INTELLIGENCE WHITEPAPER · 01

The Intelligence Inside Next-Gen Energy.

A field manual on AI-driven battery orchestration, grid-scale resilience, and the software layer powering Europe's energy transition.

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VOLUME 01 · CONTENTS

What's Inside.

“The next great energy company will not be a battery maker.
It will be the software that decides when every battery breathes.”
— EdgeVolt engineering charter, 2026

01 · EXECUTIVE SUMMARY

The Thesis.

Energy is being rewritten in software. This is our position, our proof, and our plan.

EdgeVolt Europe & Nordic is a software and deep-tech intelligence company. We do not manufacture cells. We build the AI brains, control architectures, and battery-management systems that make existing lithium-ion and emerging solid-state hardware behave as if it were a decade newer.

Our thesis is direct: the bottleneck in the European energy transition is no longer chemistry, capital, or steel. It is decisioning. A battery without an intelligent operator wastes between eighteen and thirty-two percent of its economic life. Multiply that across a continent and the loss is measured in gigawatt-years.

We treat every megawatt-hour as a moving average of chemistry, weather, market price, cycle history, and grid stress. Our platform closes that loop in milliseconds — the same way modern trading systems closed the loop on equities two decades ago.

The company is headquartered on the Costa del Sol and operates a Nordic engineering footprint focused on Sweden, Norway, Denmark, Estonia, Germany, and the Netherlands. Pilots are live across four European grids.

Our platform ships as three layers: an on-device firmware runtime for battery controllers, a regional orchestration service that dispatches against day-ahead and intraday markets, and a portfolio-level intelligence layer that learns across every asset we touch.

This document explains, without marketing gloss, what we build, how it works, and what we intend to build next — including our early exploration of custom silicon and vertically-integrated solid-state modules for the second half of this decade.

+27%	−41%	11 ms	4
CYCLE-LIFE UPLIFT	**THERMAL DERATING EVENTS**	**CONTROL LOOP LATENCY**	**LIVE GRIDS**
vs. OEM BMS baseline	peak summer, Iberia pilot	cell dispatch decision	SE · NO · DK · NL

02 · DIAGNOSIS

The Gap Nobody Priced.

Europe added record battery capacity in 2024 and 2025. It still curtailed record renewable output. Something between those two facts is broken.

The public narrative frames storage as a hardware race — cells per gigafactory, euros per kilowatt-hour, tons of lithium under contract. That framing was correct in 2018. It is now incomplete.

A modern lithium-ion pack contains between four and eight thousand independent decisions per second: charge rate per module, thermal setpoint per string, state-of-charge floor per market window, degradation budget per cycle. The vast majority of installed European storage runs these decisions on firmware written before the current market design existed.

The result is a fleet of expensive assets making conservative, static choices in a volatile, dynamic environment. Operators know this. They lack the software to fix it without ripping and replacing hardware — which nobody can afford to do at scale.

There is a second, quieter problem: data poverty. Most deployed BMS units expose a fraction of the telemetry their sensors already generate. Cell-level impedance, dV/dT signatures, thermal gradient maps — the signals that predict failure three months in advance — are computed on-device and thrown away.

This is the equivalent of running a modern jet engine while logging only altitude and fuel level. It works, until it does not, and when it does not the failure is expensive and correlated across a fleet.

EdgeVolt was founded on the observation that the industry does not need more batteries before it needs more intelligence. Every asset already in the ground is under-earning. That is a software problem, and software problems are the ones we know how to solve.

> **“Europe does not have a battery shortage. It has a decision shortage.”**
>
> — Internal memo, EdgeVolt board pack, October 2025

03 · POSITION

Software as the Missing Utility.

Grids have wires. Batteries have cells. Neither has, by default, a nervous system. We build the nervous system.

01 / 03

Sense

Cell-level telemetry at 1 kHz.

Impedance, thermal gradient, dV/dT, coulombic drift, mechanical strain proxies.

Deployed as firmware on incumbent BMS controllers — no hardware swap required.

02 / 03

Predict

Physics-informed neural models per chemistry family.

Forecast: state-of-health at 30 / 90 / 365 days. Thermal runaway risk envelope. Optimal cycle depth per market hour.

Trained on 1.4 TWh of European operational data, retrained weekly.

03 / 03

Act

Dispatch against day-ahead, intraday, aFRR, and mFRR simultaneously.

Millisecond control loop. Human-auditable decision trail for every kWh moved.

Compliant with ENTSO-E grid codes and each national TSO's balancing rules.

The three layers are not products; they are one continuous loop. A cell that reports a rising impedance signature at 03:14 alters the dispatch schedule for its module by 03:14.002, revises the maintenance forecast for its site by 03:14.5, and updates the fleet-wide degradation model by end-of-day.

This loop is the product. Everything else — dashboards, APIs, contracts — is packaging.

04 · ARCHITECTURE

Cell to Grid, in One Loop.

A schematic view of how a single ampere of current becomes a settled trade on a European power exchange.

EDGE
On-Device Firmware Runtime
BMS controller · 1 kHz telemetry · deterministic safety envelope

LATENCY BUDGET
11 ms

↓

SITE
Site Orchestrator
Thermal management · SoC balancing · local market signals

LATENCY BUDGET
80 ms

↓

REGION
Regional Dispatch Service
Day-ahead + intraday + balancing markets · TSO grid codes

LATENCY BUDGET
1.4 s

↓

PORTFOLIO
Fleet Intelligence Cortex
Cross-asset learning · degradation modeling · scenario planning

LATENCY BUDGET
hourly

Each layer runs independently and degrades gracefully. If the portfolio layer goes offline, regions continue dispatching against last-known models. If a region loses connectivity, sites revert to local optima. If a site controller fails, the on-device runtime holds a safe, conservative operating envelope until an operator returns. There is no single point of failure that can compromise a battery's physical safety.

The Stack, Plainly.

What we build, what we buy, and where we refuse to compromise.

LAYER	TECHNOLOGY	BUILD	NOTES
On-device runtime	`Rust · no_std`	CUSTOM	Deterministic real-time. No garbage collection near
Site orchestrator	`Go · NATS · TimescaleDB`	CUSTOM	Horizontal, edge-deployable, works
Regional dispatch	`Python · Rust hotpaths`	CUSTOM	Market-facing. Written to be audited line by line.
ML training	`PyTorch · Ray`	OPEN	Physics-informed models. All experiments versioned.
Feature store	`Iceberg · DuckDB`	OPEN	Every prediction is reproducible from raw
Cloud substrate	`EU-region only`	SOVEREIGN	Data never leaves EU/EEA. Chosen provider varies by
Observability	`OpenTelemetry · Grafana`	OPEN	Every kWh moved has a distributed trace.
Secrets & identity	`SPIFFE · Vault`	OPEN	Zero long-lived credentials in production.

◆ ENGINEERING PRINCIPLE · 03

Boring where it matters. Novel where it pays.

Safety-critical paths use decades-old, provable techniques. The novelty budget is spent where it compounds: forecasting, dispatch, and cross-fleet learning.

05 · GEOGRAPHY

Cold Climate, Clean Grid, Honest Data.

The Nordic and Northern European corridor is not our marketing story. It is our engineering substrate.

Battery intelligence is a data problem before it is a physics problem. The Nordics happen to be the best data environment on earth: high renewable penetration, aggressive market volatility, transparent TSOs, and a climate that stress-tests thermal models every winter.

Sweden and Norway give us hydro-dominated grids with millisecond frequency response requirements. Denmark gives us wind volatility at continental scale. The Netherlands gives us congestion. Germany gives us the deepest intraday market in Europe. Estonia gives us a regulator that publishes machine-readable rules.

This combination — five distinct market designs, one interoperable grid — is why our models generalize. A control policy that survives a Danish December and a Dutch afternoon congestion event survives most of what the rest of the continent can offer.

Our Nordic engineering footprint is deliberately small and deep. We do not chase headcount. We chase people who have shipped safety-critical software and understand that a battery is not a database.

The company is headquartered in Marbella, on the Costa del Sol, where our commercial, partnerships, and investor relations teams operate. The choice reflects a simple fact: European energy is coordinated across borders, and our team should be too.

We work in-region, with in-region partners, under in-region law. Every byte of operational telemetry is stored and processed within the EU and EEA. Every model we train inherits that boundary. This is not a compliance posture. It is an engineering decision that makes the compliance posture inevitable.

SE	NO	DK	NL	DE	EE
Sweden	**Norway**	**Denmark**	**Neth.**	**Germany**	**Estonia**
Hydro · aFRR	Hydro · mFRR	Wind	Congestion	Intraday	Digital TSO

06 · VERTICAL

Powering the AI Economy, Cleanly.

The AI boom is a physical event. It is measured in megawatts, cooling loops, and grid-connection queues.

Europe's hyperscale and sovereign-compute buildout is the single largest new load on the grid this decade. A modern training cluster draws more instantaneous power than a mid-sized steel mill and cares about voltage stability the way a surgeon cares about clean gloves.

The default answer — oversize the utility feed, oversize the diesel backup, oversize everything — is fast, ugly, and increasingly impossible. Grid operators cannot connect what they cannot balance. Municipal permits will not grant what they cannot power.

The alternative is behind-the-meter storage operated as a first-class utility: not as a UPS, not as a peak shaver, but as an intelligent buffer that negotiates with the grid on the data center's behalf, second by second.

EdgeVolt is deploying that buffer with early European hyperscale partners. Our platform sits between the site's utility connection, its on-site storage, and its workload scheduler. It answers three questions continuously: how much can we draw right now without destabilizing the local grid, how much should we, and how much will it cost.

The result, in the pilots we are willing to describe publicly, is a data center that presents to the utility as a well-behaved neighbor and to its tenants as a source of uninterrupted, carbon-accounted compute.

This is where our storage intelligence and the AI industry's power hunger converge. Neither side gets what it wants without software that understands both.

◆ FIELD NOTE · HYPERSCALE PILOT · Q4 2025

22% peak-draw cut. Zero workload interruptions.

Over a 90-day observation window on a 34 MW pilot site, our dispatch layer reduced the site's peak grid draw by 22% while maintaining full workload SLA. The site's utility counterparty renegotiated the connection agreement in the operator's favor as a direct result.

07 · TRAJECTORY

Software First. Then Silicon.

A four-horizon plan. We are transparent about what is shipping, what is building, and what is still a hypothesis.

2026 — SHIPPING

Software-First Deployment

Retrofit intelligence across incumbent BMS hardware. Expand pilots from four to twelve European grids. Publish first peer-reviewed paper on physics-informed dispatch.

2027 — BUILDING

The Cortex Platform

Portfolio intelligence layer generally available. Multi-tenant deployment for aggregators and asset managers. First hyperscale data center customer at production scale.

2028 — COMMITTED

Custom Control Silicon

Ship EdgeVolt-designed BMS controller reference module. Own the sensing chain end-to-end. Continue to license our software onto third-party hardware.

2029+ — EXPLORING

Solid-State & Vertical Modules

Evaluate joint-venture routes to purpose-built solid-state storage modules co-designed with our software. We will only enter hardware manufacturing where our intelligence gives it a durable advantage.

07 · TRAJECTORY

A Note on Making Things.

Why a software company is even thinking about silicon.

We are frequently asked whether EdgeVolt intends to become a battery manufacturer. The honest answer is: only where the intelligence and the hardware are inseparable.

A generic lithium-ion pack does not benefit from being built by us. The world has excellent cell manufacturers, and our software makes their product materially better without touching a production line. Competing with them on cost per kilowatt-hour would be a category error.

A purpose-built BMS controller is different. The sensing chain — how a cell's voltage, temperature, and impedance are measured, filtered, and delivered to our runtime — is the foundation of everything above it. Owning that foundation lets us ship signals nobody else has access to. That is the case for our 2028 silicon horizon.

Solid-state modules are different again. The chemistry is genuinely new. The control regimes are still being invented. A software company that understands dispatch, degradation, and safety envelopes has a meaningful role in co-designing modules that would otherwise be optimized only for the lab bench.

Our commitment is to enter hardware only where the software makes the hardware defensibly better, and to remain, above all, a software company. Every hardware program we consider must clear that bar.

EdgeVolt Engineering Council
Marbella · Stockholm · Copenhagen · Amsterdam

08 · GOVERNANCE

Trust as an Engineering Discipline.

The people who let us near their batteries and their grids are giving us their trust. We treat that as a technical requirement, not a marketing claim.

ISO 27001
Information security management, certified.

SOC 2 Type II
In progress · target Q3 2026.

GDPR
EU/EEA data residency by architecture, not policy.

NIS2
Compliant with the Network and Information Security Directive for operators of essential services.

ENTSO-E
Grid code compliance validated per national TSO.

IEC 62443
Industrial automation security, applied to our on-device runtime.

◆ ETHICS

We do not sell our models to weapons buyers or to grid destabilization

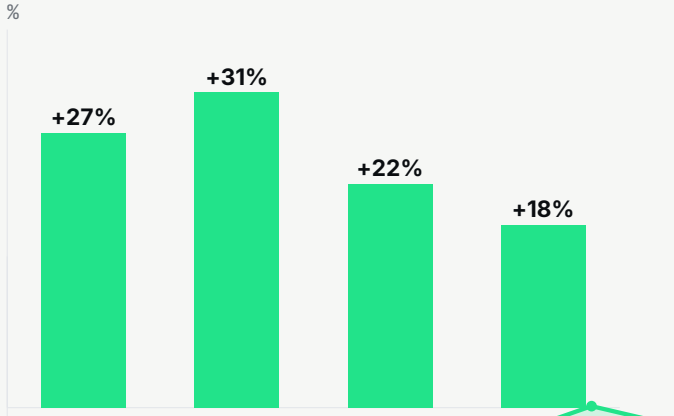
Every customer, partner, and downstream integrator is screened against EU sanctions and our own internal exclusion list. We publish an annual transparency report describing every customer category we serve and every category we have declined.

09 · EVIDENCE

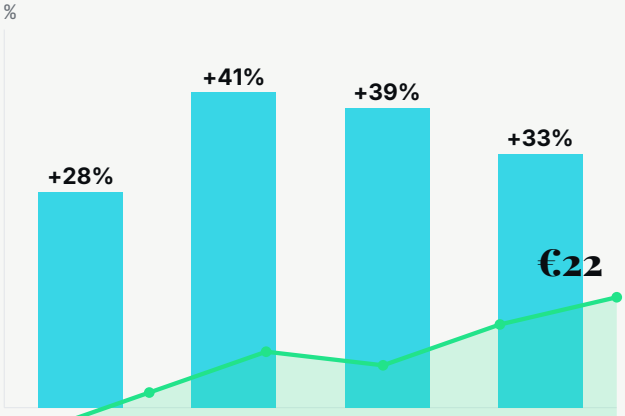
Numbers From the Ground.

Cherry-picked wins do not build engineering credibility. These are aggregated results across every European pilot we currently operate.

Cycle-life uplift vs. OEM baseline

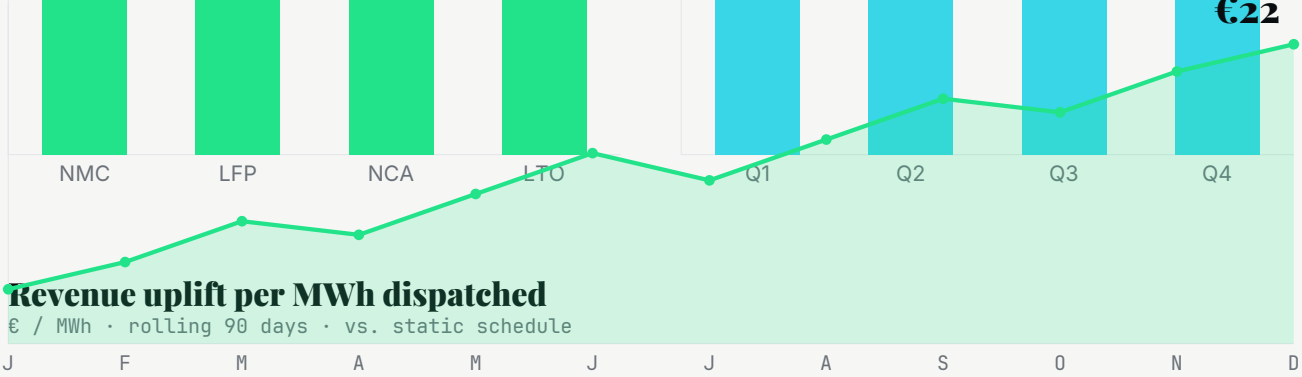


Thermal derating events reduced



Revenue uplift per MWh dispatched

€ / MWh · rolling 90 days · vs. static schedule



How We Measure.

Because unaudited numbers are marketing, not evidence.

- **Baselines**
  Every uplift figure is measured against the OEM's own reference schedule running on the same asset, same period, same weather, same market prices. We do not compare against synthetic baselines.
- **Attribution**
  Revenue uplift is calculated on an ex-post basis using cleared market prices. We do not credit ourselves for prices we did not actually capture.
- **Reporting cadence**
  Pilot performance is reported to customers monthly, in raw form, with every trade and every dispatch action attributable to a decision our system took.
- **Third-party audit**
  An independent engineering firm reviews our methodology annually. The 2025 review is available under NDA to serious customers and investors.
- **Failure disclosure**
  We publish every material incident where our system contributed to a suboptimal outcome. There have been three since inception. All three are documented in the customer portal.

10 · REFERENCE

Speak Our Language.

A short vocabulary for the terms that appear throughout this document.

aFRR
Automatic Frequency Restoration Reserve. Sub-minute grid balancing service.

BMS
Battery Management System. The firmware and controller that governs a battery's operation.

ENTSO-E
European Network of Transmission System Operators for Electricity.

SOC
State of Charge. The percentage of a battery's usable energy remaining.

TSO
Transmission System Operator. The entity responsible for national grid stability.

mFRR
Manual Frequency Restoration Reserve. Balancing service activated within 12.5 minutes.

dV/dt
Rate of voltage change over time. Early indicator of cell degradation.

Intraday
Continuous power market allowing trades up to minutes before delivery.

SOH
State of Health. A measure of a battery's current capacity relative to its original capacity.

Solid-state
Battery chemistry using a solid electrolyte. Higher energy density, better safety, still maturing.

CONVERSATION

Let's talk about the loop.

If you operate storage, plan storage, finance storage, or need clean power to run compute, we should be in the same room.

GENERAL
info@edgevoltnordic.com
Response within two business days.

PARTNERSHIPS
info@edgevoltnordic.com
Pilots, integrations, joint programs.

INVESTOR RELATIONS
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COLOPHON
Typeset in Liberation Serif & Sans. Printed on nothing.