ampverve

ENTERPRISE WHITE PAPER | 2026

Operating Flexible Energy at Enterprise Scale

A practical edge-to-cloud framework for lower cost, operational resilience, verified carbon and new grid value.

CONNECT
Assets, data and permissions

DECIDE
Forecasts, digital twins and guardrails

EXECUTE
Local edge and microgrid control

VERIFY
Delivery, carbon and settlement evidence

EXECUTIVE THESIS

The grid is becoming software-defined. Enterprise energy operations must do the same.

The value of distributed energy is created by coordination. Bankability depends on safe execution, verification and settlement.

EV fleets, batteries, solar, heat pumps, HVAC, smart meters and controllable loads are arriving at the same sites faster than traditional operating models can absorb them. Each asset may be intelligent on its own. The enterprise challenge is making the whole system act intelligently together.

Dashboards and point integrations improve visibility. They do not create a dependable operating model. Real value requires a control layer that understands physical limits, customer priorities, grid conditions, market rules and evidence requirements at the same time.

The strategic asset is not a battery, charger or building in isolation. It is the governed operating system that coordinates all of them.

FOUR ENTERPRISE OUTCOMES

01

Lower operating cost

Shift flexible demand, reduce peaks and improve use of on-site generation.

02

Operational resilience

Keep local decisions and protection logic available at the site edge.

03

Verified carbon

Measure how timing, generation and demand change emissions outcomes.

04

New grid value

Turn authorised flexibility into measurable, settlement-ready delivery.

EXECUTIVE SNAPSHOT

The opportunity is large. The operating discipline must be larger.

Electrification increases the value of flexibility, but only when assets remain dependable infrastructure first.

20M+
electric cars sold globally in 2025
IEA Global EV Outlook 2026

23M
electric-car sales expected in 2026
IEA Global EV Outlook 2026

510M
global EV fleet possible by 2035
IEA Global EV Outlook 2026

3.6%
forecast electricity-demand growth in 2026
IEA Mid-Year Update 2026

AMPVERVE PUBLISHED PLATFORM SNAPSHOT

30+	12	<100 ms	24/7	8
protocols and integration paths	awareness layers in AmpVerve Brain	published local edge decision target	grid-native operating model	asset classes across electrical and thermal loads

What this paper argues

Flexibility is not a dashboard feature. It is the ability to make distributed assets behave as dependable infrastructure without compromising mobility, comfort, safety, resilience or customer permissions.

AmpVerve closes the loop from planning and connection to local execution, verification and settlement.

Contents at a glance

01 System shift and coordination gap
02 AmpVerve operating stack
03 Digital twins and edge autonomy
04 Multi-asset and V2X operations
05 Verified value and portfolio scale
06 Enterprise readiness and deployment

Sources: IEA Global EV Outlook 2026; IEA Electricity Mid-Year Update 2026; AmpVerve website, accessed 23 July 2026.

01 | THE SYSTEM SHIFT

Electrification is moving capacity planning from an annual exercise to a daily operating challenge.

The new load is distributed, dynamic and constrained by local infrastructure.

More EVs, batteries, solar, heat pumps and data-centre loads are coming online than legacy site controls were designed to coordinate.

This growth does not create a single smooth load. It creates local constraints: depot import limits, thermal comfort bands, battery warranty limits, vehicle departure reserves, inverter capability and market commitments. The operating problem is not simply how much electricity a site uses. It is when, where and under which conditions the site can change its demand.

Smart charging can shift load away from peaks. Thermal systems can pre-heat or pre-cool. Batteries can preserve headroom and support resilience. V2G can create an additional resource where the vehicle, charger, grid connection, tariff and market programme are all compatible. The orchestration layer must coordinate these actions as one site, not as separate projects.

Implication 1

Energy capacity becomes an operating variable, not a fixed site characteristic.

Implication 2

The value of an asset depends on its relationship to every other asset and constraint.

Implication 3

Verification and settlement become part of operations, not an afterthought.

Source: IEA Global EV Outlook 2026; IEA Electricity 2026; AmpVerve analysis.

02 | THE COORDINATION GAP

Connected assets do not automatically become dependable flexibility.

The operational problem is coordinating decisions across assets, sites, people and markets.

01 Fragmented controls

Chargers, BMS, batteries, meters and HVAC are often governed through separate tools and vendors.

02 Competing objectives

Cost, carbon, comfort, readiness, warranty and revenue can point to different actions.

03 Uncertain availability

A technically controllable asset may not be available when the market needs it.

04 Weak local continuity

Cloud-only control creates risk when communications or upstream services fail.

05 Opaque decisions

Without a decision record, operators cannot explain why an action was taken or refused.

06 Settlement gaps

A command is not value. Delivery must be measured, attributed and reconciled.

THE ENTERPRISE REQUIREMENT

Coordinate every asset strongly enough to create value, but conservatively enough to protect operational reality.

OPERATING PRINCIPLES

Six principles for an enterprise energy operating system.

Maximum trustworthy value matters more than maximum theoretical dispatch.

01

Operations before markets
Flexibility is offered only after readiness, comfort, site capacity and safety are protected.

02

Local autonomy by design
Critical constraints and fallback behaviour remain available at the site edge.

03

Physics before optimisation
Every proposed action is checked against digital-twin state and asset limits.

04

Open integration
Published protocols and documented schemas reduce lock-in and integration risk.

05

Evidence as a product
Commands, measurements and outcomes become an auditable operating record.

06

Portfolio intelligence
Sites are coordinated as a portfolio without erasing local differences.

THE OPERATING ENVELOPE

Hard constraints

Readiness - safety - comfort - warranty - site import and export limits - customer permissions

→

Optimisation objectives

Cost - carbon - resilience - asset life - flexibility revenue - market value

03 | THE AMPVERVE OPERATING STACK

One operating stack from planning and connection to verified value.

Modules can operate as a full suite or compose around existing enterprise systems.

Enterprise and market layer Tariffs - grid services - wholesale - balancing - customer applications - BMS/EMS - ERP - APIs

PLAN
Model ROI, sizing and carbon before investment.

CONNECT
OCPP, ISO 15118, Modbus, MQTT, meters and APIs.

BRAIN
Forecast and optimise across twelve awareness layers.

TWIN
Check every proposed action against electrical, thermal and degradation models.

EDGE
Execute locally with low latency, fallback and store-and-forward.

TRADE
Dispatch across eligible tariffs, flexibility and energy markets.

SETTLE
Measure delivery, attribution and commercial value.

COMPLY
Permissions, audit, reporting and certification controls.

ASSET AND SITE LAYER

EVs · chargers · batteries · solar · meters · heat pumps · HVAC · buildings · grid

Security, identity, permissions, telemetry quality and evidence retention span every layer.

Source: AmpVerve website and platform positioning, accessed 23 July 2026.

AMPVERVE AI BRAIN

Twelve awareness layers. One decision context.

The optimiser evaluates cost and market value only after it understands the asset, site, customer and grid state.

01 Price
Day-ahead, intraday and retail tariff signals.

02 Weather
Irradiance, wind, cloud and temperature.

03 Travel
Departure time, journey length and reserve.

04 Comfort
Set-points, occupancy and thermal envelope.

05 Demand
Per-asset and per-site load forecasts.

06 Solar
Production curves calibrated to the meter.

07 Battery
SoC, SoH, chemistry and cycle limits.

08 Grid
Frequency, voltage, congestion and carbon.

09 Tariff
Standing, time-of-use and export rates.

10 Carbon
Marginal carbon and avoided emissions.

11 Asset
Digital-twin state checked on every command.

12 Settlement
Programme rules, baselines and reconciliation.

FORECAST	SIMULATE	OPTIMISE	GOVERN	EXECUTE
What is likely to happen?	What are the safe choices?	Which choice creates the best value?	Which permissions and limits apply?	What local action should occur now?

DIGITAL TWINS AND GUARDRAILS

Every action is tested against reality before it is executed.

A useful digital twin changes the quality of a live decision. It is not a static asset record.

OBSERVE

Asset state, meter data, schedules, connectivity and context.

SIMULATE

Forecast load, generation, price and operating conditions. Test alternatives before control.

GOVERN

Apply hard limits for readiness, comfort, safety, warranty, permissions and site capacity.

HARD CONSTRAINTS ARE POLICY, NOT PREFERENCES

Departure reserve | Battery warranty | Thermal limits | Import/export cap | Comfort band | Customer opt-out

DECISION RECORD

Record	What it proves
Input state	What the platform knew
Forecast	What it expected
Optimisation	Why an action was selected
Safety check	Which constraints were tested
Execution	What command was issued
Verification	What the asset delivered
Settlement	How value and carbon were attributed

04 | LOCAL RESILIENCE

AmpVerve Edge keeps the site intelligent when conditions change.

The edge layer enforces site rules close to physical assets and preserves safe operation during communication loss.

Three operating modes

- **GRID CONNECTED**
  Optimise cost, carbon and market value while protecting the connection agreement.
- **CONSTRAINED**
  Prioritise critical loads, maintain import limits and reduce non-essential demand.
- **ISLAND READY**
  Coordinate local generation, storage and loads when approved protection and switching exist.

Local decisions

Control remains close to chargers, batteries, meters, HVAC and building systems.

Continuity

Store-and-forward and safe fallback preserve the operating record.

Microgrid control

Local coordination supports grid-connected, constrained and engineered island modes.

Secure operations

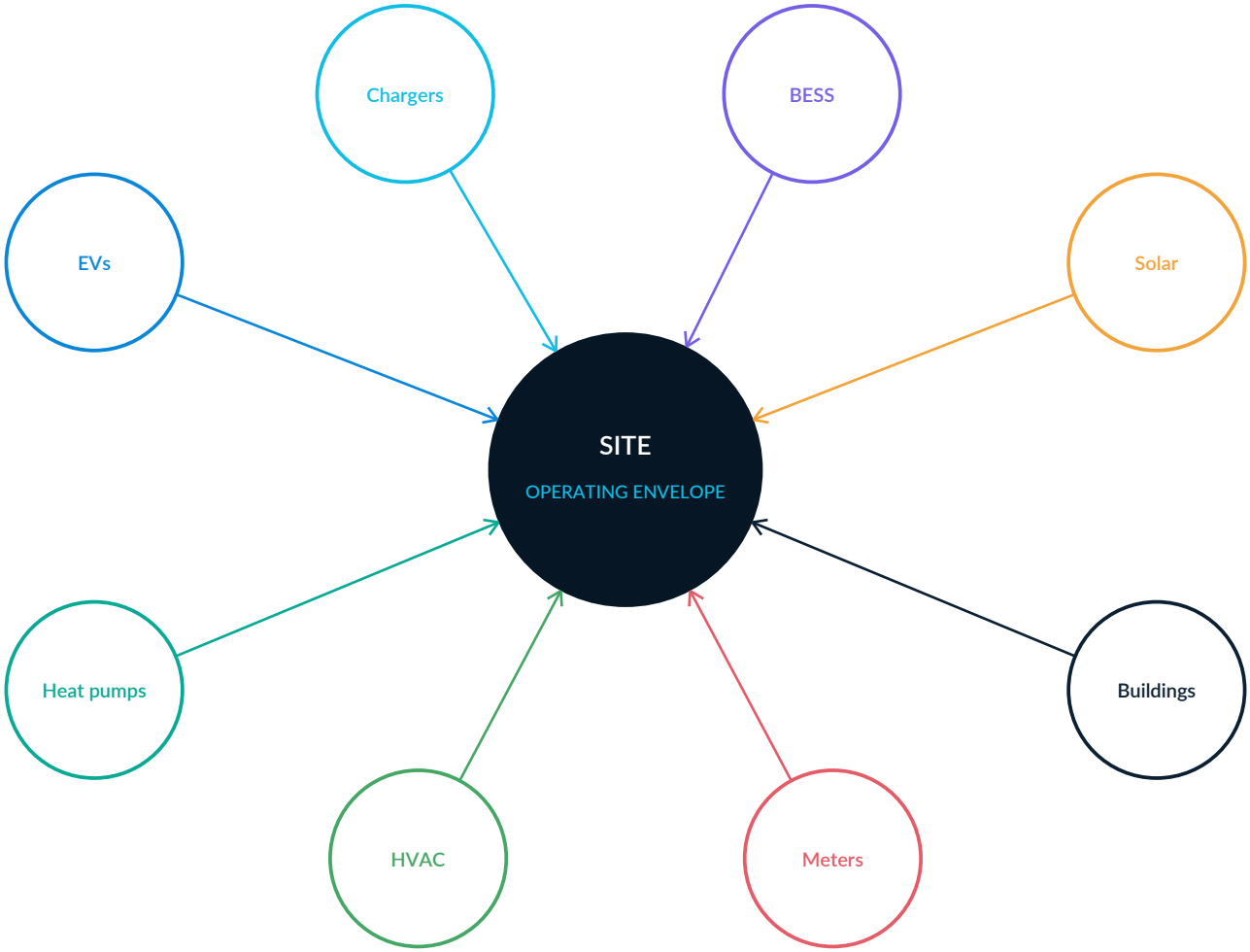
Signed commands, monitored updates and explicit identity across cloud and edge.

Engineering qualification. Islanding requires site-specific protection, switching, inverter capability, commissioning and approval. Software orchestration does not replace those electrical requirements.

05 | MULTI-ASSET OPERATIONS

One site. Different assets. One operational envelope.

Electrical and thermal flexibility are coordinated together rather than managed as isolated programmes.



Primary objective

Meet mobility, comfort, safety and service requirements first.

Optimisation objective

Use remaining flexibility to minimise cost and carbon while protecting asset life.

Commercial objective

Expose only authorised, measurable and settlement-ready flexibility.

V2X OPERATING MODELS

V2G, V2H and V2H2G describe different operating relationships.

Bidirectional capability is a system property, not a feature of the vehicle or charger in isolation.

V2H

Vehicle to home

Use the vehicle battery to support a home or behind-the-meter load.

VALUE PATHWAY

Backup, self-consumption and tariff optimisation.

V2G

Vehicle to grid

Export through an approved grid connection for a grid or market service.

VALUE PATHWAY

Flexibility, capacity, balancing and energy value.

V2H2G

Vehicle to home to grid

Optimise household or site demand first, then expose residual flexibility to the grid.

VALUE PATHWAY

Local optimisation plus external market participation.

01	02	03	04	05	06
Vehicle and firmware	Bidirectional charger	Grid connection and protection	Metering and tariff	Customer permission	Market eligibility

ENTERPRISE RULE

Revenue must never be created by borrowing from the next journey, reducing required backup, violating warranty limits or bypassing customer permissions.

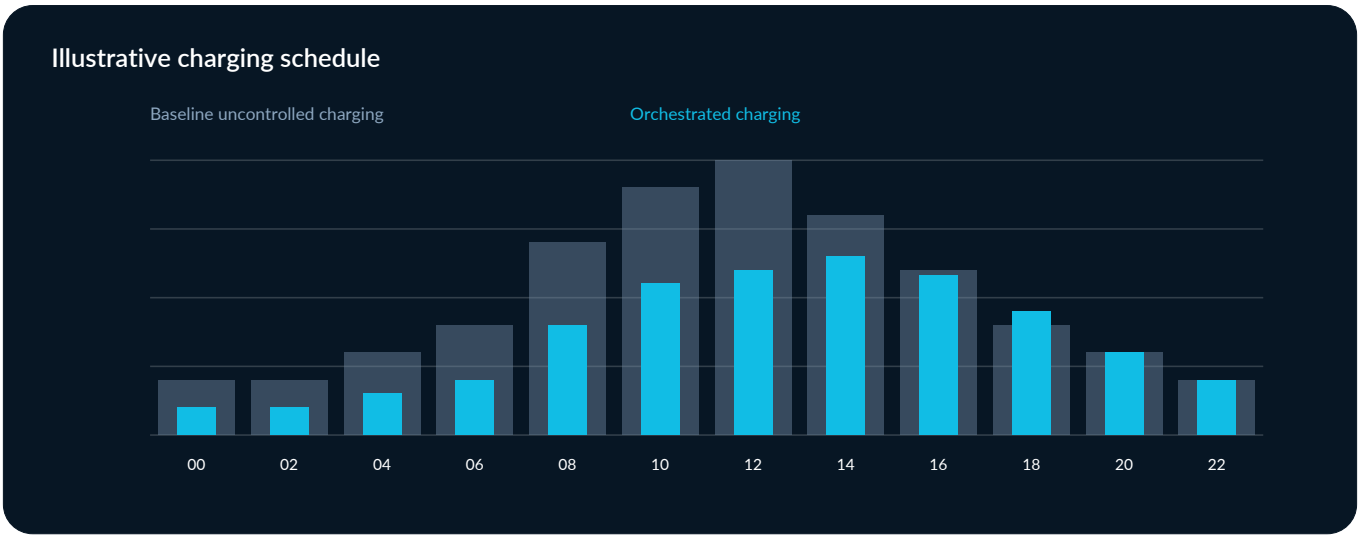
The operating envelope is defined first. Market participation is optimised inside it.

SMART CHARGING AND MOBILITY

Charging becomes an operational schedule, not a queue.

The objective is to protect departure readiness while using site headroom, tariffs, solar and flexibility opportunities more intelligently.

A fleet does not need every vehicle to charge at maximum power as soon as it returns. It needs every vehicle to meet its next duty cycle. AmpVerve converts departure times, route requirements, reserve levels, charger availability and site constraints into a continuously updated charging plan.



Readiness protected

Vehicle reserve and departure times are hard constraints.

Peak controlled

Charging is allocated inside the site import envelope.

Solar absorbed

Flexible charging follows local generation when valuable.

Market aware

Residual flexibility can support eligible grid programmes.

SMART HEATING AND COOLING

Comfort can be protected while electrical demand becomes more flexible.

Thermal inertia creates flexibility only when comfort, air quality, occupancy and equipment constraints remain explicit.

Illustrative thermal demand shift

PRE-CONDITION

Move heating or cooling into lower-cost or lower-carbon windows while respecting comfort bands.

HOLD COMFORT

Use building and thermal inertia to reduce draw during a constrained period.

RECOVER SMOOTHLY

Return to normal operation without rebound peaks and verify delivered demand change.

Hard guardrails: temperature, humidity, air quality, occupancy, hot-water availability, equipment duty cycle, recovery time and maintenance state.

06 | ENTERPRISE VALUE

Four value pools. One governed operating model.

Cost, carbon, resilience and revenue should be co-optimised, not pursued through separate control systems.

COST

Smart charging, demand shifting, peak control and self-consumption.

Reduce avoidable energy and capacity costs.

CARBON

Carbon-aware timing, local renewable use and event-level evidence.

Reduce operational emissions and strengthen reporting.

RESILIENCE

Local fallback, import-cap control and microgrid coordination.

Protect continuity as the site becomes more electrified.

REVENUE

Demand response, local flexibility, wholesale, balancing and V2X where eligible.

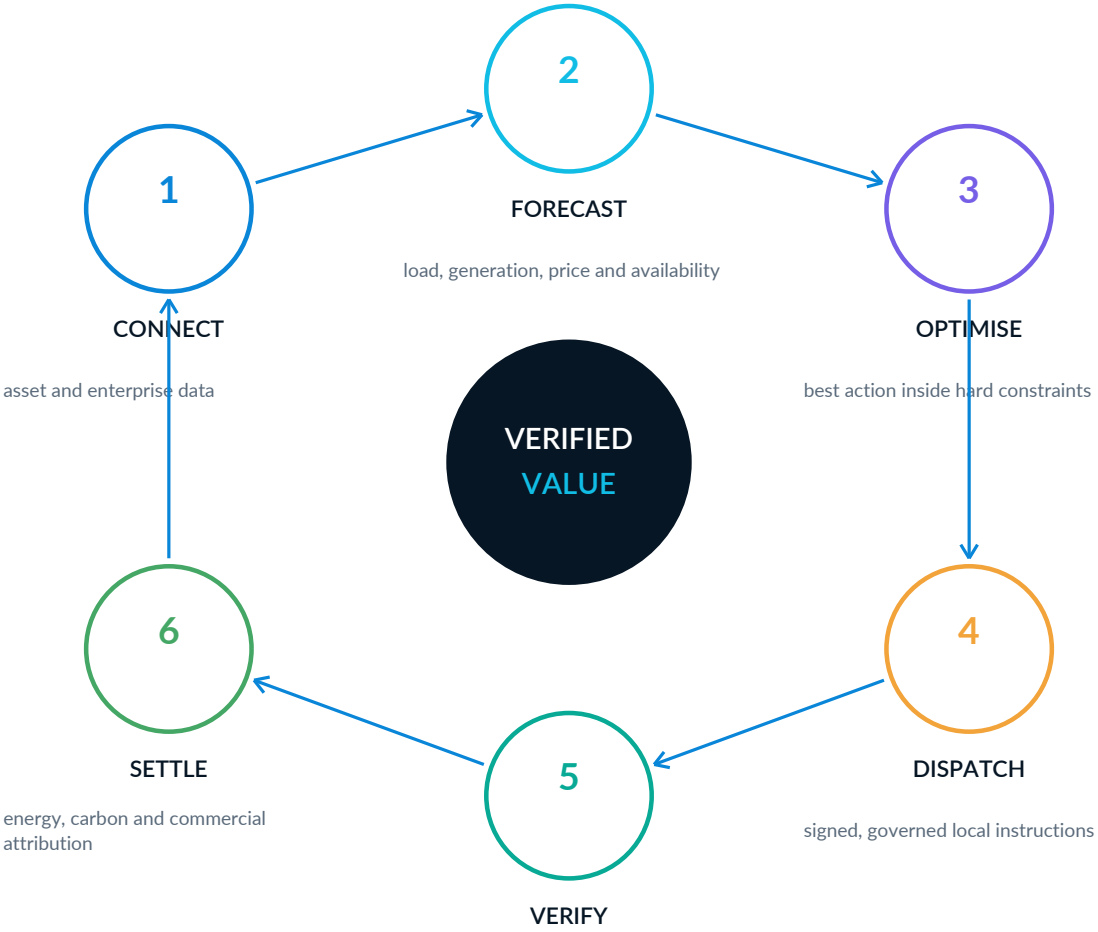
Create new income without compromising primary operations.

Asset	Cost	Carbon	Resilience	Revenue
EVs / chargers	High	Med	Med	High
BESS	High	High	High	High
Solar	Med	High	Med	Low
Heating / cooling	High	High	Med	Med
Buildings / loads	High	Med	High	Med

FROM FORECAST TO VERIFIED VALUE

A complete loop from telemetry to settlement.

Optimisation creates potential. Governed execution and evidence turn that potential into measurable outcomes.



Audit trail
What was known, decided and executed.

Settlement readiness
What was delivered, when and for whom.

Carbon evidence
How timing, demand and generation changed emissions.

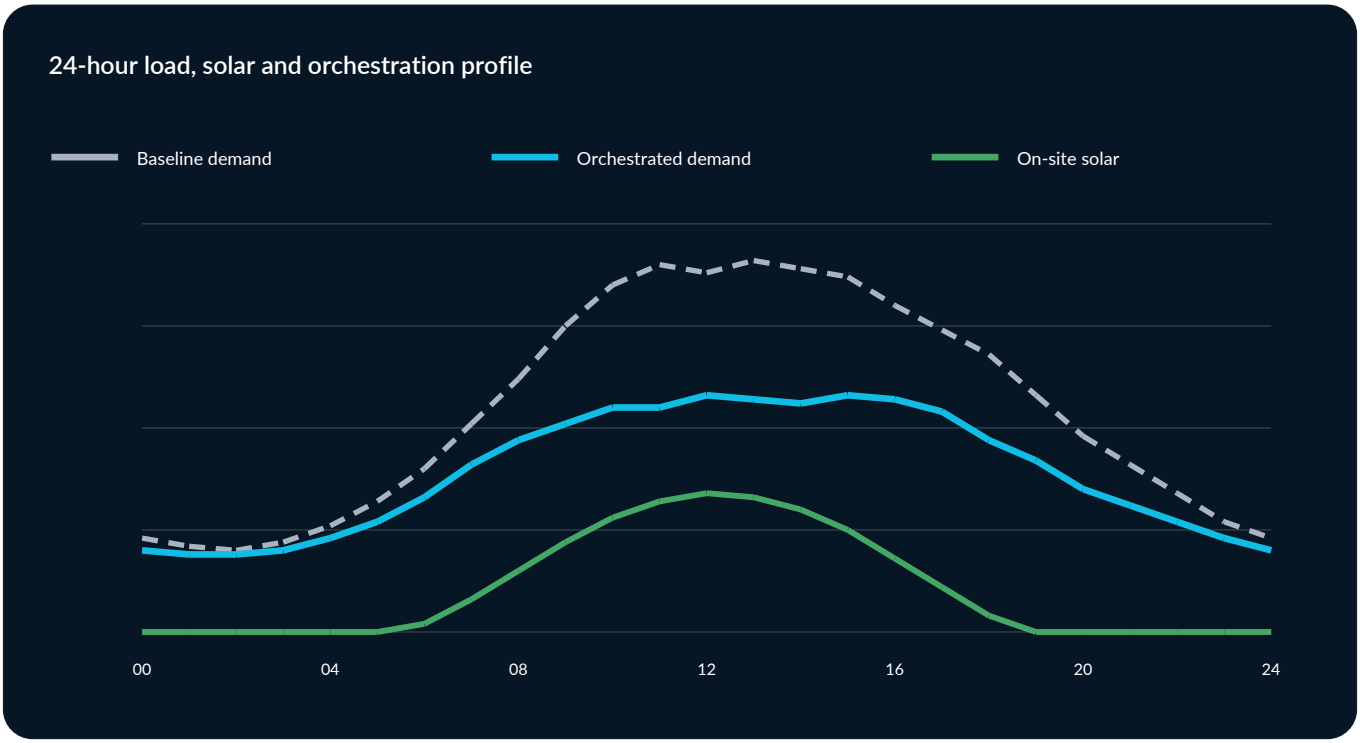
Continuous improvement
How verified outcomes improve the next decision.

ILLUSTRATIVE OPERATING MODEL

What coordinated operation can change across a 24-hour site.

This scenario demonstrates the operating logic. It is not a customer result or commercial guarantee.

SITE	ASSETS	GENERATION	THERMAL
1.2 MW peak demand	40 EVs + 500 kW BESS	300 kWp solar	280 kW HVAC and heat pumps



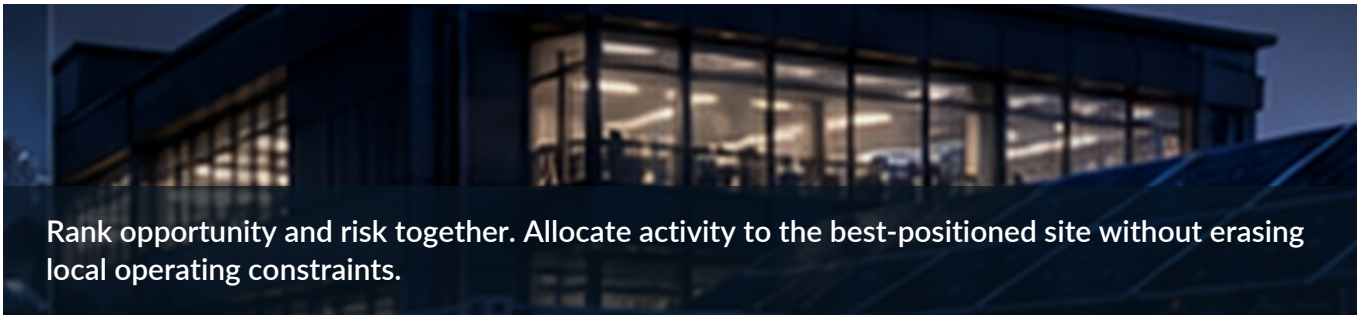
14%	11%	9%	340 kW
illustrative peak reduction	illustrative energy-cost reduction	illustrative operational-carbon reduction	illustrative dispatchable headroom

Illustrative model only. Outcomes depend on tariffs, equipment, permissions, site constraints and market access.

07 | PORTFOLIO SCALE

The best site for the next action is not always the nearest site.

At portfolio scale, orchestration becomes an allocation problem across headroom, readiness, risk and eligible value.



Rank opportunity and risk together. Allocate activity to the best-positioned site without erasing local operating constraints.

ILLUSTRATIVE PORTFOLIO READINESS MATRIX

Site archetype	Available flex	Import headroom	Readiness	Eligible value
Fleet depot	620 kW	31%	High	Tariff + local flex
Commercial campus	480 kW	24%	High	Peak + HVAC + BESS
Data-centre support estate	350 kW	18%	Medium	BESS + demand response
Mixed-use building	710 kW	11%	Medium	HVAC + EV charging
Residential portfolio	260 kW	27%	Developing	Tariff + V2H/V2G

Allocation logic

Prioritise sites by headroom, operational readiness, forecast value, delivery confidence and market eligibility.

Multi-region model

United Kingdom - Europe - United States - Australia - New Zealand - emerging markets.

Portfolio figures are illustrative. Market eligibility and asset compatibility vary by region and programme.

08 | ENTERPRISE READINESS

Interoperability, security and governance are operating requirements, not procurement footnotes.

Enterprise flexibility requires the same discipline applied to other operational technology and financial systems.

OPEN INTEGRATION

Published protocols, documented APIs and portable data reduce lock-in.

OCPP, ISO 15118, IEEE 2030.5, IEC 61850, Modbus, MQTT, DLMS and enterprise APIs.

IDENTITY AND ACCESS

Device, user and service identity must remain explicit across cloud and edge.

TLS, mutual authentication, certificate management and role-based access.

AUDIT AND EVIDENCE

Every dispatch should be reconstructable from input state to measured result.

Immutable logs, evidence export, permissions, signed commands and settlement records.

RESILIENCE

Security controls must not remove the local capability needed to operate safely.

Fallback policy, store-and-forward, monitored updates and safe local execution.

COMPLIANCE

Controls and certification status should be transparent during due diligence.

AmpVerve publishes ISO 27001 and SOC 2 controls with certification in progress.

DATA GOVERNANCE

Operational data, permissions and commercial evidence require clear ownership.

Retention, residency, privacy, portability and incident response.

Procurement principle: confirm the current status of certifications, market qualifications, supported asset combinations and site-specific electrical requirements during technical due diligence.

09 | DEPLOYMENT

Start with evidence. Introduce control only when the operating model is ready.

A governed deployment creates confidence in data, constraints, permissions and value before live dispatch begins.

1 DISCOVER
Map assets, priorities, tariffs, grid limits, data quality and permissions.

2 CONNECT
Establish secure telemetry and a reliable operational baseline.

3 MODEL
Build digital twins, forecasts and the policy envelope.

4 SHADOW
Run recommendations without control and compare prediction with reality.

5 CONTROL
Enable governed local actions with approvals and rollback.

6 SCALE
Replicate proven patterns across sites, partners and markets.

STAGE GATES

Data quality	Baseline confidence	Operating permissions	Safety validation	Control readiness	Verification quality	Commercial eligibility

WHO OWNS WHAT

Site operations
Operating priorities, overrides and emergency states.

Energy team
Tariffs, market strategy, baselines and value cases.

IT and security
Identity, connectivity, data governance and incident response.

Engineering
Protection, switching, asset limits and commissioning.

Commercial partner
Market access, programme eligibility and settlement obligations.

PROCUREMENT GUIDE

The questions that distinguish a dashboard from an operating system.

The strongest response is evidence of safe operation, not a theoretical optimisation screenshot.

01 Operations
Which requirements are hard constraints? How are overrides and emergency states handled?

02 Control
What remains available locally if cloud or connectivity is unavailable?

03 Integration
Which protocols and device combinations are production-supported now?

04 Physics
How are battery, thermal, inverter and site limits tested before dispatch?

05 Evidence
Can every decision be reconstructed from input state to measured delivery?

06 Markets
Which programmes are directly supported and which require partners?

07 Security
How are identity, certificates, updates, residency and incidents governed?

08 Commercials
Who owns data, registrations and performance history? How are fees calculated?

What good looks like

Explicit operating envelopes, local fallback, verified telemetry, supported integrations, clear market responsibilities and exportable evidence.

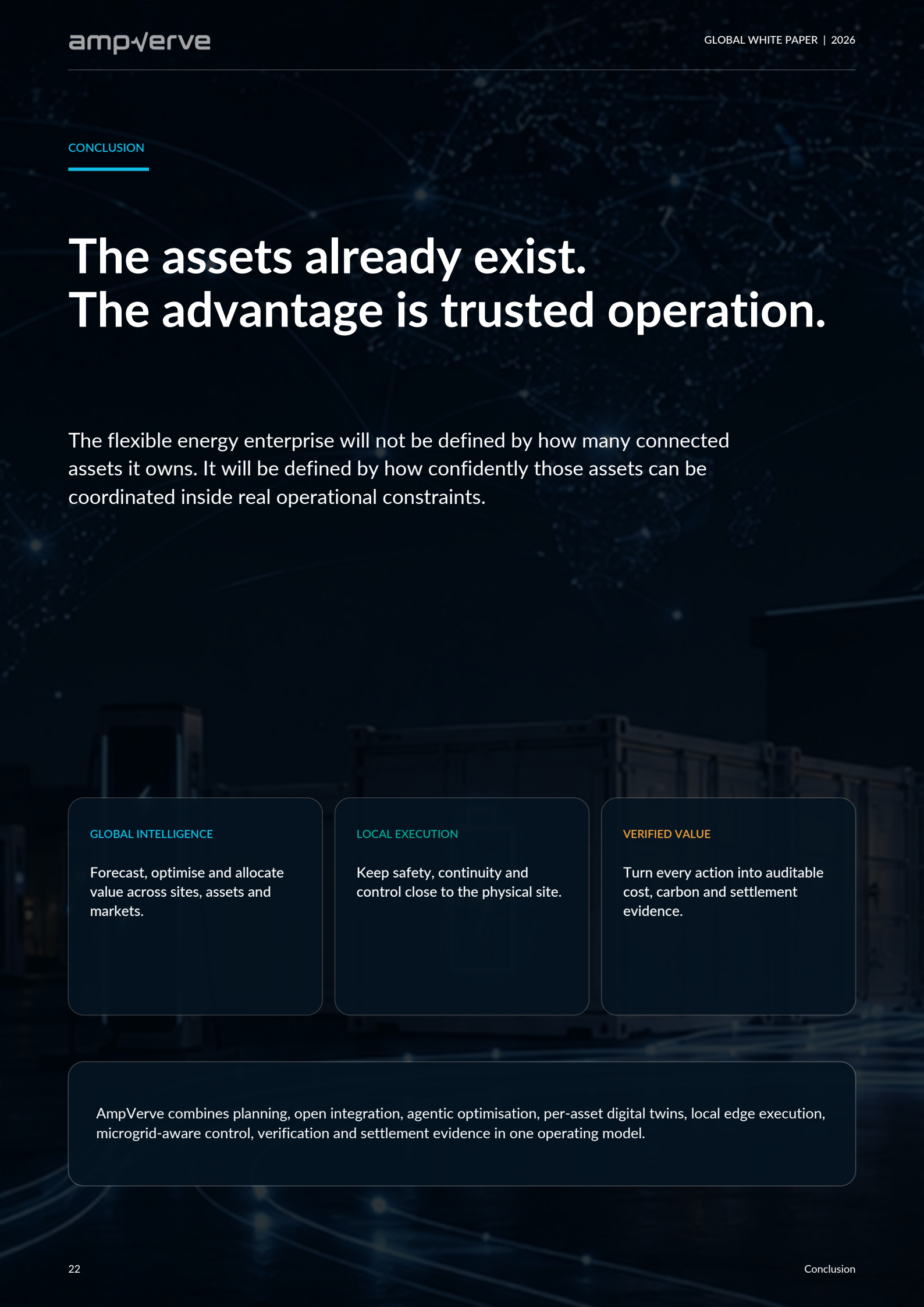
Red flags

Unqualified savings claims, cloud-only control, undefined baselines, unsupported device promises and opaque settlement logic.

CONCLUSION

The assets already exist. The advantage is trusted operation.

The flexible energy enterprise will not be defined by how many connected assets it owns. It will be defined by how confidently those assets can be coordinated inside real operational constraints.



GLOBAL INTELLIGENCE

Forecast, optimise and allocate value across sites, assets and markets.

LOCAL EXECUTION

Keep safety, continuity and control close to the physical site.

VERIFIED VALUE

Turn every action into auditable cost, carbon and settlement evidence.

AmpVerve combines planning, open integration, agentic optimisation, per-asset digital twins, local edge execution, microgrid-aware control, verification and settlement evidence in one operating model.

METHODOLOGY AND SOURCES

Scope, qualifications and source framework.

This publication combines AmpVerve platform positioning with public market context from primary energy sources.

Scope. This paper describes an enterprise operating model for distributed energy orchestration. It does not present live customer results. Illustrative charts, site values and portfolio tables demonstrate decision logic only.

Qualification. Product capabilities, integration support, market eligibility, certification status and regulatory requirements change over time. Procurement and investment decisions should be confirmed against current technical documentation, approved equipment combinations and live market rules.

Commercial outcomes. Savings, revenue and carbon outcomes depend on actual tariffs, asset availability, site design, permissions, baselines, market access and measured delivery.

Primary sources

01 **AmpVerve website**

Homepage, platform, integrations, digital twin, security and market pages. Accessed 23 July 2026.

02 **International Energy Agency**

Global EV Outlook 2026; Electricity 2026; Electricity Mid-Year Update 2026.

03 **International Renewable Energy Agency**

Renewable Capacity Statistics 2026.

04 **Technical standards named by AmpVerve**

OCPP, ISO 15118, IEEE 2030.5, IEC 61850, Modbus, MQTT, DLMS and documented interfaces.

ampverve

Turn distributed assets into dependable infrastructure.

Commercial walkthroughs for fleets, commercial buildings, data centres, utilities, OEMs and partners.

TALK TO AMPVERVE

ampverve.com

hello@ampverve.com

Reading, United Kingdom | Houston, United

Global deployment: UK | Europe | US | Austra