

Making storage work beyond solar

As battery energy storage systems become increasingly important to renewable energy projects, developers are looking more closely at how storage can reduce curtailment, make better use of grid connections and strengthen project economics. Daniel Barandalla, Solar and Storage Advisory Lead EMEA at UL Solutions Renewables, discusses the technical, financial and operational risks that need to be addressed as the market develops.



PES: Welcome to PES Wind, Daniel. How would you characterise the current battery energy storage systems (BESS) market and which developments are having the greatest influence on project design and investment decisions?

Daniel Barandalla: The EMEA (Europe, Middle East and Africa) market is evolving quickly, with new initiatives and regulations helping to unlock investment and accelerate the deployment of energy storage. This is strengthening grid resilience, supporting the integration of renewable energy and contributing to grid stability and energy security.

Regulatory certainty, project bankability and more diverse revenue streams, including energy arbitrage, ancillary services, capacity mechanisms and grid support, are important drivers.

As battery costs continue to fall, adoption is expected to accelerate, while greater attention is being paid to equipment selection, warranty structure, degradation behaviour, cybersecurity and fire safety.

Initiatives such as the EU Digital Battery Passport, due to take effect in 2027, will also increase the focus on battery traceability, sustainability and compliance.

PES: As BESS deployment increases, how is the industry's approach to battery safety and project risk evolving?

DB: While compliance with UL standards is generally not mandatory across EMEA, demonstrating conformity with UL 9540 and providing test reports in accordance with UL 9540A, Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems, has become widely recognised as industry best practice.

Developers, insurers, investors and lenders are placing greater emphasis on fire safety and operational resilience. As technical advisers, we assess compliance with fire safety requirements and whether appropriate mitigation measures are in place to reduce the likelihood and consequences of a thermal event.

Independent assessment can strengthen stakeholder confidence, support bankability and contribute to safe, reliable long-term operation.



Key insights for wind developers

- Curtailment: store energy that might otherwise be curtailed during network congestion or negative electricity prices.
- Grid connections: make better use of shared infrastructure through wind, solar PV and BESS hybridisation where conditions allow.
- Dispatch and revenue: improve flexibility over energy delivery and create additional revenue opportunities.
- Bankability: strengthen financing assumptions through realistic degradation modelling, warranties and independent verification.
- Risk management: address safety, supplier suitability and contractual requirements early.
- Commissioning: test performance against contractual guarantees before commercial operation.

PES: Which risks are most important for developers to get right early in a BESS project, rather than trying to address them further down the line?

DB: Some markets have regulatory pathways that make it easier to hybridise existing solar or wind assets with BESS, but the regulatory, technical and permitting requirements vary by jurisdiction. Understanding these requirements early is important because they can influence design, permitting and the overall development timetable.

The BESS design also needs to reflect how the stored energy will be commercialised. Warranty provisions, degradation assumptions and safety requirements should be properly defined from the outset. If they are not, changes can become costly once procurement and construction are under way.

Long-term revenue, degradation and augmentation assumptions are equally important. Independent modelling can help test those assumptions and provide a more robust basis for valuation and financing.

PES: For wind developers specifically, where can BESS add the greatest value to a project, particularly when it comes to curtailment, grid constraints and the timing of energy delivery?

DB: Although BESS is more commonly combined with solar PV, the technology is also increasingly relevant to wind developers in some markets. It can help address curtailment, grid constraints and the need to make better use of existing grid connections.

This is particularly important where wind projects are exposed to network congestion and negative power prices during periods of high renewable generation. By storing energy that might otherwise be curtailed, BESS can improve energy capture, make better use of the grid connection and create additional revenue opportunities.

It can also give wind developers greater flexibility over when energy is delivered, helping to turn a variable generation profile into a more dispatchable asset.

We are seeing this in markets including Spain and Poland, where regulations governing hybridisation and so-called 'cable pooling' are encouraging different technologies to share grid infrastructure. This can allow wind, solar PV and BESS to make more efficient use of the same interconnection infrastructure where conditions allow.

PES: From technology selection and design through to construction, commissioning and operation, how should the approach to risk management change at each stage?

DB: The earlier risks are identified, the better. Development work leading up to ready-to-build status will determine how factors such as climate, soil and hydrology affect the engineering and overall design.

Procurement is also critical. The technology supplier needs to be financially stable and able to meet the required certification and compliance standards. Degradation assumptions and other technical parameters should align with the intended use case and dispatch strategy, with appropriate contractual protection.

Thorough commissioning is equally important, including performance validation and testing against contractual guarantees. Where problems are identified, remedies can then be requested from contractors or equipment suppliers before commercial operation begins. Corrective measures are generally less costly and more effective when issues are found early.

PES: When investors and financiers look at a BESS project, which technical and operational considerations carry the most weight in their decisions?

DB: Investors and lenders take a long-term view, so the strength of the project and sustainability of its cash flows are central to the investment case.

Important technical considerations include battery degradation assumptions, warranty robustness, operational strategy, system availability guarantees, fire safety design and supplier bankability.

Lenders also look closely at contractual structures, including EPC contracts, O&M

agreements and long-term service agreements, as well as augmentation strategies over the expected operating life of the asset.

Cybersecurity, climate resilience and insurability are becoming increasingly important too. Robust mitigation measures in these areas help protect performance and reduce operational risk.

PES: Are there recurring gaps in project documentation, testing or due diligence that can make a viable BESS project harder to finance?

DB: One recurring issue is a lack of detail or technical accuracy in the revenue modelling presented to financing providers. The equipment assumptions may not match what is actually being purchased, or the dispatch strategy may not reflect how the project will operate.

Independent validation can help ensure the dispatch strategy reflects the relevant markets and contractual arrangements, which may include energy and capacity markets, ancillary and regulation services, contracted deliveries and time-of-delivery obligations.

Documentation can also lack detailed commissioning procedures, proper verification of degradation warranties, evidence of factory acceptance testing or clear confirmation that safety systems have been assessed at system level rather than only at component level.

PES: What role can independent verification of battery performance, degradation assumptions and safety characteristics play in giving investors confidence in a project's long-term business case?

DB: Usable capacity, round-trip efficiency, auxiliary consumption and degradation are among the most important battery performance parameters and key inputs when assessing investment feasibility and expected returns.

Independent verification helps establish whether system performance aligns with the assumptions behind the business case. It can also provide an objective basis for claims if actual performance differs from guaranteed values and begins to affect revenues.

PES: Grid integration is becoming more complex. What should developers consider when assessing how a BESS project will interact with the wider electricity system?

DB: The growing penetration of renewable energy is changing how power systems are operated, and BESS is becoming increasingly important in enabling higher levels of renewable generation while maintaining grid stability.

Batteries bring additional complexity through advanced controls, state-of-charge management, cybersecurity requirements and the need to coordinate multiple grid services. Their ability to respond quickly, shift energy between time periods, provide ancillary services and support system recovery can strengthen grid resilience and security of supply.

Developers therefore need to look beyond the battery itself. Grid connection requirements, local network constraints, system strength, congestion risk, curtailment exposure and access to revenue-generating grid services can all influence the dispatch strategy and the project's investment case.

PES: Digital battery passports are attracting more attention across the industry. What would you want to see included in one for it to have real value for developers, operators, investors and regulators?

DB: The EU Digital Battery Passport will apply from 18th February 2027 to industrial batteries above 2 kWh, including stationary BESS, providing a verified record of areas such as product composition, sustainability, performance and lifecycle history. Further supply chain due diligence requirements are expected to follow.

Performance information such as state of health and round-trip efficiency could be particularly valuable, but consistent access remains a challenge because manufacturers use different proprietary methods to estimate state of health.

Greater standardisation and industry alignment will be needed if the information is to be genuinely useful and comparable for developers, operators, investors and regulators.

PES: Looking beyond the initial project, how could battery passports improve traceability and lifecycle management, as well as support second-life and end-of-life decisions?

DB: They have the potential to improve lifecycle traceability and support better informed decisions on continued operation, repurposing and recycling. The concept still needs to demonstrate that it can deliver sufficiently reliable and comparable information in practice.

Its success will depend not only on regulatory enforcement, but also on data verification, interoperability and standardised state-of-health methodologies.

PES: Where can an independent third party add the most value in BESS development, particularly when multiple manufacturers, contractors and technical disciplines are involved?

DB: An independent technical adviser can help ensure that clear Employer's Requirements are in place and that responsibilities are properly allocated across the contracting parties.

These might include the battery supplier, system integrator, EPC contractor, O&M provider, long-term service provider, route-to-market party and network operator. Gaps in scope, responsibilities or performance requirements can expose the project owner or financier to unnecessary risk.

In our experience, these gaps are rarely caused by poor work from one party. Each contractor manages its own scope and boundaries, but somebody still needs to look across the whole project. That is where an independent adviser can add real value.

PES: Looking ahead, which changes in standards, regulation, technology or financing do you think will shape the next phase of BESS development?

DB: The next phase of BESS development across EMEA will be shaped by clearer regulation, more consistent technical standards and stronger revenue frameworks. Mechanisms such as Italy's MACSE, Poland's capacity market, Spain's FEDER-backed storage programme and Bulgaria's RESTORE initiatives are supporting deployment.

Faster and more coordinated adoption of such mechanisms would give developers and investors greater certainty.

As the market matures, a longer operational track record should also improve understanding of performance, degradation and safety. That should lead to stronger warranties, better operating strategies and more robust financing assumptions.

Combined with more predictable revenue streams, this could broaden access to financing as storage becomes an increasingly important part of grid infrastructure.

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Daniel Barandalla has more than 20 years of experience in renewable energy and BESS.

He leads solar and storage advisory across EMEA at UL Solutions and has advised on hybrid renewable projects combining wind and BESS, as well as wind, solar PV and BESS.

His work includes system sizing and optimisation, technical due diligence, independent engineering and Lender's Technical Advisor support.