Eos Indensity™

How Eos reimagined energy storage configuration, and demonstrated zinc's system-wide potential

By Daniel Chang and Josh Payne

In a world of surging power demand, energy storage must be everywhere.

But the standard form factor of the battery energy storage systems (BESS) the industry relies on took shape in an era of remote renewables generation or transmission installations, defined by expansive sites, experienced utility crews, and long construction timelines.

Today's demand is different. Data centers, military installations, commercial campuses, and urban distribution substations, where electricity is urgently needed, all present new constraints on space, labor, deployment, and infrastructure. The assumptions built into conventional systems don't transfer easily to these environments.

Eos recognized this demand evolution as an opportunity to rethink energy storage architecture from the ground up. The result is an entirely new form factor designed to fit the physical, environmental, and human realities of the places energy storage must now operate.

Spatial Intelligence: Designing for a changing energy landscape

Battery energy storage entered the mainstream as a solution to the intermittency of renewable energy generation relative to baseload grid demand. Lithium-ion technologies quickly proved viable for this application and established the dominant form-factor for today's grid-scale storage.

Spatial Intelligence led the Eos team to ask a fundamentally different set of questions.

- What footprint would realistically be available in suburban and urban environments?
- How much would site layouts vary from one deployment to the next?
- What material-handling equipment would installation and service teams have available?
- How could the system be designed to reduce the need for specialized installation and maintenance expertise?
- How rapidly would these new customer segments expect systems to be installed and energized?
- What environmental conditions would the system need to withstand across these diverse deployment locations?
- How could the system be designed to integrate more seamlessly into surrounding communities?

Most current BESS units are, in essence, industrial electrical equipment: large, single-level metal enclosures placed side by side across open land. They require significant spacing for thermal management, fire safety, and maintenance access. Interconnecting them also requires extensive field wiring, including cable runs, junction boxes, and switchgear that is installed by certified electricians. Within each enclosure, multiple battery strings are managed by a shared control system. A single hardware or software failure can take a meaningful portion of the system's capacity offline.

These constraints are manageable on a hundred- or thousand-acre solar site with experienced utility crews and long construction timelines. But they become limiting when storage must fit into a quarter-acre footprint, be installed in weeks rather than months, and be serviced by teams whose primary expertise is general electrical or construction work rather than power plant operations.

The electrical grid's new needs for energy storage are increasingly concentrated in places where space is at a premium, and time and expertise may be constrained. Urban distribution substations serving growing load from data centers and electrification sit on lots that were sized decades ago for transformers and switchgear, not large battery systems. Data centers and industrial facilities need on-site storage but cannot reallocate acres of land, or costly personnel, away from core operations. Military installations require energy resilience within secured perimeters that have fixed boundaries. In each case, storage is needed exactly where the grid requires it. But those locations are not designed or resourced for conventional systems.

It was from this reality that Eos developed the concept of 'Spatial Intelligence.' This philosophy guided the development of Eos Indensity, its third-generation energy storage solution.

Under Spatial Intelligence, system design extends beyond technical performance alone. It accounts for the highly varied, real-world places and people who will live alongside future systems. The goal was to create a high-performance, scalable architecture that could be installed and serviced in a broad range of environments using commonly available equipment and appropriately trained personnel.

Eos was well-positioned to deliver on the promise of a Spatially Intelligent storage system because of two key technological differentiators. First, the zinc-halide technology in the Eos Z3 modules is inherently non-flammable. As independently verified by the Energy Safety Response Group (ESRG), under NFPA-855 direct flame and overcharge fire-test conditions, the Z3 modules did not experience thermal runaway, sustain fire, or propagate failure. This allows for very tight horizontal placement spacing, and more importantly, vertical stacking of the individual BESS units that house them. Second, Eos DawnOS™, its controls and software platform, enables distributed battery management, right down to an individual Z3 battery module.

From Cube to Core: Three generations of compounding insight

Generation 1: The Eos Cube

Eos' first commercial product, the Eos Cube (originally called the EnergyBlock) was launched in 2018. It housed the Eos 2.3 zinc-halide battery modules inside a standard shipping container with a footprint of 8 by 20 feet.

It was a practical starting point. Shipping containers are structurally robust, widely available, already familiar to the utility industry, and were widely adopted by emerging lithium-ion storage companies. The format also allowed Eos to focus early engineering efforts on its battery chemistry and battery management system, rather than enclosure design.

The original Cube successfully brought Eos' zinc halide chemistry into the field. But it quickly revealed the limitations of adapting an off-the-shelf form factor to a purpose-built energy storage system.

While convenient to acquire, and aligned with industry expectations, shipping containers were not designed around the specific thermal, structural, or service requirements of the Eos system. Retrofitting them introduced significant manufacturing complexity. In addition, the internal layout limited energy density. With access required on all four sides, maintenance considerations further expanded the overall footprint for an individual Cube well beyond the shipping container's physical dimensions.

Despite the fact that Eos' zinc-based chemistry required no additional ancillary HVAC equipment, the original Cube's energy density was limited to less than 50MWh per acre. For power projects of real scale, it became clear that a fundamentally different architecture would be needed.

Generation 2: The In-Line Cube

In 2023, Eos launched its second-generation Cube: a custom-fabricated steel enclosure designed to leverage the capabilities of the zinc halide chemistry and the latest Eos Z3 battery module.

The result was a system half the size of the original Cube, with more than twice the energy capacity.

This improvement went far beyond packing more batteries into a smaller box. The internal architecture was fully rethought: how batteries were arranged, how airflow was managed, how electrical connections were routed, and how the system was accessed for service. A key change in door placement allowed Cubes to be sited closer together in an in-line configuration, reducing overall site footprint. Together, these changes increased energy density per acre to approximately 100MWh.

By owning the enclosure design, Eos gained the ability to iterate on the structure itself. It could optimize for manufacturability, constructability, and serviceability in ways an off-the-shelf container never permitted. But even with these improvements, the second-generation In-Line Cube also revealed what a single-enclosure form factor could not do.

Each Cube still contained six battery strings sharing a common unit control system. It still relied on ground-based, single-layer deployment, utilizing only horizontal space. And field interconnection still required substantial cabling, conduit, and electrical integration work performed on site. The enclosure had improved. But the architecture of one large box placed next to another large box remained fundamentally unchanged from the rest of the industry.

The insight that led to the Indensity Core was not to build a better box. It was to take the box apart.

Generation 3: The Indensity Core

The foundational design decision behind Eos Indensity was to deconstruct the multi-string Cube into individual, self-contained units. Each Core houses a single battery string with its own controls, cooling, and communications. Rather than six strings sharing an enclosure and control system, Indensity distributes them across six independent Core units. Each Core operates as a complete energy storage system at the smallest practical scale, while still aggregating seamlessly into systems of any size.

Announced in 2026, the Indensity Core is a fully ruggedized, outdoor-rated, human-scaled unit measuring just 54 by 75 inches in footprint and 68 inches in height. It houses 112 Eos Z3 battery modules, each managed independently by a built-in control panel. Internal cooling fans drive 800 cubic feet per minute of airflow, drawing fresh air through an easily accessible filter. Exhaust exits from the back.

Externally, the Core's physical design reflects a deliberate philosophy drawn from consumer product engineering: the system should work the way a person expects it to. A forklift-ready base is integrated directly into the structure. No fasteners are required above head height. Wherever possible, connections are push-to-connect. The result is a system that can be installed and serviced without the highly specialized equipment or extensive battery-storage training often required by conventional utility-scale storage systems.

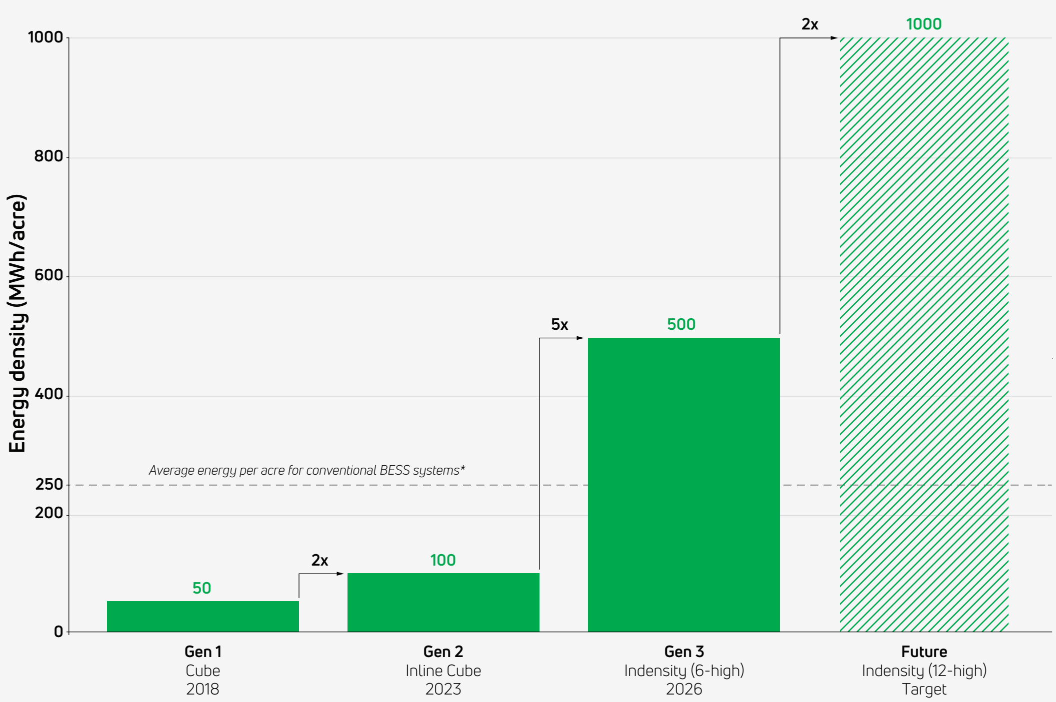
Dramatically simpler, lighter, and more compact than its Cube predecessors, the Core's engineering leverages the inherent non-flammability of Eos' Z3 battery modules to unlock a structural breakthrough: Cores could be easily and densely racked to fill the three-dimensional space of any given project site, scaling not just across the ground, but vertically.

This enabled entirely new deployment environments. Cores could also be installed indoors, opening access to locations previously considered unusable for energy storage. Not only space-constrained sites, but spaces with no available outdoor footprint at all. What was once dead space, from basement mechanical rooms, to parking structures, to enclosed utility spaces within commercial campuses, could now become active grid assets.

Figure 1

Engineering density, generation by generation

Moving from conventional containerized systems, to custom enclosures, to a modular, three-dimensional architecture has increased energy density of Eos systems 10x from Gen 1 to Gen 3. That's twice the density per acre of today's conventional systems, with a path to 4x.*



* Comparisons are derived from publicly available, third-party-reported performance data for representative lithium-ion BESS systems.

Reimagining the frame as infrastructure

The system that Eos is developing to stack the Cores is not racking in any conventional sense.

It is better understood as infrastructure: it is closer to a modular installation or process skid than a traditional storage rack. Each structural unit is a proprietary, prefabricated frame that integrates support, electrical distribution, and signal routing in a single assembly.

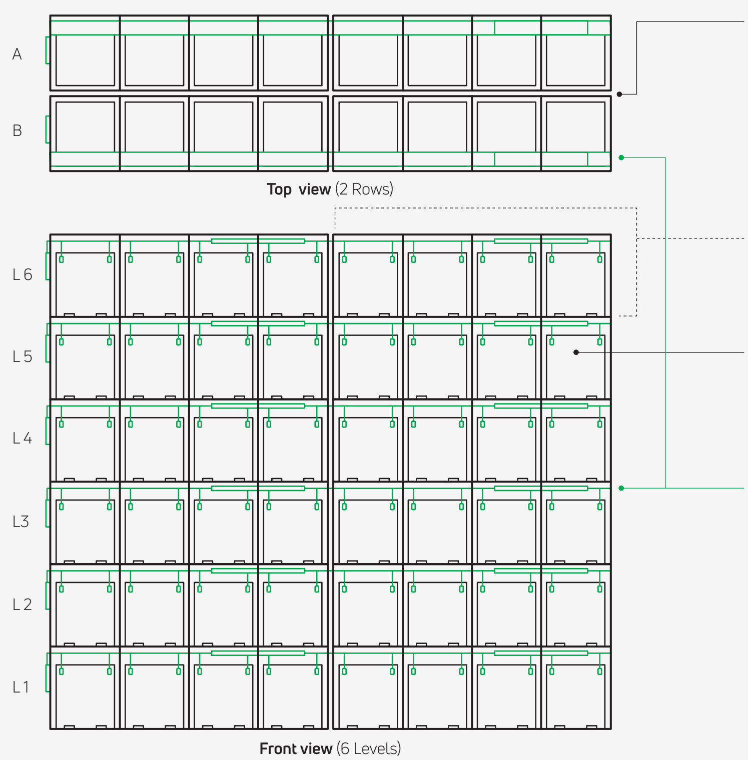
A single frame unit holds four Cores side by side in a single row. It contains the full electrical collection system for the column, including a junction box, vertical and horizontal cable raceways, custom busbars, fusing, and connections for UPS and auxiliary power. The Ethernet communication network is routed through the structure alongside the power conductors. Power from individual Cores passes through junction boxes at each level, aggregates through the raceways, and collects at busbars. The result is an electrical architecture embedded within the physical structure, rather than layered onto it after construction.

The frame units connect to one another through twist-lock fittings, the same mechanism used on shipping container corners. No special tools are required. A frame is positioned by a standard telehandler, set next to or on top of another, creating columns, and locked in place with a quarter turn. Bridge fittings tie adjacent columns together laterally.

Cores slide into the structure from the front. Power and communications cables are unfurled and terminated horizontally across and vertically down the frame. Only two of the four sides of a column require access: the front, for Core installation and service, and one short end, for cable connections.

Because the Cores are internally ventilated, the backs of adjacent columns can sit closely together. This enables Indensity installations to achieve density not only through vertical stacking, but also through tight horizontal packing across the site. A modest clearance zone is maintained only on the access sides, providing space for telehandler operation and service access.

Figure 2
Indensity architecture: Core + frame
The Indensity system separates structure from storage. Standardized frame units support, connect, and stack self-contained Cores up to six levels high. Electrical infrastructure—junction boxes, busbars, and cable raceways—is embedded directly in the frame, eliminating field wiring between levels. The back-to-back row configuration creates a central ventilation corridor, keeping thermal management simple without auxiliary HVAC.



Row configuration
Cores are arranged in back-to-back rows separated by a central ventilation corridor. Exhaust from each Core's internal fans exits into the gap, providing sufficient airflow for thermal management.

Frame unit
1-level structural steel unit with a group of four Core systems.

Individual Core
Self-contained system houses 112 Z3 battery modules, controls, cooling, and comms.

Electrical infrastructure
Junction boxes, busbars, and cable raceways are embedded in the frame connecting Cores and channeling power and comms.

What the Indensity architecture delivers

The Indensity architecture ultimately does more than redefine the BESS form-factor. It delivers a complete plant-level solution.

Each Core is a self-contained energy storage system, stacked and connected through proprietary infrastructure and controlled individually and collectively by DawnOS. Configurable to specific locations and applications, constructable with ease and speed, and capable of achieving new levels of energy density and reliability, Indensity is an all-in-one answer to the demands of a new generation of energy storage customers.

Configurability: Fitting every site, everywhere.
Because both the Core and the framing infrastructure are modular and self-contained, an Indensity system can be configured to fit virtually any site geometry.

The same building blocks can be deployed in different ways depending on the environment: spread across a suburban data center site and racked three levels high to meet local height restrictions; arranged six levels high on a narrow urban substation lot; or deployed as a single-level distributed system across a military field headquarters for secure, decentralized power.

System size is driven by the project's energy requirements and the site's three-dimensional opportunities, not by the fixed footprint of a conventional enclosure.

Density: Breaking the conventional ceiling.
The current Indensity design supports stacking Cores up to six levels high, reaching approximately 48 feet, the height of a four- to five-story building. Each level combines a 68-inch Core with its supporting frame structure, for roughly eight feet per level.

At this configuration, Indensity targets 500 MWh per acre, roughly double the density of many incumbent single-plane battery installations* On a quarter-acre suburban lot, a six-high configuration would deliver enough capacity to power more than 4,000 homes for a full day.

Future configurations extending to twelve levels, approximately eight to ten stories, would target 1 GWh per acre, representing up to four times the density of many conventional systems*

4,000+ homes

Powered from a quarter-acre site

On a standard quarter-acre suburban lot, a six-level Indensity installation can store enough energy to power more than 4,000 homes for one day.

Constructability: Designed to be built.
The physical process of constructing an Indensity system in the field is deliberately simple. An initial design goal was to install a 250MWh system, ready for interconnection, within a single week (a target expected to soon be validated in the field).

All infrastructure frame units will arrive prefabricated and are positioned using a standard telehandler. It's the only heavy equipment required, and one commonly found on construction sites. Cores ship with all batteries and controls pre-installed, then slide directly into the frames and connect.

The no-fastener, push-to-connect design philosophy reduces reliance on specialized labor. Installation teams do not require high-voltage electrical experience for mechanical assembly, as critical electrical integration is embedded into the system design.

250 MWh

Installed in one week

Design target: Complete installation and ready for interconnection.

Serviceability: Optimizing for uptime.
The Core architecture distributes system-level risk across independently controlled units, so an issue with one Core remains localized rather than compromising the broader system. For example, in a six-level installation with twelve Cores per level, an issue with a single Core would impact less than 1.5% of total capacity.

Equally important, that capacity reduction can be quickly corrected. A Core can be removed, replaced with a functioning spare, and serviced separately. This approach gets capacity back online quickly while allowing the removed unit to be repaired without taking the surrounding system offline. The result is greater resilience and improved uptime across the entire installation.

* Comparisons are derived from publicly available, third-party-reported performance data for representative lithium-ion BESS systems.

Accelerated by vertically-integrated operations

Eos moved from concept to the current Indensity architecture in less than seven months.

This pace was possible because Eos controls every layer of the system: battery chemistry, hardware design, control software, manufacturing, and field deployment. This vertical integration allowed teams to identify and implement cross-domain opportunities in real time, optimizing the system as a whole. Achieving this is difficult or impossible when assembling a system from outsourced components.

One principle that emerged during the development captured this philosophy: every part should do at least three jobs.

The Core's enclosure protects the Z3 modules, manages airflow, and serves as the mounting interface to the framing infrastructure. The infrastructure itself supports the Cores, routes the electrical and control system, and provides a common interconnection point for balance-of-plant equipment. Even the twist-lock fittings serve multiple functions, providing structural connection, alignment, and seismic resistance.

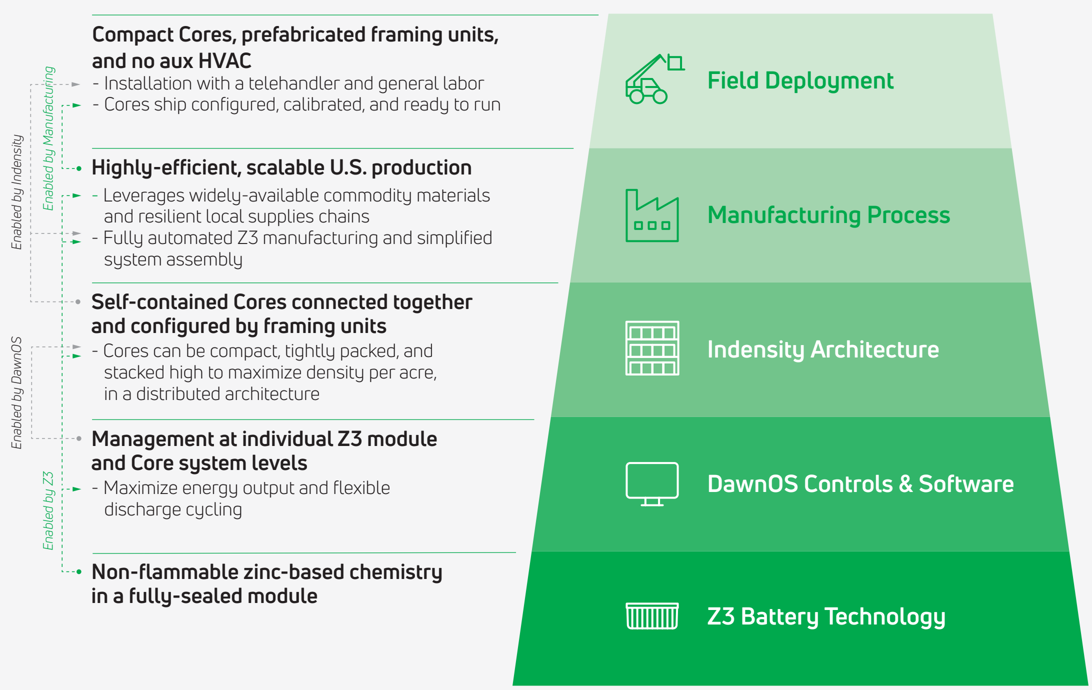
This philosophy extends throughout the Indensity architecture. Components are designed as integrated systems rather than discrete parts, eliminating unnecessary complexity while improving manufacturability, constructability, and performance. It is an approach made possible by Eos' vertical integration and end-to-end control of the technology stack.

Figure 3

Vertical Integration: Why Eos controls every layer

From battery chemistry to field deployment, Eos controls every layer of the system. Each one simplifies the next.

The result: A typical multi-year development cycle compressed into less than seven months.



This is what zinc makes possible.

Energy storage's ability to address urgent system challenges has been constrained not just by chemistry, but by a form factor designed for a limited range of applications. Eos Indensity was engineered to unlock its potential.

The Eos Z3's non-flammable battery technology is the key to Indensity's novel architecture. Without it, Cores would need the thermal separation distances and fire suppression infrastructure that constrain conventional systems to single-plane layouts.

Guided by its Spatial Intelligence philosophy, Eos created a compact, self-contained, individually intelligent base unit of storage, held in framing infrastructure that is itself engineered to carry power, data, and structure simultaneously. The result is a fully modular, integrated solution that better responds to the physical, environmental, and human realities of the places energy storage is now most needed.

Forward-Looking Statements and Performance Expectations. Certain statements in this paper describe expected or anticipated future performance, development targets, design objectives, deployment scenarios, installation timelines, density targets, comparative performance metrics, indoor deployment capabilities, projected customer applications, residential-equivalent energy supply estimates, or other anticipated capabilities of Eos Indensity. Such statements are based on current expectations, assumptions, engineering analyses, prototype designs, representative system layouts, and available information and are subject to risks, uncertainties, and change. Actual results, performance metrics, installation timelines, energy density, deployment configurations, operating characteristics, customer use cases, indoor deployment suitability, and residential-equivalent energy output may differ materially based on engineering development, testing, customer requirements, project design, site conditions, permitting requirements, local code requirements, setbacks, access requirements, regulatory approvals, construction conditions, operating environments, and other factors.

About the series

This paper is part of Principle to Proven, the Inside Eos Innovation Series exploring how Eos's zinc-halide chemistry reshapes every layer of energy storage. The next paper examines serviceability: how Eos is borrowing aviation's rotable-pool model to replace days of on-site repair.

About the authors

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Mr. Payne is Vice President of Manufacturing Engineering and Design at Eos, spearheading the integration of new production technologies to streamline manufacturing processes and drive continuous improvement. He brings three decades of experience in automotive battery production from American Battery Solutions, FCA Fiat Chrysler, LG Chem Power, and General Motors.