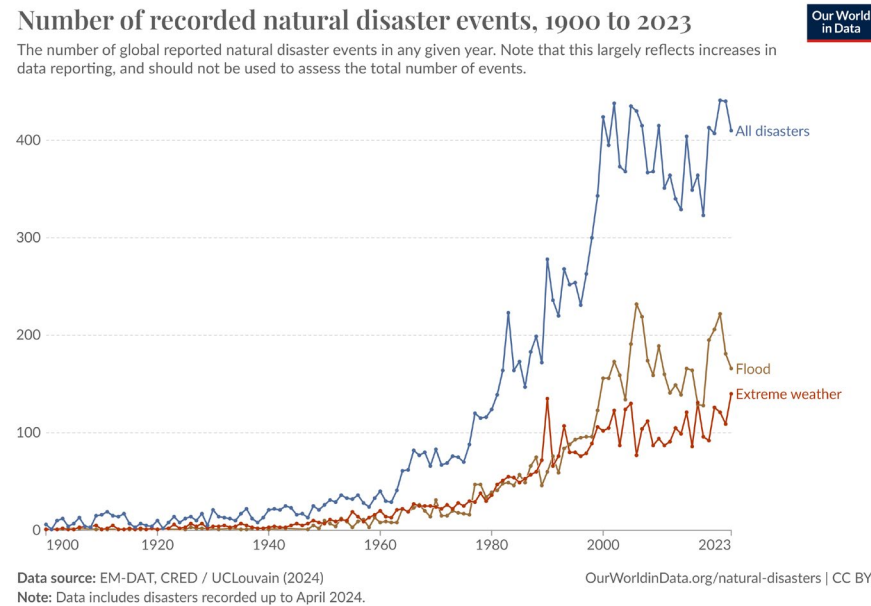
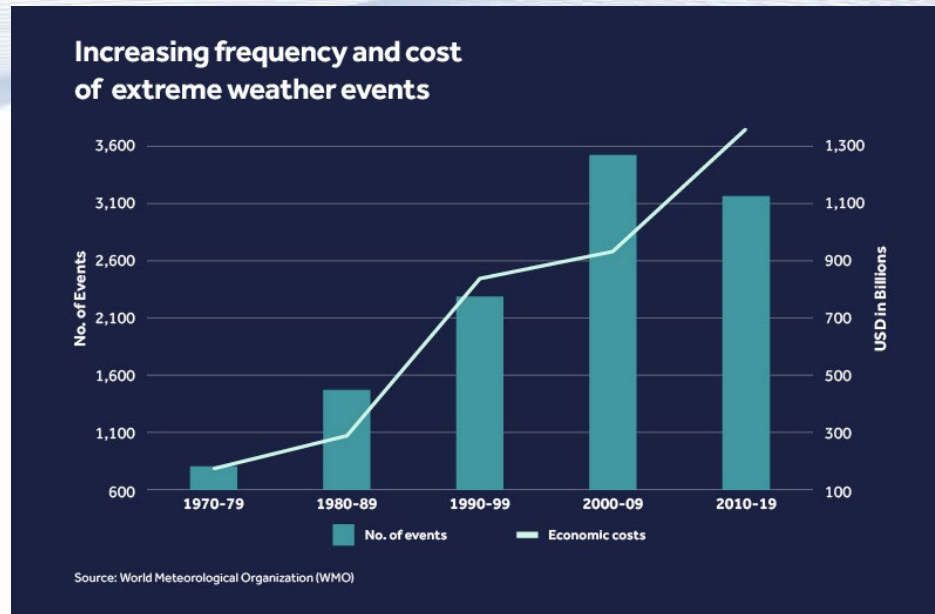


YEARS OF
INNOVATION
SINCE 1981

Extreme Weather Impacts

- Tropical Cyclones:
 - Frequency is expected to remain unchanged
 - Most intense storms are expected to increase in frequency
- Severe Convective Storms:
 - Frequency and variability will increase
 - Unclear how tornado and hail events will change
- Storms will continue to have an impact on solar installations

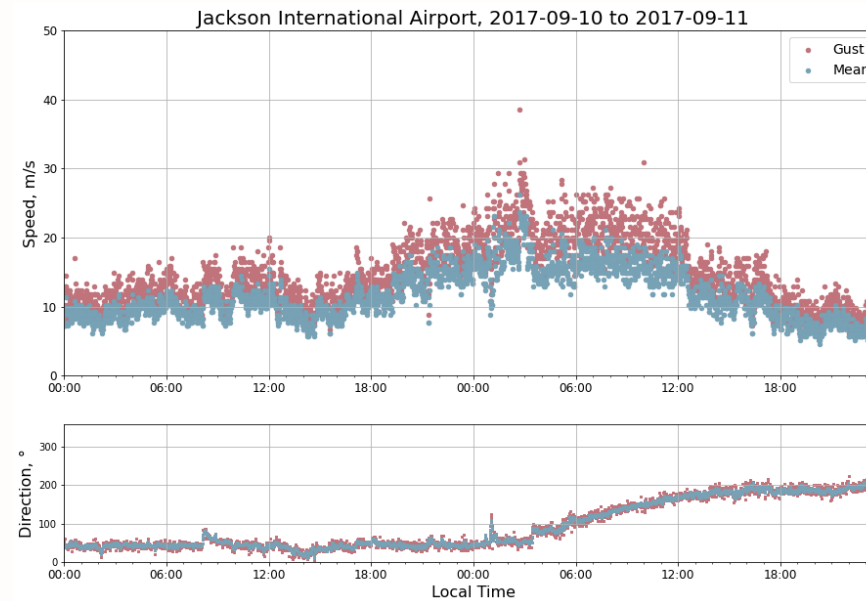
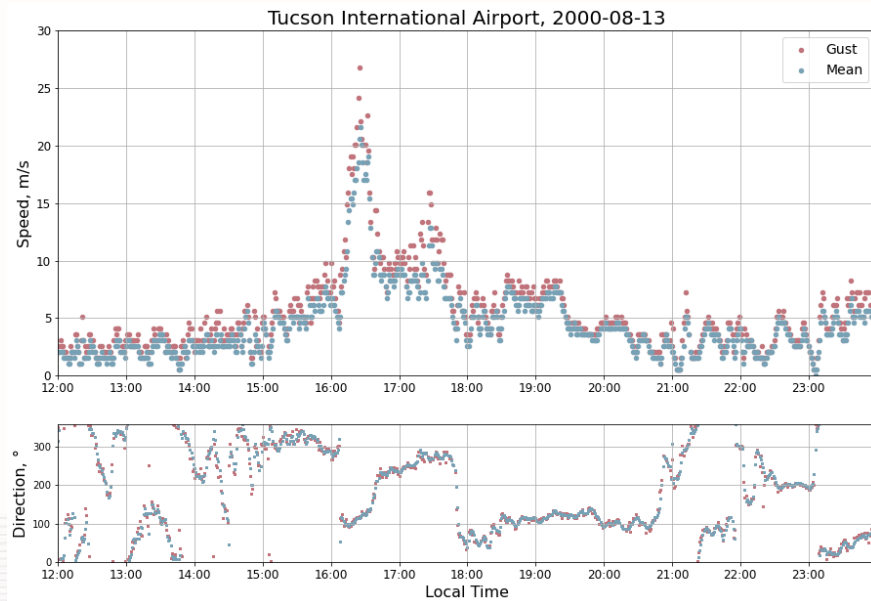
IPCC Sixth Assessment Report (2021)



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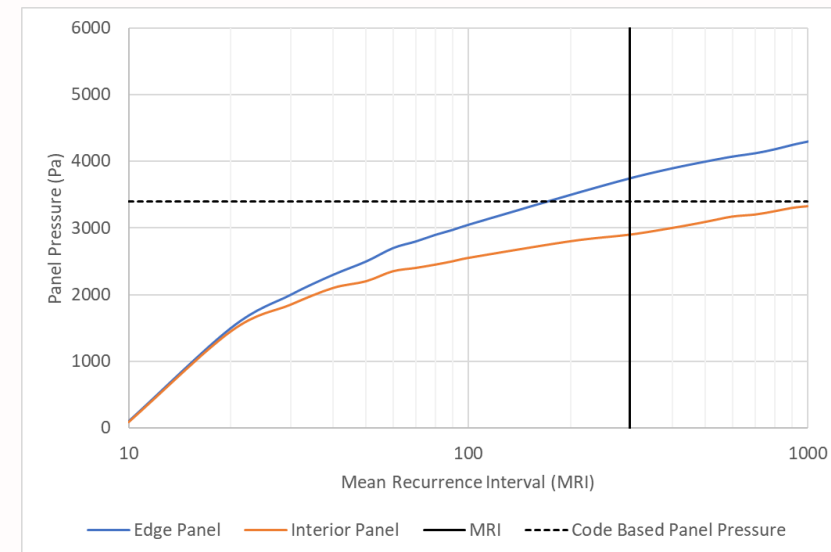
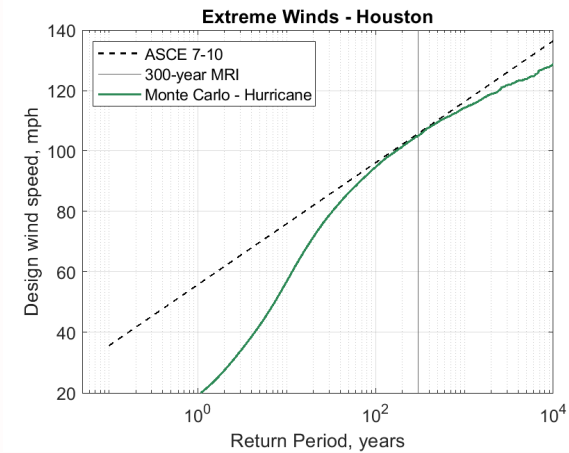
Wind Direction Changes

- Hurricane winds will change direction as the eye passes over the site
- Thunderstorms ramp quickly and are characterized by a shift in wind direction.



Site Specific Wind Assessments

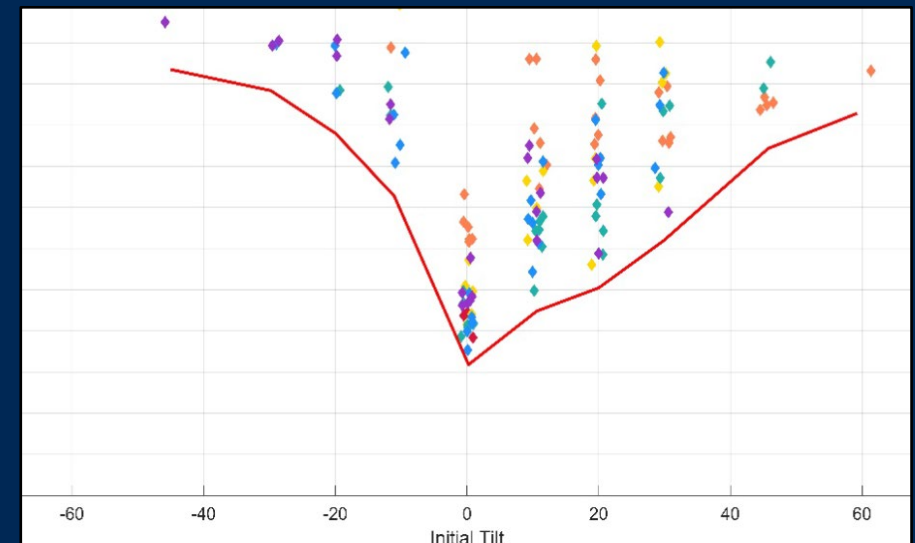
- Risk Category Changes for solar developments
- Site specific wind assessments can help to understand the wind climate at a site and the types of storms.
 - Some reductions in design wind speeds are possible
 - Understanding of the risk at a site
- Site Specific loading studies are an additional step towards understanding the risk at a site and potentially reducing the loads.
- Anemometer siting can also play a large role in trackers getting to stow in time.



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Why do trackers need a Stow Strategy

- **Sensitivity to Wind Forces:** Tracker structures are flexible structures and can be highly responsive to wind forces, making them vulnerable to dynamic excitation if not designed with resilience in mind.
- **Preventing Aeroelastic Instabilities:** Proper stow strategies help avoid aeroelastic instabilities, which can arise from the interaction between the structure and wind, leading to potentially damaging oscillations.
- **Evolution of Stow Strategies:**
 - **Early Practices:** Initially, a flat stow position was widely used to minimize loads, but there was limited understanding of low-speed wind vulnerabilities.
 - **Latest Practices:** Active and passive stow strategies have since evolved to enhance resilience and ensure safety of tracker systems at a broader range of wind speeds.



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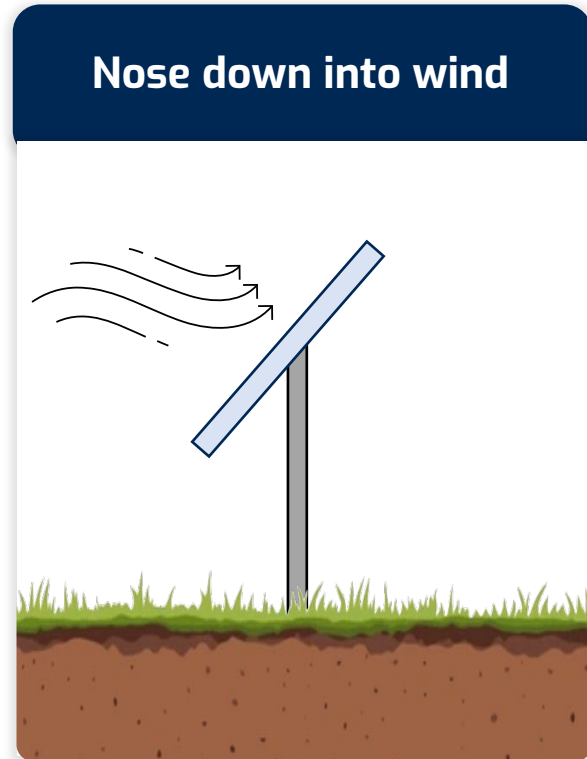
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Stow Strategies for Solar Trackers

Commonly seen stow strategies in the market



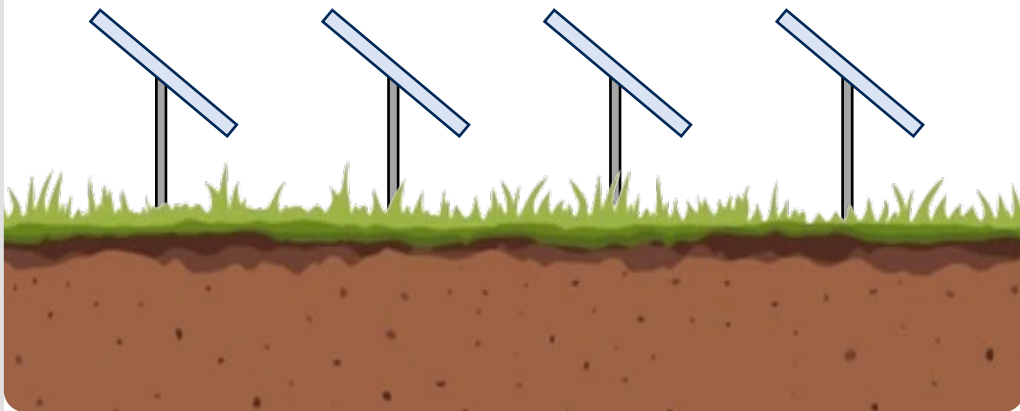
Protection During Construction



Market Standard

LIMITED SAFETY

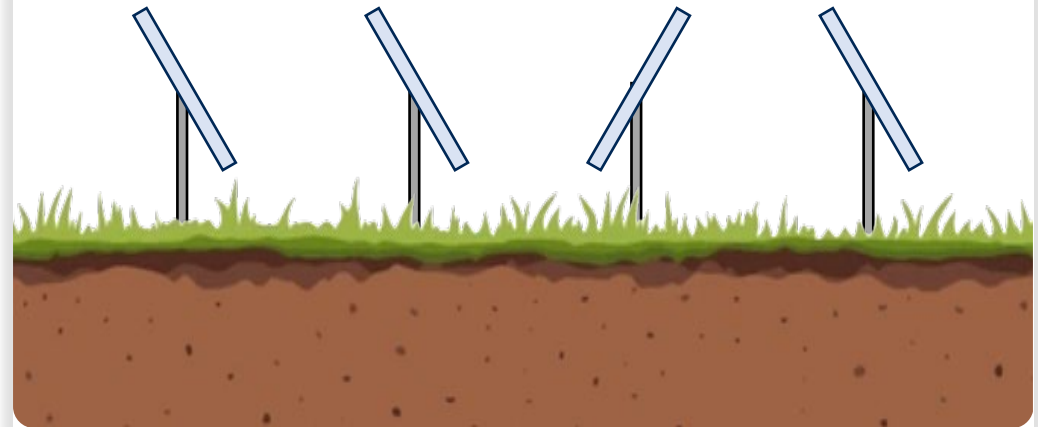
- Directional stowing
- Intermediate unsafe position



PVH TotalStow™ Solution

SUPERIOR WIND PROTECTION

- Non directional stowing
- Safest position from the start



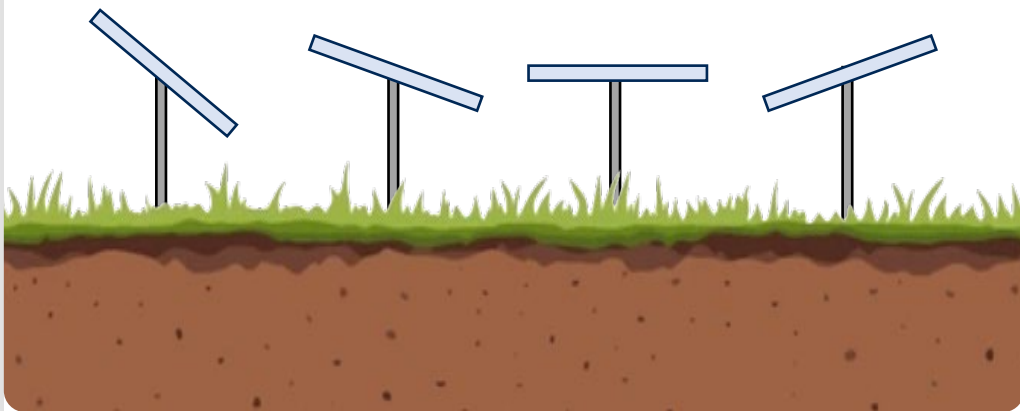
Protection Against Changing Wind Direction



Market Standard

LIMITED SAFETY

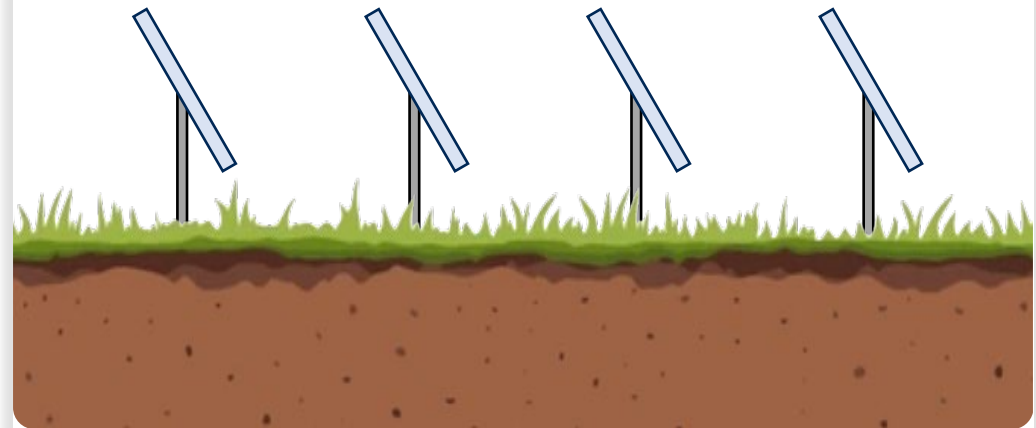
- More time to reach safe position
- Need to overcome wind force
- Movement goes through unsafe positions



PVH TotalStow™ Solution

CONTINUOUS PROTECTION

- Half the time to reach safe position
- Works with the wind to reach stow
- Movement always to safer positions



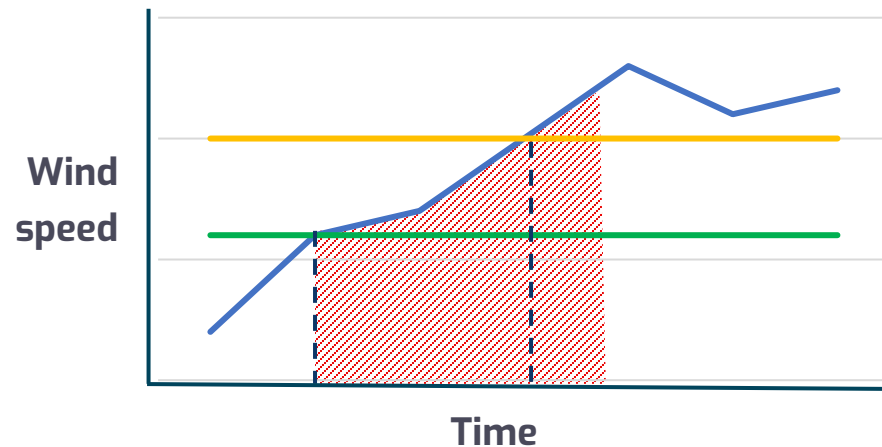
Protection Against Wind Ramp



Market Standard

SLOW AND RISKY RESPONSE

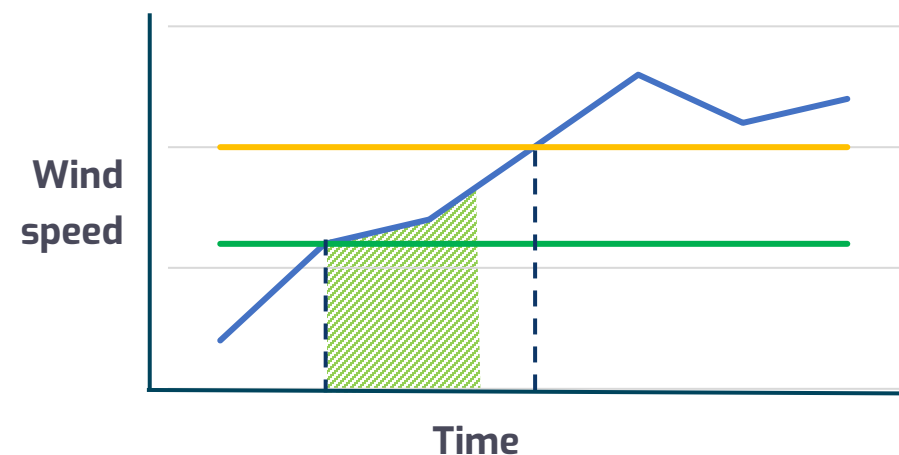
- More time to reach safe position
- Need to overcome wind force
- Movement goes through unsafe positions



PVH TotalStow™ Solution

FAST AND SECURE STOWING

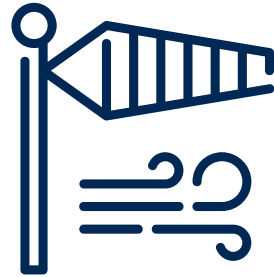
- Half the time to reach safe position
- Works with the wind to reach stow
- Movement always to safer positions



| Advantages of TotalStow™



Reduced risk during
construction



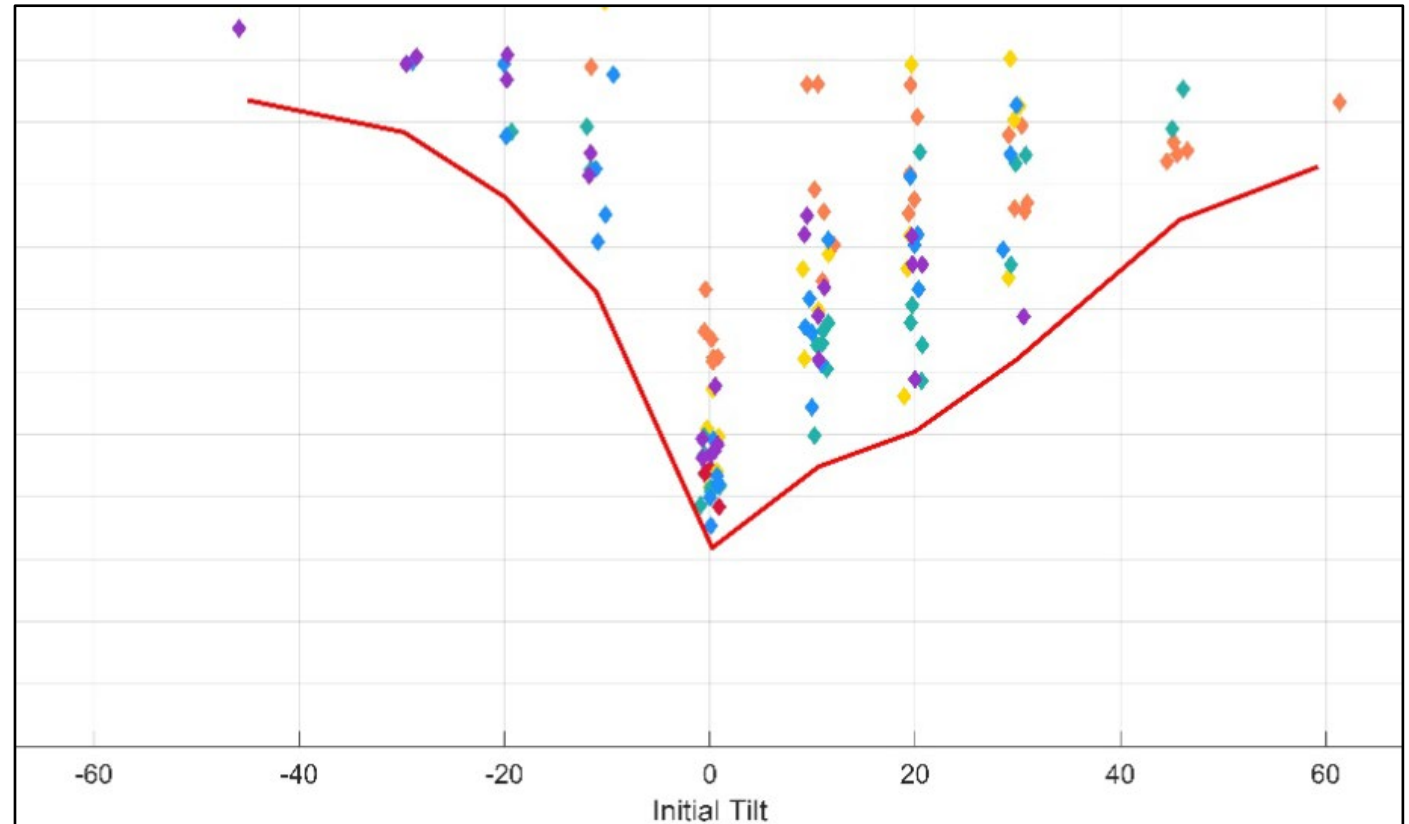
Enhance protection during
**rapid changes in wind
direction**



Protecting from **higher
wind ramp rates**

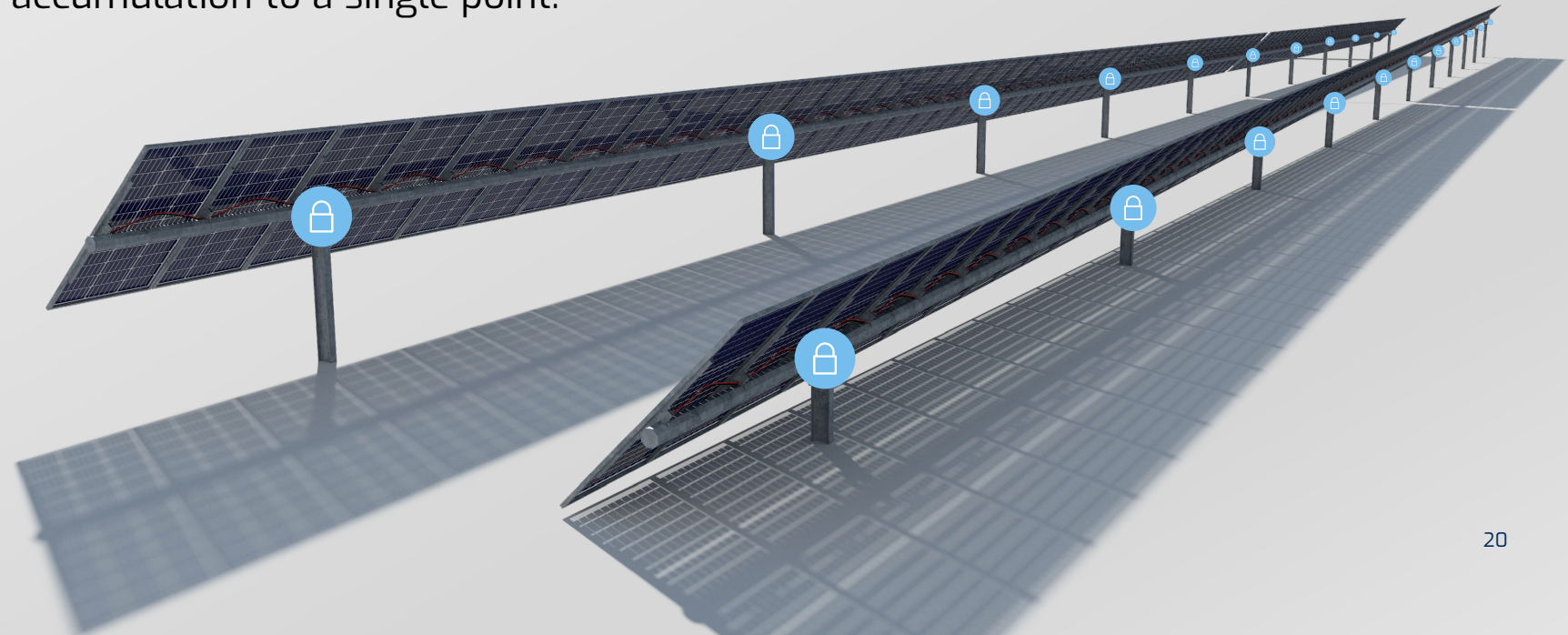
Speed to Stow: A Critical Factor

- **Rapid Stowing Enhances Durability**
Faster stowing minimizes exposure to instabilities, protecting the trackers' structure and components
- **Reduced Risk at Higher tilts**
Significant risk reduction as tracker tilts beyond 30° stabilizing the structure before instabilities come in.
- **TotalStow™ Advantage**
Ensures optimal protection by quickly reaching the safest angle in any direction, enhancing resilience during a weather event.



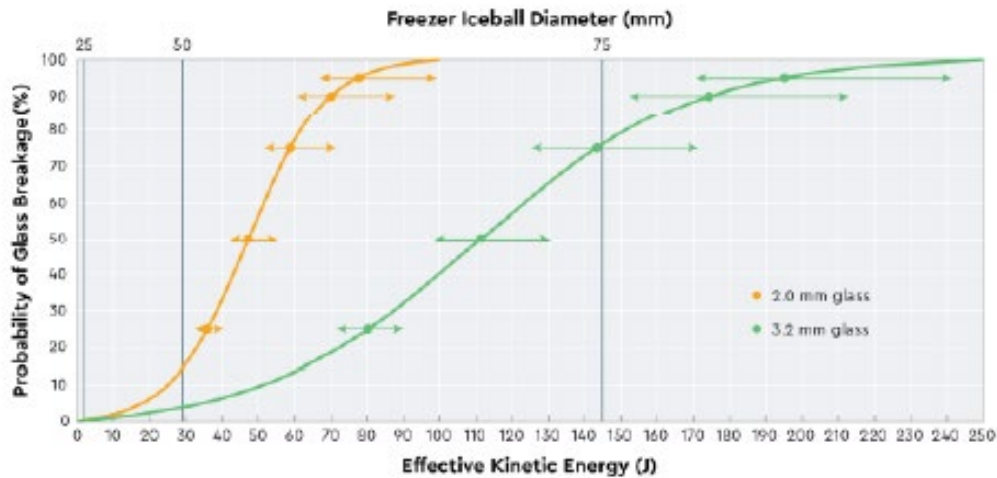
Mechanical Limits at Stow: Why they matter

- **Torsional Locks for Stability**
Mechanical limits act as torsional locks, transferring loads from the tracker to the nearest posts for added stability
- **Enhanced Load Distribution**
Wind loads are distributed evenly across all posts, optimizing the posts and foundations and reducing load accumulation to a single point.
- **Preventing over-rotation**



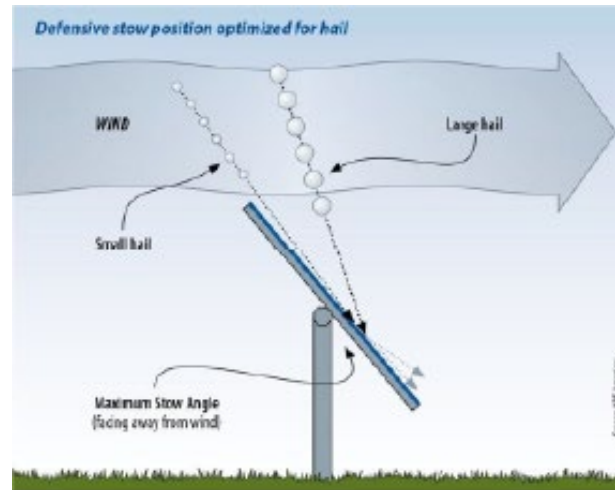
Hail Defense Strategy

- Using Higher stow position to minimize impact
- TotalStow™ ensure that we are in best positions during hail events
- Thickness of glass has an impact on the resilience
- Advanced weather monitoring to help with being in better positions when hail arrives



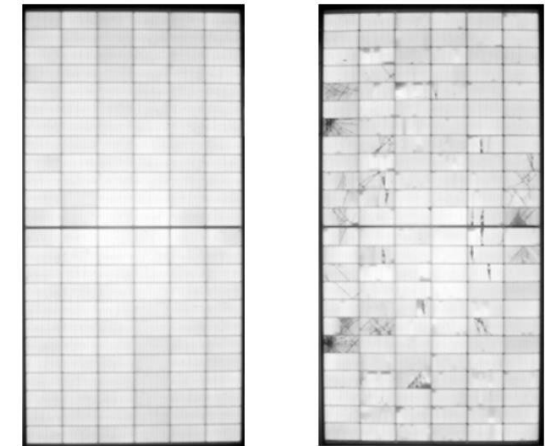
Comparative freezer iceball resiliency curves for common c-Si PV module packages

(Source: RETC)



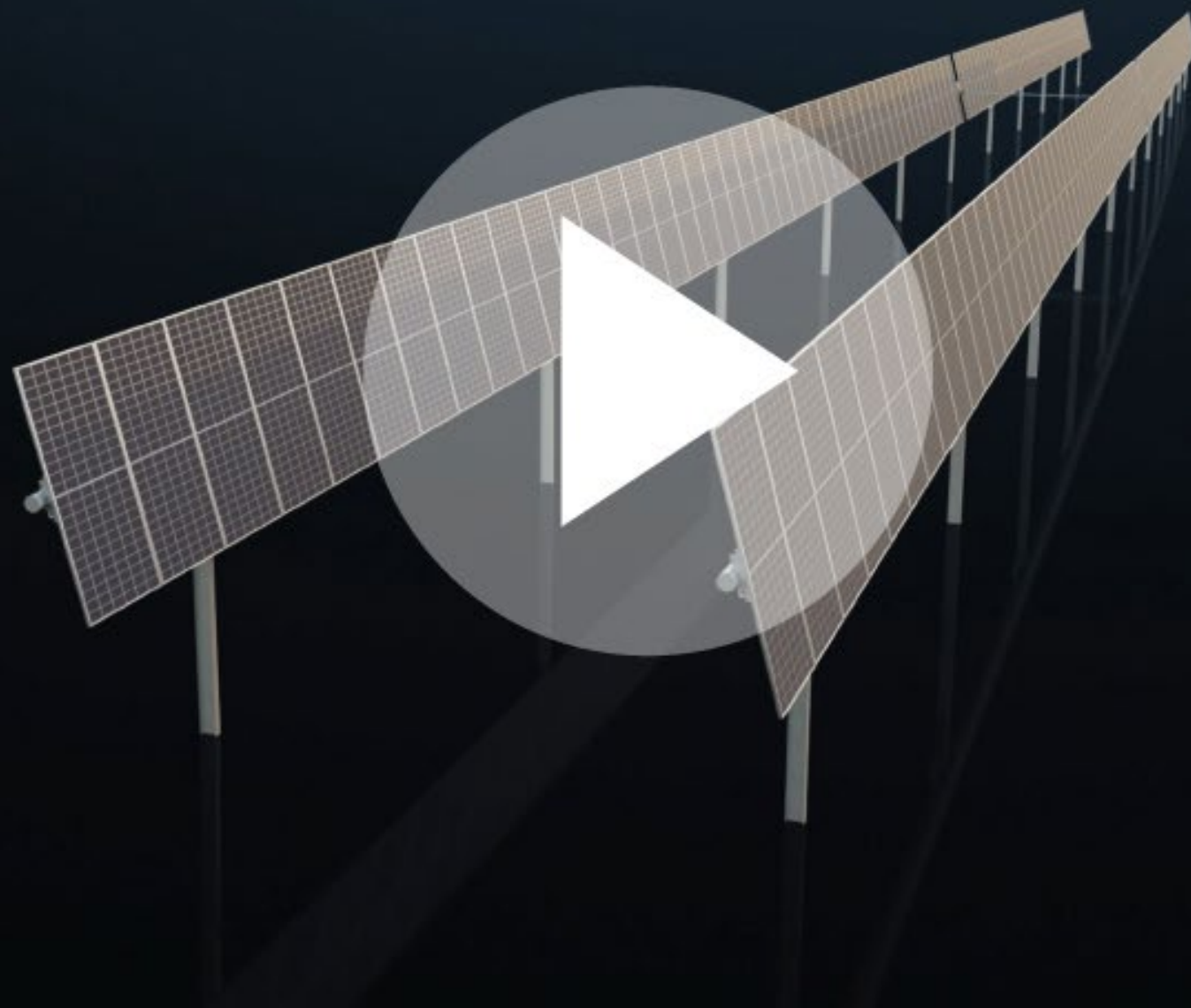
PV modules stowed away from the wind at a maximum tilt angle

(Source: VDE Americas)



Effects of 50mm hail strikes on Dual glass(left) and Glass/backsheet (right)

75° HAIL PROTECTION OPTION



Tracker Protection Strategies

Control System

Mbox – Meteorological stations with wind, snow, and hail sensors. Self powered (AC powered optional) and wireless.

Tbox – Master network controller.

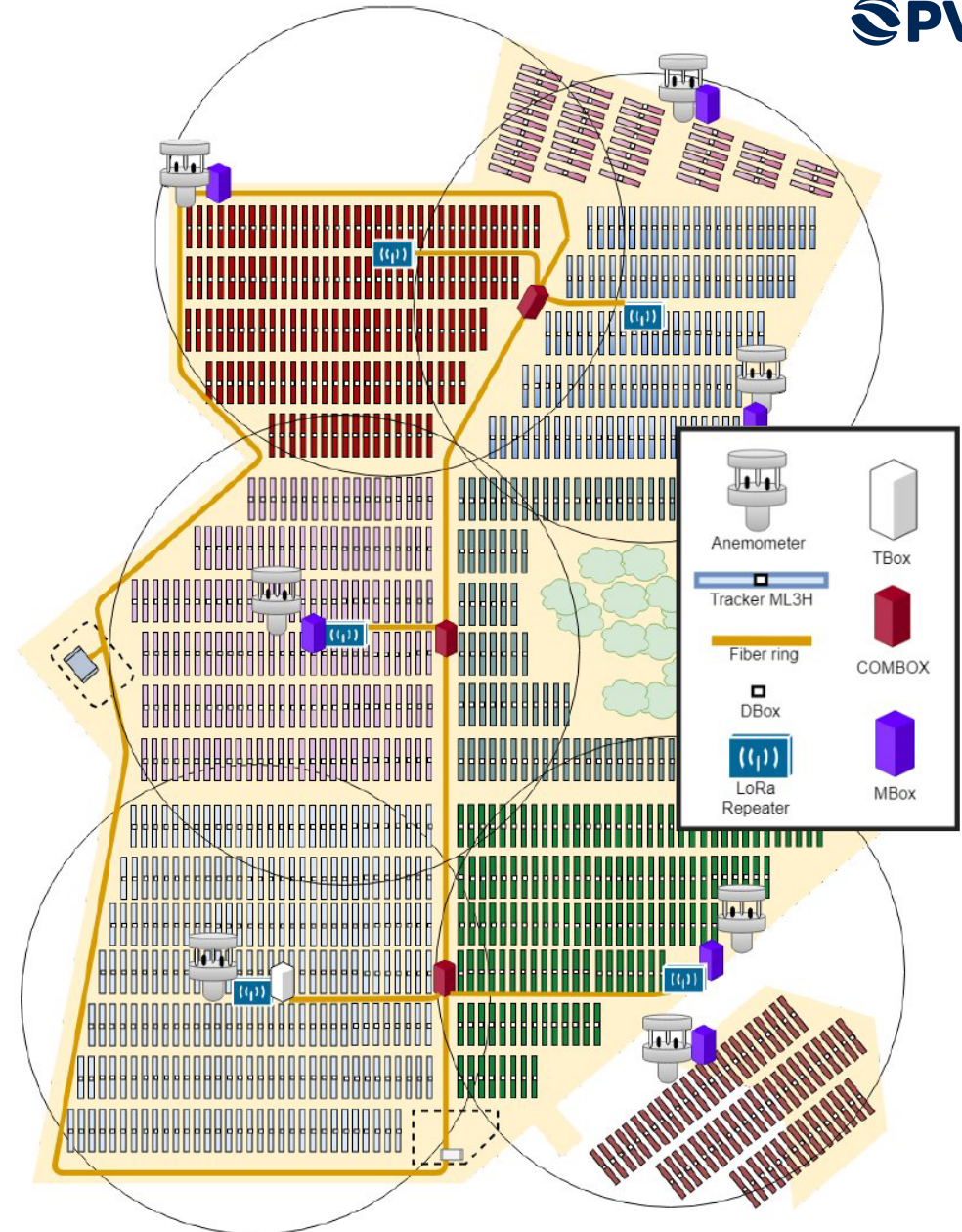
Dbox - Tracker motor controller. Self powered LiFePo or LTO for cold weather. (AC powered optional).

Gateway - LoRa communication device provides wireless communication to Dboxes and back to Tbox via fiber ring. Quantity depends on site shape and size. Can be ~6-12 per 100MW.

Protocols - LoRa wireless, OCP-UA or MODBUS for SCADA

Wind Sense

Wind prediction system with forecasting. The main advantage is to move the tracker in advance and the possibility to increase the trigger in order to reduce possible false alarms and increase the time in operation



Pre-Assembly and Proper Installation techniques

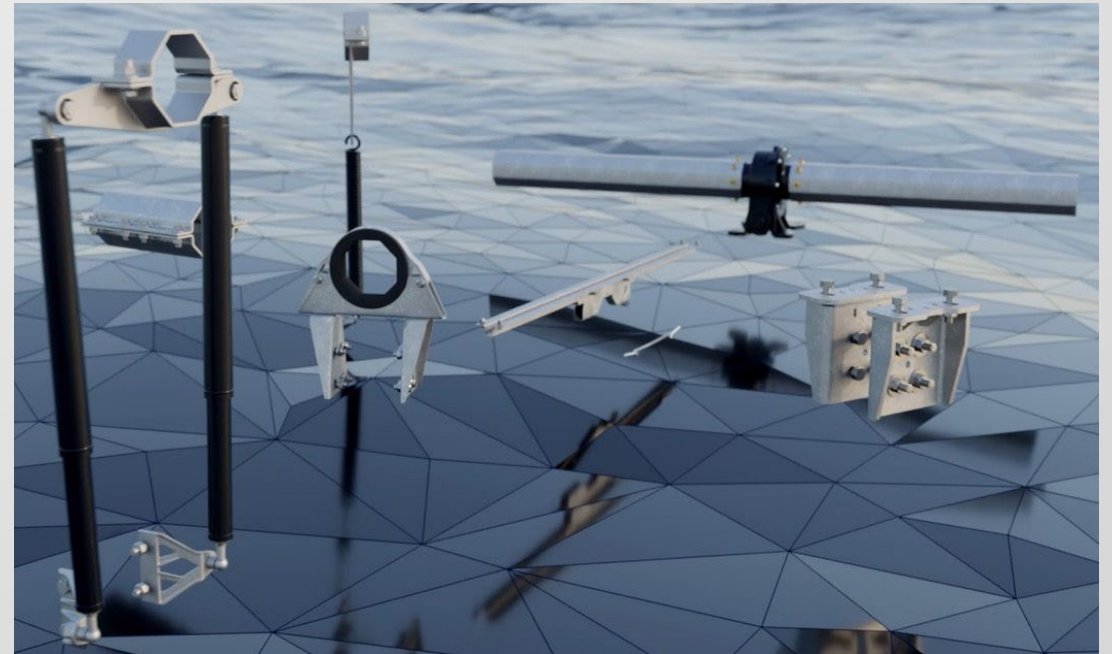
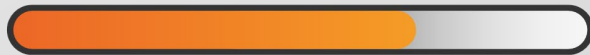
- Proper tracker installation also impacts in the tracker resilience against climate events.
- Preassembled components reduce the man hours on site, the quantity of components and facilitate the correct installation.
- Finally, it is important to note that the ITPs must be followed properly for a good installation verification.



44% time savings on on-site installation



65% reduction of the number of components



| Operation and Maintenance

- Operation and maintenance of solar trackers is easy and not complicated but people involved must be aware of the procedures.
- Good training is essential to reduce risks and ensure the best plant operation.
- Solar trackers have several protocols to protect itself when they are in auto mode (weather alarms, low battery, communication loss...). Removing them from this mode puts them in a helpless situation.
- Common errors which make remove the trackers from auto mode are the improper use of Emergency Stop or non control on vegetation or other obstacles that can lock the tracker movement.



| Looking to the Future: Resilient Solar Energy

Conclusions

- Increased frequency, severity, and duration of weather events impact the global PV industry.
- Mitigation of climate events must be considered in all the project phases, from the design phase and beginning of the construction till operation.
- Importance of Stow strategies, to respond to the most severe weather events.
- Installation Best practices and proper Operation and Maintenance is crucial for the resilience of the plant.



THANK YOU FOR YOUR ATTENTION

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Q&A



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Saudi Arabia's 3.7 GW solar tender attracts lowest bid of \$0.0129/kWh

by Emiliano Bellini



Most-read
online!

Credence unveils 725 W bifacial TOPCon solar module

by Uma Gupta



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2:00 pm – 3:00 pm CET, Berlin

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**The impact of
modularity on cost-
efficiency of battery
storage systems**

**Mitigating the CO2
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