

MARKET ANALYSIS · OCTOBER 2026

Storage equipment supply outlook

Lead times, prices and delivery risk for the electrical equipment used in US utility-scale battery storage projects.

18 months

Longest quoted lead time for main power transformers in the sample, Q3 2026

5 months

Median lead time for battery enclosures, down from 9 months a year earlier

\$47/kWh

Average contracted price for LFP storage cells, Q3 2026, down 19% in a year

Contents

Key findings and about this outlook	2
1. Market context	3
2. Battery cells and enclosures	4
3. Power conversion systems	5
4. Transformers	6
5. Lead times by equipment class	7
6. Switchgear, breakers and protection	8
7. Schedule risk after connection approval	9
8. Procurement timing	10
9. Outlook for 2027	11
Methodology, definitions and contacts	12

Key findings

- 1 Battery availability has improved.** The median lead time for battery enclosures fell from 9 months to 5 months over the year to the third quarter of 2026. The average contracted price for LFP storage cells fell 19%, to \$47/kWh.
- 2 Transformer lead times reach 18 months.** Main power transformers for project substations had a median quoted lead time of 15 months, up from 14, with quotes from 12 to 18 months. They are the only major equipment class whose lead time rose.
- 3 Long-lead electrical equipment can delay projects after connection approval.** For 22 of the 34 projects in the sample with a signed interconnection agreement, the main power transformer was the last major item to arrive on site.
- 4 Order timing explains most delays.** None of the 18 projects that ordered the main power transformer before or within three months of signing their agreement had a transformer-driven delay. Seven of the 16 that ordered later did.
- 5 Grid-side equipment costs are rising as battery costs fall.** Main power transformer prices rose 6% and high-voltage breaker prices 4%, while integrated DC block prices fell 14%.

About this outlook

This outlook reports lead times and prices for the electrical equipment used in utility-scale battery storage projects. It is based on Vale Systems' order book and quotes for 57 US projects, totaling 2.6 GW and 9.6 GWh, for which Vale supplied or quoted equipment between October 1, 2024 and September 30, 2026.

Lead times are measured from purchase order to delivery at site. Prices are average contracted prices, delivered to US sites. The sample covers equipment delivery only. It does not measure how long projects wait for interconnection approval, and it does not include projects that have not yet reached the ordering stage. Full definitions are on page 12.

1 Market context

Storage projects are reaching the ordering stage in larger numbers and at larger sizes.

The 18 projects that placed a first equipment order with Vale in the second and third quarters of 2026 total 3.2 GWh, compared with 1.7 GWh for the 11 projects that placed first orders in the fourth quarter of 2024 and first quarter of 2025. Average duration across the sample is 3.7 hours, and nearly all projects that ordered in 2026 are four-hour designs.

Table 1. Projects in the sample by period of first order

Period of first order	Projects	Power (GW)	Energy (GWh)
Q4 2024 – Q1 2025	11	0.48	1.7
Q2 2025 – Q3 2025	13	0.57	2.1
Q4 2025 – Q1 2026	15	0.70	2.6
Q2 2026 – Q3 2026	18	0.85	3.2
Total	57	2.60	9.6

Table 2. Projects by region

Region	Projects	GWh
Southwest	21	3.8
Central and Plains	14	2.3
Southeast	10	1.6
Mountain West	7	1.2
Northeast	5	0.7
Total	57	9.6

Table 3. Interconnection status, September 30, 2026

Status	Projects	GWh
Signed agreement	34	6.1
Facilities study	15	2.4
Earlier study phase	8	1.1
Total	57	9.6

Status as reported by developers and updated quarterly.

Most projects reach Vale once they are close to, or past, a signed interconnection agreement. The 23 projects that have not yet signed are in the sample because they requested quotes or placed early orders, usually for main power transformers.

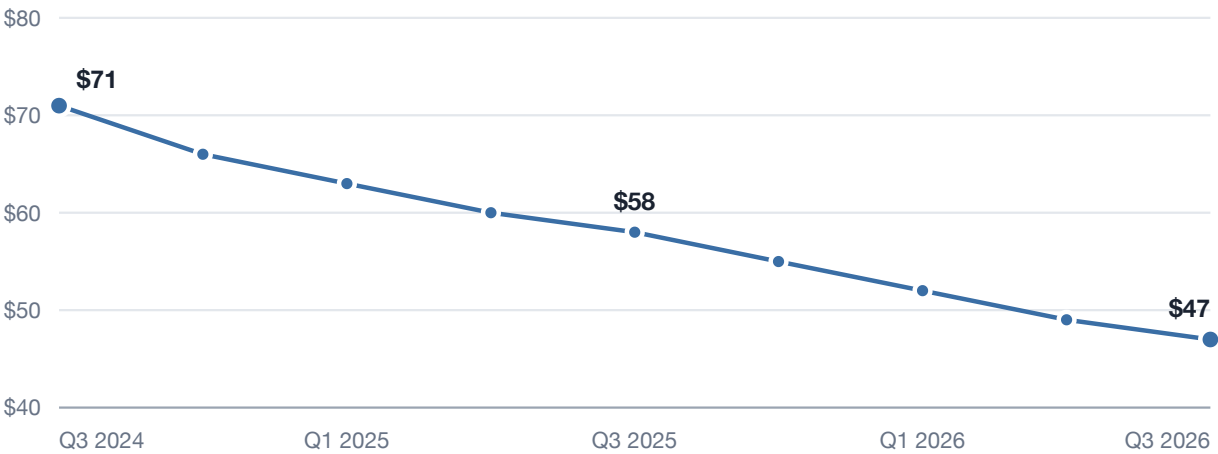
Storage is one source of demand among several for grid equipment. Utilities are replacing aging transformers and breakers, and large new loads compete for the same factory slots. Storage developers order in smaller quantities than utilities and tend to order later in a project's life, which places them toward the back of factory schedules for the largest units. That pattern matters more for transformers than for anything else in this outlook.

2 Battery cells and enclosures

Battery supply is no longer the constraint it was two years ago. Cell manufacturing capacity has grown faster than storage demand, and suppliers now compete on price and delivery terms.

The average contracted price for LFP storage cells delivered to US projects in Vale’s procurement data fell from \$58/kWh in the third quarter of 2025 to \$47/kWh in the third quarter of 2026, a decline of 19%. Two years earlier the price was \$71/kWh. Integrated DC blocks, which combine cells, racks, thermal management and the enclosure, fell 14% over the year, to \$96/kWh, because the non-cell components fell less.

Chart 1. Average contracted price for LFP storage cells, delivered US, \$/kWh



Source: Vale Systems procurement data and quotes from six cell suppliers. Quarterly averages, nominal dollars. The vertical axis starts at \$40.

Table 4. Battery prices and lead times

Measure	Q3 2024	Q3 2025	Q3 2026	Change, 1 year
LFP storage cells (\$/kWh)	71	58	47	–19%
Integrated DC blocks (\$/kWh)	131	112	96	–14%
Battery enclosure lead time, median (months)	12	9	5	–4 months
Late enclosure deliveries in sample (prior 12 months)	n/a	11	2	–9

Lead times moved in the same direction. The median quoted lead time for battery enclosures fell from 9 months to 5 months, and quotes in the third quarter of 2026 ranged from 4 to 7 months. Late enclosure deliveries in the sample fell from 11 in the year to September 2025 to 2 in the year to September 2026.

For developers, the practical effect is that the battery has moved from the front of the procurement schedule to the back. A project can now confirm its enclosure order several months after its grid-side equipment and still receive the batteries first.

3 Power conversion systems

Power conversion lead times eased slightly over the year, and prices fell 6%.

Power conversion systems (PCS), the inverters and their medium-voltage skids, sit between the battery and the project's collector system. The median quoted lead time fell from 8 months to 7 months, with a range of 5 to 9 months in the third quarter of 2026. The average price fell from \$68/kW to \$64/kW.

PCS supply depends on power semiconductors and on the medium-voltage transformer built into each skid. Suppliers that build the skid transformer in-house quoted shorter and more reliable lead times than those that buy it in, by about two months at the median.

Table 5. PCS lead times and prices by configuration

Configuration	Median lead time Q3 2025 (months)	Median lead time Q3 2026 (months)	Price Q3 2026 (\$/kW)
Central inverter skid, in-house transformer	7	6	61
Central inverter skid, bought-in transformer	9	8	66
String inverters with separate pad-mounted transformers	8	7	63
All PCS in sample	8	7	64

Lead times from purchase order release to delivery at site. Prices are average contracted prices, delivered, per kW of PCS rating.

Grid code review adds engineering time

Several grid operators now require grid-forming capability or detailed dynamic models for new storage. The model review can add four to eight weeks before a PCS order is released for manufacture. This is engineering time rather than factory time, and it is not included in the lead times above. Developers who start model review during the facilities study avoid most of it.

Spares and warranty terms

With supply easier, PCS suppliers are offering longer warranties and holding more spares in the US. Twelve of the 31 PCS orders placed in the sample during 2026 included on-site spare power modules, compared with four in 2025. Spares do not affect the construction schedule, but they shorten outages once a project is operating.

We do not expect PCS to be the critical path for many projects in 2027. Where it is, the cause is usually late design changes or grid code review rather than factory capacity.

4 Transformers

Transformers are the longest-lead items in a storage project, and main power transformers are the only major equipment class whose lead time rose over the year.

A typical project uses two kinds. Pad-mounted step-up transformers raise the output of each PCS block to the collector voltage, usually 34.5 kV. A 200 MW project might need 40 to 60 of them. The main power transformer at the project substation steps the collector voltage up to the transmission voltage. Most projects need one or two.

For the projects in the sample, the median quoted lead time for main power transformers rose from 14 months to 15 months, and quotes in the third quarter of 2026 ranged from 12 to 18 months. Pad-mounted transformers improved slightly, to a median of 10 months.

Table 6. Transformer lead times and prices

Class	Typical rating	Median Q3 2025 (months)	Median Q3 2026 (months)	Range Q3 2026 (months)	Price change
Pad-mounted step-up	3–5 MVA, 34.5 kV	11	10	7–13	
Main power transformer	60–200 MVA, 115–345 kV	14	15	12–18	

Quoted lead times from purchase order to delivery at site, for orders and quotes in the sample. Prices are average contracted prices per unit, adjusted for rating.

Why main power transformer lead times stay long

- **Core steel.** Grain-oriented electrical steel for large cores comes from a small number of mills, and allocation is set a year or more ahead.
- **Winding and test capacity.** Winding lines and test bays for units above 100 MVA are fully booked at most factories into the second half of 2027. At several plants the test bay, not the winding line, is the bottleneck.
- **Competing demand.** Utility replacement programs and large new loads compete for the same slots. Storage orders are a modest share of the total and are often placed late.

Pad-mounted units are built on shorter, more automated lines and draw on a wider supplier base, which is why their lead times have started to ease.

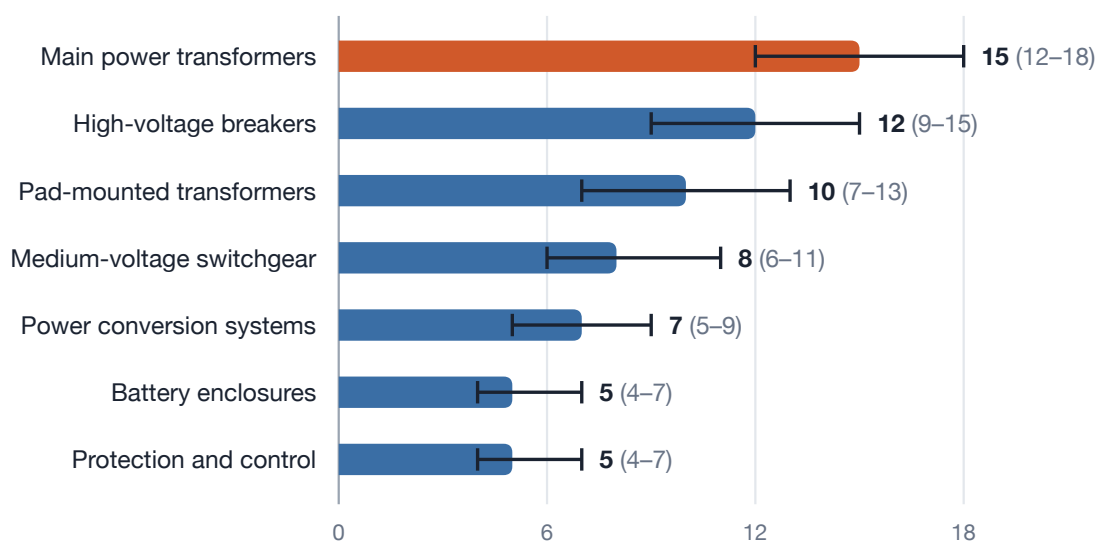
Vale's Carver Point plant builds main power transformers up to 300 MVA. On September 29, 2026 we announced a second production line there. Its effect on lead times is covered in the outlook on page 11.

5 Lead times by equipment class

Battery enclosures can now be ordered last. Main power transformers and high-voltage breakers have to be ordered first.

Chart 2 shows the median and the range of quoted lead times for the main equipment classes in the third quarter of 2026. The order of the list has changed since 2024, when battery enclosures had the second-longest lead time in the sample after main power transformers.

Chart 2. Quoted lead time from order to delivery at site, Q3 2026, months



Bars show the median quote. Lines show the range of quotes in the quarter. Source: Vale Systems order book and quotes, 57 projects.

Table 7. Median quoted lead times, months

Equipment class	Q3 2025	Q3 2026	Range Q3 2026	Change
Main power transformers	14	15	12–18	+1
High-voltage circuit breakers	12	12	9–15	0
Pad-mounted step-up transformers	11	10	7–13	–1
Medium-voltage switchgear	9	8	6–11	–1
Power conversion systems	8	7	5–9	–1
Battery enclosures (DC blocks)	9	5	4–7	–4
Protection and control panels	5	5	4–7	0

6 Switchgear, breakers and protection

High-voltage breakers are the second-longest item in the sample. The rest of the substation package is not a constraint.

High-voltage circuit breakers for the project substation had a median lead time of 12 months, unchanged from a year earlier, with a range of 9 to 15 months. Breakers rated 230 kV and above sit at the top of that range. Medium-voltage switchgear for the collector system eased to 8 months, and protection and control panels held at 5 months. Substation steel, bus and cable are not a constraint in the sample, with lead times of 3 to 5 months.

Prices for grid-side equipment rose while battery prices fell. Table 8 compares the change across all equipment classes in the sample.

Table 8. Price change by equipment class, Q3 2026 compared with Q3 2025

Equipment class	Price change
LFP storage cells	–19%
Integrated DC blocks	–14%
Power conversion systems	–6%
Protection and control panels	0%
Medium-voltage switchgear	+2%
Pad-mounted step-up transformers	+3%
High-voltage circuit breakers	+4%
Main power transformers	+6%

The result is a shift in what a storage project spends its equipment budget on. For a typical four-hour project in the sample, grid-side electrical equipment, meaning transformers, breakers, switchgear and protection, rose from 14% of equipment cost in 2024 to 19% in 2026, as the battery share fell.

Table 9. Equipment cost shares for a typical four-hour project in the sample

Cost share	2024	2026
Batteries and enclosures (DC blocks)	71%	64%
Power conversion systems	15%	17%
Grid-side electrical equipment	14%	19%

Lower battery prices therefore make the grid-side package a larger part of both the budget and the schedule. Developers who negotiated hard on batteries in 2024 are now spending that effort on transformer and breaker terms.

7 Schedule risk after connection approval

A project with a signed interconnection agreement has cleared the approval queue. From that point, its energization date depends on construction and on equipment arriving in time.

For the projects in Vale's sample, transformer lead times reach 18 months. Battery availability has improved, but long-lead electrical equipment can delay projects after connection approval. The sample covers equipment delivery, not the approval queue.

This section looks at the 34 projects in the sample that had signed an interconnection agreement by September 30, 2026, using actual deliveries or confirmed delivery dates. For 22 of them, the main power transformer was the last major item to arrive on site. For only three was it the battery enclosures.

Table 10. Last major item to arrive on site

Item	Projects	Share
Main power transformer	22	65%
HV breakers or switchgear	5	15%
Power conversion systems	4	12%
Battery enclosures	3	9%
Total	34	

Shares do not sum to 100% because of rounding.

Table 11. Last major item against planned energization

Arrival	Projects
3 or more months before	15
0 to 3 months before	10
After planned energization	9
Total	34

Transformer delivery can delay projects after connection approval. For nine of the 34 projects, the last major item arrived after the planned energization date, by a median of four months and at most seven. In seven of the nine, the late item was the main power transformer. In the other two, it was a high-voltage breaker.

The median time from signed agreement to planned energization in this group was 20 months. With main power transformer lead times of 15 months at the median and up to 18, a project that orders more than a few months after signing has little or no float.

These results describe equipment delivery only. The projects waited for their agreements for periods we do not measure, and for most of them that wait was longer than any equipment lead time in this report. A project that has not cleared the queue is not yet exposed to the risks described here.

8 Procurement timing

The difference between projects that were delayed by equipment and those that were not was mostly when they ordered.

Table 12. Main power transformer order timing and delivery outcome, 34 projects with a signed agreement

Main power transformer ordered	Projects	Transformer arrived after planned energization
Before the agreement was signed	6	0
0 to 3 months after signing	12	0
4 to 6 months after signing	9	3
More than 6 months after signing	7	4
Total	34	7

None of the 18 projects that ordered the main power transformer before signing, or within three months after, had a transformer-driven delay. Seven of the 16 that ordered four or more months after signing did.

Ordering early has a cost. A transformer ordered before the agreement is signed carries cancellation exposure if the project fails in study, typically 10% to 25% of the order value depending on how far manufacturing has progressed. Developers in the sample that order early usually do so only after the second cluster study results, when the remaining study risk is lower.

Practical steps for developers

- Order the main power transformer at or before agreement signature where study results allow, and negotiate cancellation terms that step up with manufacturing progress.
- Standardize transformer ratings across projects so a unit can be reassigned if one project slips or fails.
- Release high-voltage breaker and PCS orders next. Battery enclosures can be ordered last.
- Allow four to eight weeks for grid code model review before PCS release, or start it during the facilities study.
- Confirm factory test slots in writing. At several factories, test bay capacity is the binding constraint.

What suppliers can do

Suppliers can reserve production slots against a deposit before a full order, publish lead times by rating rather than by product family, and give earlier notice of test slot changes. Vale has offered slot reservations for main power transformers since the second quarter of 2026. Eleven projects in the sample have used them.

9 Outlook for 2027

We expect the pattern in this outlook to hold through the first half of 2027: battery supply ample, grid-side equipment tight.

Table 13. Expected median lead times, months

Equipment class	Q3 2026	Expected mid-2027	Direction
Battery enclosures	5	4–6	Stable
Power conversion systems	7	6–8	Stable
Pad-mounted step-up transformers	10	9–11	Stable to slightly shorter
Medium-voltage switchgear	8	7–9	Stable
High-voltage circuit breakers	12	11–14	Stable
Main power transformers	15	14–18	Stable to longer

Battery supply

We expect enclosure lead times to stay between four and six months and cell prices to be flat to slightly lower. The main risk to that view is trade policy rather than manufacturing capacity.

Transformer capacity

New transformer capacity is coming, but not quickly. Vale's second line at Carver Point will raise the plant's annual capacity from 60 to 105 large power transformers, with first units expected in the second half of 2027. Other manufacturers have announced additions on similar timelines. We do not expect these additions to shorten main power transformer lead times before late 2027.

The queue as a demand driver

One risk runs against the usual expectation. If interconnection studies speed up, more storage projects will reach the ordering stage at the same time. Transformer demand from storage would rise before new factory capacity arrives, and lead times could lengthen. Faster approvals would move more projects into the part of the schedule that this outlook describes.

What we will track

- Main power transformer quotes by rating and voltage class, quarterly.
- Late deliveries against planned energization for projects with signed agreements.
- Use and conversion of slot reservations into firm orders.

Methodology and definitions

Sample. 57 US utility-scale battery storage projects, totaling 2.6 GW and 9.6 GWh, for which Vale Systems supplied or quoted electrical equipment between October 1, 2024 and September 30, 2026. Projects smaller than 10 MW, behind-the-meter systems, projects outside the United States and spare-parts-only orders are excluded.

Lead time. Time from purchase order release to delivery at site. For delivered items we use the actual date. For open orders we use the confirmed delivery date. Quoted lead times are the supplier's committed time at order. Medians and ranges cover orders and quotes in the quarter shown.

Prices. Average contracted prices in the quarter, delivered to US sites, including freight and duties, in nominal dollars. Cell prices draw on Vale's purchases for its integrated DC blocks and on quotes from six cell suppliers.

Interconnection status. As reported by developers at order and updated quarterly. Vale does not measure how long projects wait in interconnection queues. For queue data, see grid operator reports.

Planned energization. The energization date in the project schedule at the time the last major item was ordered.

Major items. Main power transformers, pad-mounted transformers, high-voltage breakers, medium-voltage switchgear, power conversion systems and battery enclosures.

About Vale Systems

Vale Systems manufactures power transformers, switchgear and integrated battery enclosures for utilities and energy developers. The company employs about 2,400 people at three US plants, including its transformer plant at Carver Point.

Contact. Elena Marsh, Director, Market Analysis. market.analysis@valesystems.example

This outlook is provided for information only. Lead times and prices are drawn from Vale's sample and are not quotes or commitments. Vale Systems is a supplier to some of the projects described, and its own products are included in the sample.

Fictional page for product demonstrations. Names and figures are invented.