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From market discovery to designed resilience:

What Ofgem's LDES Window 1 means for CAES and long-duration storage

Great Britain’s energy regulator Ofgem’s provisional decision on the first phase of its Long Duration Electricity Storage (LDES) support scheme is significant because it backs 16 projects, which together would provide 7.6 gigawatts of storage capacity. However, the more interesting point is what it says about how the system is starting to think about resilience. In other words, the headline is deployment, but the deeper story is about how value is being judged.

A lot of the value long-duration storage brings — lower constraint costs, better operability, more resilience, support for decarbonization — does not show up cleanly in market revenues. That’s the basic reason the LDES Cap & Floor regime exists, and what seems to be emerging from it is something more important than a support mechanism for individual projects — it’s an early sign of a system in which resilience is being secured more explicitly where markets alone don’t reward it properly.

From market discovery to designed resilience

One of the most interesting things about Window 1 is that it starts with project economics and goes beyond. Ofgem begins with project-level modeling and then takes those outputs into a broader assessment of deliverability, uncertainty, technology diversity, location and consumer outcomes. Projects are being selected as part of a portfolio that has to work as a whole, not on their standalone merits.

Figure 1. *Window 1 reflects portfolio construction rather than technology selection*

Dimension	Evidence from Window 1
Technology diversity	Four technology classes selected
Duration diversity	8 hours to 32 hours
Geographic diversity	Scotland, England and Wales
Capacity concentration	Majority located in North Scotland
Long-duration resilience assets	Pumped Storage Hydropower (PSH) and Compressed Air Energy Storage (CAES) retained
Consumer value screening	Projects passed economic assessment before portfolio selection
Deliverability considerations	Included within Multi-Criteria.
Final outcome	Portfolio of complementary assets rather than single technology optimization

Source: *Ofgem Window 1 Minded-to-Decision and MCA framework*

That is a meaningful shift because the regulator is asking which projects look strongest in isolationand also what combination of assets is most likely to deliver the right system outcome. This is system design, informed by risks, under uncertainty, rather than optimization in a narrow sense.

That matters well beyond storage. It suggests we're moving away from a world in which resilience is expected to emerge from market interaction, and toward one in which is increasingly shaped through regulatory judgment.

This development is consistent with a broader shift across U.K. public policy. Recent government resilience frameworks and emerging approaches to resilience valuation increasingly recognize that critical systems can't be assessed solely through expected outcomes — they must also be evaluated based on their ability to perform under stress, uncertainty and disruption. Window 1 can be viewed as an early example of that thinking being applied within electricity system planning and investment support.

The limits of expected value optimization

That shift is necessary but doesn't explain how resilience should be assessed in a system that will be defined more and more by extremes rather than averages.

The analytical framework behind Window 1 is sophisticated — it uses whole system modeling, multiple scenarios and alternative weather years — but it still leans heavily on expected outcomes. That's where the tension sits. In a high renewables system, it is not average conditions that matter most. It is the harder periods such as prolonged low renewable output, regional imbalance, binding network constraints, and demand surges arriving at the wrong moment. Those are the periods when reliability is really tested and when system costs can rise quickly.

Resilience is now being selected using tools that recognize uncertainty but still rely heavily on expected value views of system performance.

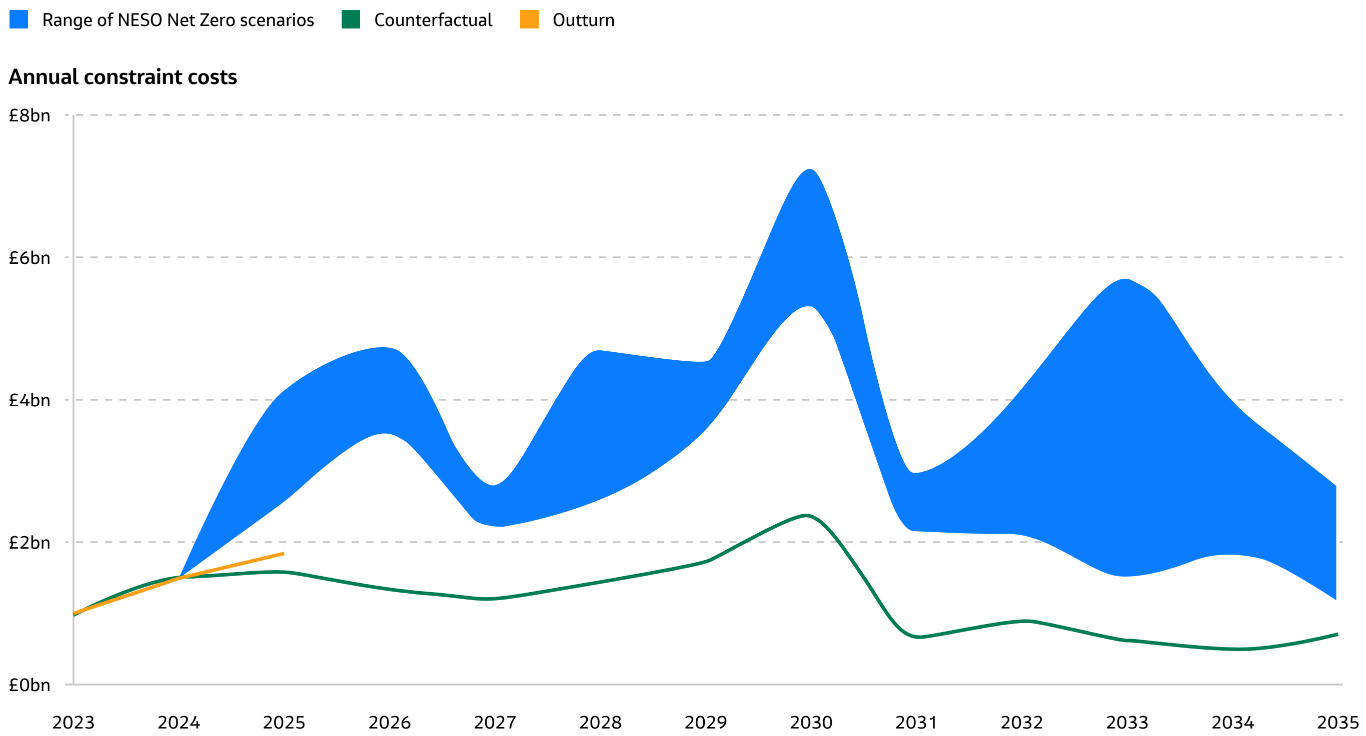
A portfolio can therefore look sensible in expectation and still perform quite differently under the conditions that matter most. The key gap, then, is not just between planning and connection. It is between portfolio selection and real-world system performance under stress.

Flexibility is spatial and resilience is conditional

Two things follow from that. First, flexibility is becoming more spatial. It matters where capacity is located relative to constraints, renewable concentration and demand, as well as how much flexible capacity exists. Second, resilience is becoming more conditional. Assets create value because they can respond for long enough, in the right place, when the system is under real strain.

Constraint costs across Great Britain are one of the clearest indicators that system value is becoming increasingly location dependent. As congestion grows, the economic value of flexibility depends on its capability and where it's located relative to constrained boundaries, renewable resources and centers of demand.

Figure 2. *Rising constraint costs indicate the growing importance of locational flexibility and network aware system planning.*



Source: *NESO Annual Balancing Cost Report Data Workbook (2025) and Constraint Breakdown Costs and Volume (2026).*

What matters here is what the rising costs tell us. As congestion becomes a larger part of total system cost, flexibility derives more of its value from where it's located and how it performs under constrained conditions, as well as its ability to shift energy over time.

Locational value is recognized in current assessment processes, but locational diversity is not the same as locational precision. It's often that precision — being close to a persistent bottleneck, a stressed demand center or a constrained boundary — that determines whether an asset delivers real system value when conditions tighten.

Why CAES is an important example

This is where technologies such as CAES become particularly interesting. CAES matters because it illustrates the kind of value that becomes easier to see in a portfolio-based framework. Its relevance lies in duration, sustained output and the potential to be located strategically within constrained parts of the network. That makes it particularly relevant where the issue is more than flexibility in the abstract — it's also reliability during prolonged stress.

While CAES is limited by access to suitable geology and salt cavern storage, those same constraints are part of what makes it strategically interesting. It can provide large storage volumes and longer discharge durations that complement more geographically flexible technologies such as batteries. Those characteristics may matter most under exactly the kinds of conditions that are hardest to capture fully in expected value modeling: prolonged renewable shortfalls, multi-day low wind events and compound stress across the system.

For that reason, assets such as CAES may also have value as a safeguard against model uncertainty, because their contribution becomes most visible in system conditions that are difficult to represent fully through expected value frameworks.

CAES also matters from a diversification perspective. Resilience is about more than installed capacity — it's also about diversity in technologies, operating characteristics and failure modes. A portfolio that includes batteries, pumped storage hydro, flow batteries and CAES is likely to be better equipped for a wider range of conditions than one dominated by a single technology class. In that sense, diversity itself becomes a resilience attribute.

What Window 1 signals

While Window 1 doesn't solve the resilience challenge, it does show the direction of travel. The significance of the decision is that it both supports long-duration storageand reflects a move away from relying only on market signals or simple project ranking toward shaping portfolios that are expected to perform under uncertainty. This raises the following questions:

1

How should portfolio performance under prolonged or compound stress be assessed?

2

How should locational system value be captured more precisely?

3

How should diversity, consumer protection and deliverability be balanced against pure economic rank?

4

How should future windows evolve as spatial system planning becomes more explicit?

These issues are at the heart of how resilience is defined, valued and procured in a decarbonizing power system.

The next phase

The next phase of the transition will defined by how much flexible capacity gets built and how effectively that capacity is selected, combined and positioned within the system. That means complementing expected value analysis with more explicit assessment of performance under stress: prolonged low renewable periods, binding network constraints, regional imbalances and correlated system shocks.

The challenge is therefore more than identifying technologies capable of delivering flexibility — it's working out how regulatory and market frameworks recognize, reward and procure the resilience characteristics the future system will need. That's because resilience is increasingly something the system is starting to design rather than reveal.

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