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Market Guide for DERMS

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A DERMS enables utilities to integrate loads and generators in the rapidly growing DER space. Utility CIOs can use this research to understand the evolving DERMS market and functional requirements, and align strategies with new regulatory mandates and operating models.

Overview

Key Findings

- Distributed energy resources (DERs) deployment continues to accelerate as DER proliferation and penetration increase, which are driven by government incentives and mandates. Pilot projects are demonstrating technical results, but value realization with additional revenue remains challenging.

- Utilities are finding it complicated to integrate and orchestrate DERs due to the number of participating systems and closed vendor-centric ecosystems.

- Distributed energy resource management systems (DERMSs) is heading into the Trough of Disillusionment on the 2023 Gartner Hype Cycle for Digital Grid Transformation Technologies, meaning that no single vendor can meet all use cases for all utilities. More mergers and acquisitions along with some vendor partnerships are expected.

- The lack of consistent data that reflects customer-owned assets accurately blended onto a full network model remains the key weakness of DERMS implementations. Some vendors are addressing this issue with network model managers.

Recommendations

- Scale out by moving beyond proofs of concepts and pilots, which requires a focus on monetization. Look to peers who are ahead in the journey and are implementing DERMSs, and use their lessons learned to fine-tune DERMS ambitions, benchmark possible business improvements and set realistic expectations.
- Plan to address DER requirements via a set of packaged business capabilities, by leveraging a composable DERMS architecture allowing rapid reconfiguration of DERMS-packaged business capabilities to support new and evolving business requirements. Ensure your vendor's roadmap can move and adjust alongside your evolving business strategy.
- Ensure investments in DERMSs are protected by contracts that deal with vendor merger and acquisition risks. Develop contingency plans/exit strategies associated with the product to protect the rights (and cost base) for the software and/or services being purchased, and insist on graceful exits that protect data and services.
- Evaluate DERMSs' network model management functionality to assess vendor capabilities. If lacking, consider innovative third-party network model managers and/or grid twin vendors.

Strategic Planning Assumptions

By 2025, 30% of energy markets in developing countries will use Internet of Energy (IoE) online-to-offline (O2O) platforms to address DER's integration challenges.

By 2025, behind-the-meter distributed energy resources will exceed 50% of the installed in-front-of-meter utility-scale generation.

Market Definition

A distributed energy resource management system is a set of software applications that manage and orchestrate distributed energy resources that are connected to the electric distribution grid. By orchestrating DERs' operational activity across different roles, a DERMS makes DERs accessible and beneficial for all electricity market participants, including:

- Customers
- Prosumers

- Aggregators
- Retailers
- Grid owners
- Grid operators
- Energy market coordinators

A minimum DERMS solution includes:

- DER awareness
- Identification and representation in system models
- Logical DER grouping
- Device and status management
- Real and reactive power dispatches
- Forecasting

Extended functions that turn DERs into controllable, flexible resources include:

- Schedule exchange
- Voltage set points
- Regulation services
- Microgrid control
- Optimal dispatch
- Demand response
- Dynamic voltage stabilization

Market Description

Flex DERs to Accelerate the Energy Transition

Transmission and distribution utilities, as well as electricity retailers and aggregators, use a DERMS to manage and orchestrate DERs that are connected to the electric distribution grid. A DERMS is most valuable for jurisdictions where DER volumes are growing rapidly, turning DERs into useful contributors for energy management, distribution network operation, end-user energy trading and energy efficiency programs.

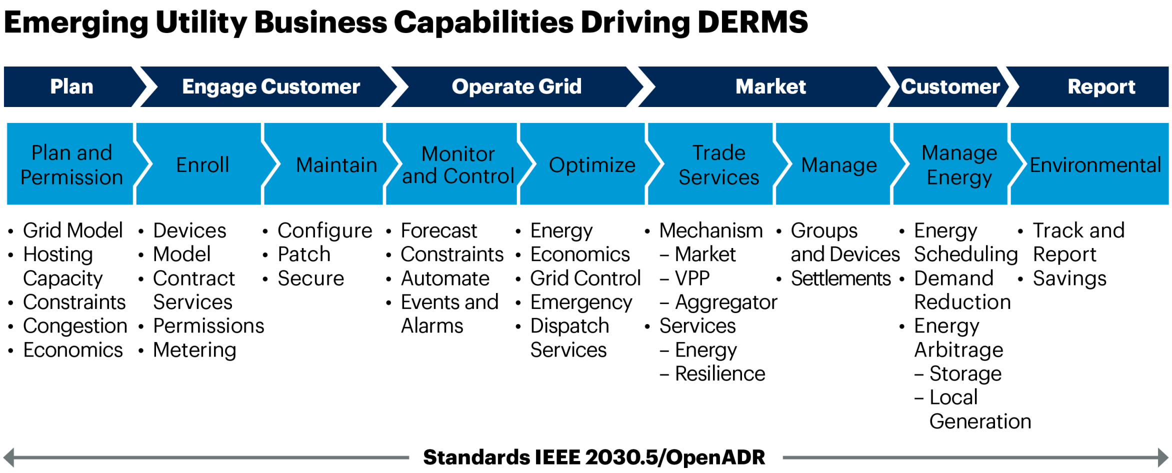
The energy transition gained momentum during 2022 and 2023, fueled by government incentives, such as the Inflation Reduction Act of 2022 in the United States, as well as regulatory mandates and emission reduction targets. [1] DERs are gaining a share of the overall generation portfolio, making DER flexibility a key business imperative beyond 15% of annual peak load. [2]

In practice, DERs have expanded beyond small-scale generation resources, such as solar, wind and batteries located close to loads, to now include load orchestration of heating, cooling and charging. Electric vehicle adoption is reaching exponential rates in several jurisdictions, triggering infrastructure upgrades, which could be delayed by flexing charging loads with DERMSs. This marks a fundamental transformation of the legacy utility business model of “always on” to permissioned use. This requires the development of new value propositions and a shift in operational performance management and system control.

DERs are transforming multiple business processes from customer and prosumer enrollment, DER identification and analysis, DER connectivity request management or DER grid hosting capacity assessment, to dynamic operating envelope calculation. Emerging DERMS capabilities that serve retailer and aggregator virtual power plant ambitions include services such as overall program management, wholesale market integration, billing and settlement, reporting and presentation layers in the form of utility- and customer-facing portals.

DERMS solutions are evolving into cloud-based platform plays including market mechanisms, such as aggregation, virtual power plants, system planning and customer enrollment. This extends the span of the DERMS solution toward a comprehensive set of capabilities needed by diverse market participants (see Figure 1).

Figure 1: Emerging Utility Business Capabilities Driving DERMS



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DERMSs for grid integration and energy availability are most applicable for distribution utilities where DERs are rising rapidly. Integration of DERs and turning DERs into system resources for transmission and distribution system operators (DSOs) across operating scenarios from business as usual, to low-load and emergency conditions is a priority. However, this is an area for improvement, but remains constrained by external factors, such as market design and regulation, making this area difficult to realize consistent benefits.

DERMSs for energy management by retailers and aggregators must cover incentives, permissions, price signals and emergency control activated through mechanisms, such as scheduling, demand response, and emergency control.

In addition to the analysis in this Market Guide, more information on sample DERMS vendor capabilities and coverage is available in a companion document: Market Snapshot 2023: DERMS.

Market Direction

DERMS Vendor Progress Persists Amid Obstacles

Buyer perspectives of DERMS requirements vary by the organization’s position within the electricity value chain. Innovative utilities embarked on proofs of concept to learn by doing, focusing on assessing DERs according to their specific roles and immediate requirements, resulting in narrow requirements.

Consequently, RFPs were issued with a bias toward a single dominant use case. This was a mistake, leading to application proliferation as execution gaps had to be plugged. Narrow RFPs have encouraged a broad swath of vendors to enter the DERMS space. Investment in more rigorous requirements gathering across the organization and even industrywide partnerships can develop a shared set of requirements across organizations to develop the specification of a DERMS platform across roles as indicated in Figure 2.

Figure 2: DERMS Requirements by Organizational Role

DERMS Requirements by Organizational Role

● Comprehensive Use-Case Coverage Required ◐ Partial Use-Case Coverage Acceptable ○ N/A

		Local Utility	Network Operator	Retailer	Aggregator	Energy Services
Energy Availability	Grid Model	●	●	◐	◐	○
	Grid Control	●	●	○	◐	○
Energy Orchestration	Commodity Management	◐	○	●	◐	●
	Wholesale Market Integration	◐	◐	●	◐	◐
Energy Management	Energy Efficiency	◐	◐	◐	●	●
	Device Control	◐	◐	◐	◐	◐

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There is still an intense focus on integrating DERs into the distribution grid. However, Gartner observes convergence around three value propositions (energy availability, energy orchestration and energy management), with a bias toward energy availability and grid automation use cases and weaker coverage of energy orchestration and management.

The emergence of regulatory mandates, such as the Federal Energy Regulatory Commission (FERC) Order No. 2222, and the acceleration of DER adoption, driven by the grid parity and e-mobility, is shifting buyers' needs toward a more comprehensive view of DERs (see Figure 1). Ongoing acquisitions and partnerships to round out vendor offerings and use cases continue. For instance, GE's acquisition of Greenbird is to be expected in this stage of the Hype Cycle (see Hype Cycle for Digital Grid Transformation Technologies, 2023). Some large vertical software vendors, such as GE, Oracle and Siemens have multiple products that, when combined, can offer the majority of required capabilities. Other vendors are leveraging partnerships to round out their offerings. Buyers must pay attention to the product roadmap and interrogate the technology alignment and migration promises or risk paying the integration cost of the vendor's brochure claims.

The IEEE 2030.5 standard is slowly emerging both as an interface standard, as well as an information construct to support data exchange across ecosystem participants. IEEE 2030.5 is receiving wider support from industry bodies such as the International Council on Large Electric Systems (CIGRE), the Electric Power Research Institute (EPRI) and the IEEE Power & Energy Society (PES). [3] Type conformance testing of OEM hardware providers through to cloud-first software remains challenging. This is essential to facilitate data exchange across participants. Industry cloud exponents need to drive jurisdiction-specific utility-led cloud patterns that are agnostic to hyperscalers and/or industry vendors to create a cloud-first data exchange capability.

Customer retention and integration through go-to-market product offers supported by a VPP-centric DERMS with strong customer energy management capabilities remains a market gap.

Market Analysis

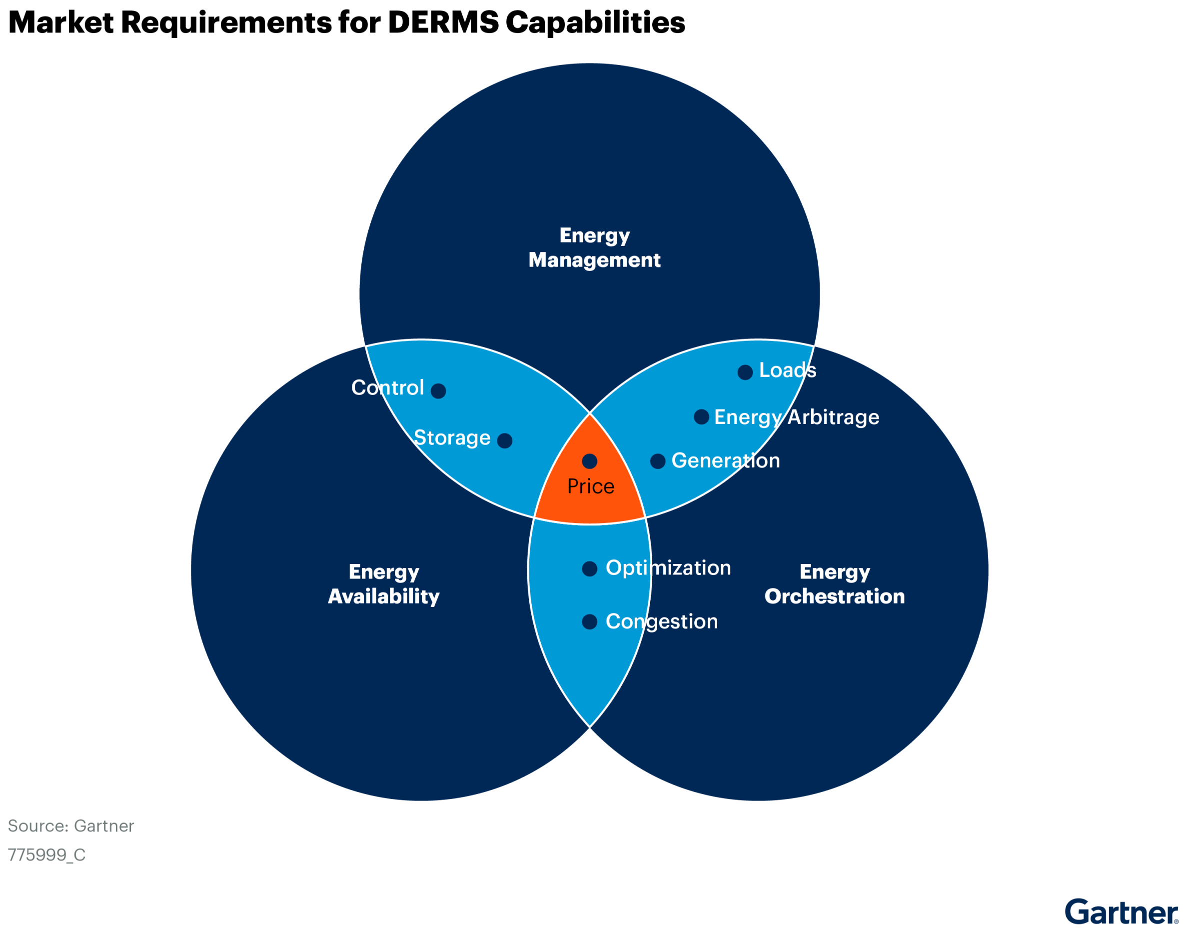
Drive DER Value Realization

Energy ecosystem participants can leverage one to all three value propositions in electricity markets to secure (or maybe gain additional) customer revenue when integrating DERs with a DERMS solution related to their role, as highlighted in Figure 3:

- **Energy management (on behalf of/by customers):** This involves managing energy resources beyond the meter to provide energy efficiency and energy management services. Buyers include retailers, aggregators, and hardware vendors (e.g., microgrids), as well as energy management and energy-efficiency services. Go-to-market strategies typically target large industrial and commercial energy users with energy arbitrage, including storage and generation resources. Additional value can be unlocked with electricity market integration to trade both the energy and flexibility alongside grid services.
- **Energy availability (distribution system operator [DSO] grid automation):** Grid resilience is driven by weather, power quality and reliability concerns. Alongside these issues is the need to address the uncertainties created by high-penetration DERs. Also, turning DERs into a control lever for distribution network operations requires a detailed distribution grid model. The grid must remain stable even as the proliferation of renewable power generation at the edge is creating volatile energy profiles, forcing a change to grid operating practices. Some advanced distribution management system (ADMS) vendors have evolved the DERMS product strategy and developed DERMS capabilities within ADMS, but most often as a stand-alone adjacent product. DERMSs enable increased visibility and facilitate evaluation and processing of DER interconnection requests.
- **Energy orchestration (VPP to manage energy):** Leverage DERs to address the increasingly variable energy profiles beyond the meter driven by increased renewable resources penetration. Load and storage and generation are collectively dispatchable as a flexible resource, which is needed at both wholesale energy markets and at transactive markets on the distribution level. Software vendors already active tend to see DERMSs as an extension of a demand response management solution (DRMS). In markets with overall high penetration of renewables, VPP operators are emerging to aggregate DERs for the purpose of market arbitrage to address the need for flexibility services.

Note that the three core value propositions leverage a range of use cases (see Note 1) to exchange value as noted on the overlaps of Figure 3. This points to three emerging submarkets served by DERMS vendors.

Figure 3: Market Requirements for DERMS Capabilities



While any one of these value propositions can provide an initial starting point and even a stand-alone business case, most utilities find that over time they have to address all three value propositions, either directly or through industry consortiums. Architecting for and demanding composability and interoperability from vendors will give buyers the flexibility to navigate vendor risks in this phase of the market.

DERs pose unique control challenges because of varying ownership (utilities, prosumers, aggregators and large commercial and industrial [LC&I] customers), high volumes, geographical distribution and fast-changing performance characteristics. These same complex DER attributions enable a wide range of potential services — from energy management to voltage and frequency response — which are monetized by an ever-expanding set of incentives and rewards.

Customer Engagement Needs DER Monetization

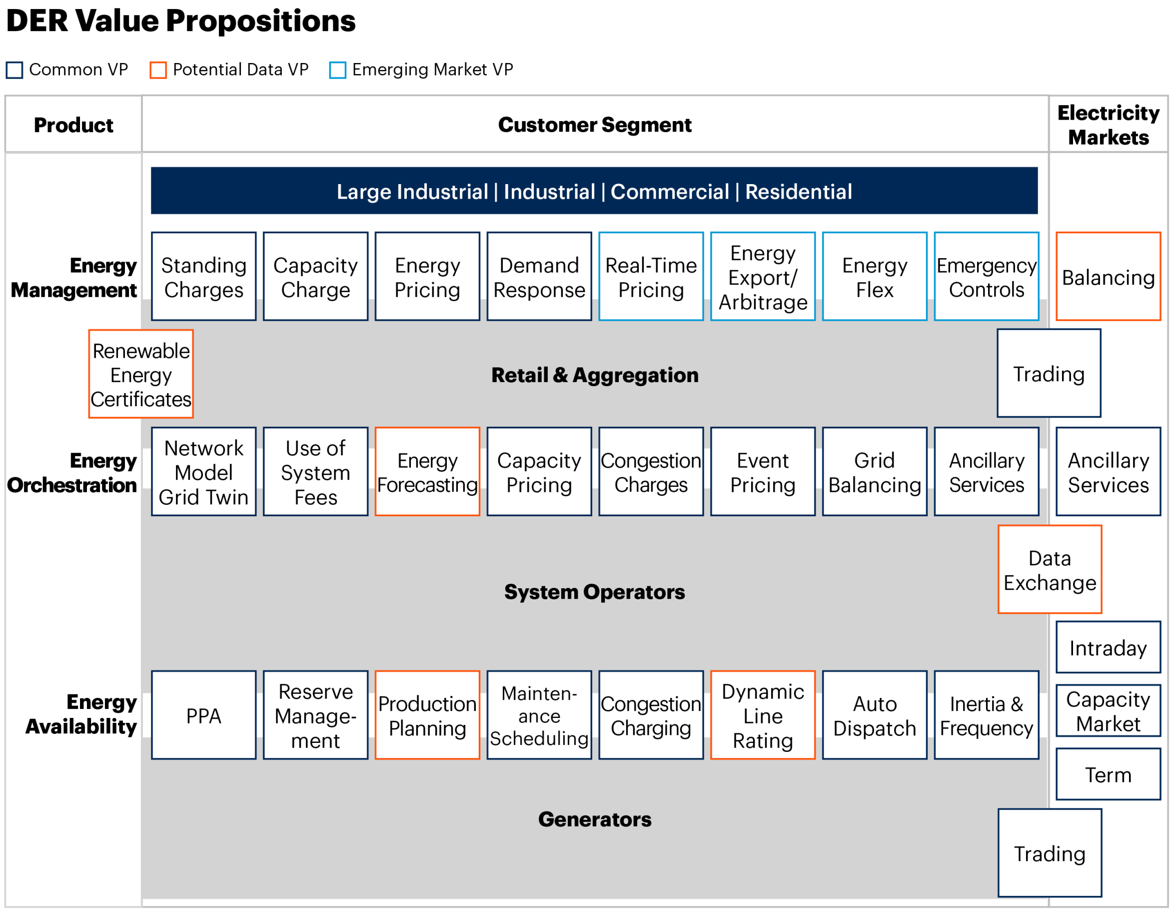
The initial system operator's fear of rapidly rising DER penetration triggering wide-scale grid disruption and system instability is receding. This is driven by improved learning and shifts in operating practices by utilities, and some limited success with DERMS pilots. Generators still need to make energy available to system operators who must transport (orchestrate) that energy to retailers for customers to consume. However, customers are becoming prosumers and want to export electricity, making energy orchestration for system operators a key issue. Furthermore, customers require a carrot and a stick to drive behaviors. As a result, the value proposition offered through the customer-retailer interface must evolve.

This evolution puts pressure on DSOs to share rewards with customers promoting the democratization of energy. This must be accompanied by clear and transparent rules on pass-through mechanisms, such as delayed infrastructure upgrades with incentives like avoided rate increases or penalties in the form of passed-through congestion charges to pay for those upgrades. This opens an opportunity to implement new grid monetization models, such as congestion management and distribution marginal pricing. Utilities are experimenting with customer-centric value propositions that will incentivize customers through an appropriate product architecture with options from real-time prices to participation in aggregation pools, to the frequency response market. Some examples of monetization approaches include using DERs:

- For an individual contributing resource for a single customer's energy efficiency.
- For dispatchable energy resources in capacity markets, offsetting central generation.
- As controllable resources to manage grid congestion.
- Pooled together as a resource in flexibility markets.
- Pooled together as virtual synchronous condensers.

Monetization opportunities are based on value propositions and value exchange on the business interfaces as set out in Figure 4. Value exchange is bidirectional and is a choice for each market participant to experiment with the combinations of value to achieve the primary DER outcome as defined at the interface on the left-hand side of the diagram.

Figure 4: DER Value Propositions



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Manage DERs to Control Operational Challenges

Rising DER deployment has positive and negative implications for utilities. Customer DER adoption accelerates with the dominance of solar photovoltaic (PV) accelerating the duck curve. [4] The duck curve characteristic dominates the load profile with a rapid evening ramp rate. Seasonality can create periods of negative energy costs that will appear before the summer midafternoon. Left unmanaged, the DER surplus energy will trigger feeder disconnections, resulting in power blackouts. Relative to traditional loads, individual DERs have reduced predictability and increased energy volatility, and when scaled out adds significant complexity to the overall energy management process.

In some markets, the combination of high penetration rates of PV solar, electric vehicles and energy storage has destabilized the distribution grid, eroded reliability, accelerated distribution asset degradation (particularly transformers) and increased operating expenses. Thus, DERs are perceived to create significant challenges for grid management and operations, with a consequential impact on network resilience, if left unresolved. This scenario is usually the motivation for a distribution utility to invest in DERMSs to orchestrate energy — both from the transmission system operator (TSO) and from customers alongside other grid resources, such as storage.

The management of DERs must become part of every energy company's go-to-market product offering.

DERs give energy customers more choices while increasing the installed base of environmentally and economically sustainable generation, which reduces greenhouse gasses and encourages or directly supports improved energy efficiency. If customers consent to permissioned control of their DERs, there are a number of network operations benefits, including reducing the peak consumption and improving grid asset utilization with the consequent investment deferral for the new grid assets (see Note 1 for common DER capabilities).

The ability to integrate DERs into energy markets, both wholesale and retail, enables flexibility markets and supports new energy provisioning models, such as transactive energy in peer-to-peer (P2P) or IoE models. However, the data exchange and messaging needs to be consistent across market participants so that loads and generators can be orchestrated. The EU-SysFlex proposal D5.5 published in 2021 proposes data exchange and standards that will derisk this process. [5]

DERMS Deployment Considerations

DERMS initiatives are commonly led by the business or operations side, but the IT effort required in DERMS deployment is significant. A DERMS will generate, as well as consume, a lot of data, which can be both utilized internally for business insights, or potentially monetized externally. Consequently, a DERMS implementation project should consider:

- Data management
- Data exchange
- Composability and orchestration

- Stakeholder engagement and alignment
- Standards across IT, operational technology (OT) and engineering technology (ET)
- Cyber-physical security

For a more detailed discussion, see Quick Answer: How to Prepare for a Successful DERMS Rollout?.

Representative Vendors

The vendors listed in this Market Guide do not imply an exhaustive list. This section is intended to provide more understanding of the market and its offerings.

Vendor Selection

Vendors provided in Table 1 offer DERMS-related functionality available globally and in select regions. Their functional scope ranges across grid control, energy management and device control, including any combination of these.

Table 1: Representative Vendors in Distributed Energy Resource Management Systems

(Enlarged table in Appendix)

Vendor	Product Name
AspenTech (Open Systems International [OSI])	OSI Integra DERMS
Centrica Business Solutions	REstore FlexPond
CGI	CGI OpenGrid DERMS
Connected Energy	DER Management
Doosan GridTech	Doosan GridTech Distributed Energy Resource Optimizer (DG-DERO)
EnergyHub	Mercury DERMS
Energy Pool	EMS/VPP/DERMS Platform
Generac Grid Services (Enbala)	Concerto
GE Vernova	GrisOS DERMS; GE Digital DER Orchestration
GreenSync	deX
GridPoint	GridPoint Intelligence
Hitachi Energy	ABB Ability DERMS, ABB Ability Virtual Power Pools, e-mesh
Indra (Minsait)	Onesait Utilities DERMS
Itron	DER Optimizer; Distributed Energy Resource Optimizer (DERO); IntelliSOURCE Enterprise
Kiwi Power	Kiwi Core
Lockheed Martin	Smart Energy Enterprise Suite (SEEsuite), SEEload, SEEview, SEEgrid
mPrest	mDERMS
Next Kraftwerke	NEMOCS
Open Access Technology International (OATI)	OATI webSmartEnergy DERMS Solution
Oracle	Utilities Network Management System (NMS DERMS)
S&C Electric (Intelligent Power & Energy Research Company [IPERC])	GridMaster Microgrid Control System
Schneider Electric	EcoStruxure DERMS
Schneider Electric (AutoGrid Systems)	Flex
Siemens	Siemens DERMS (EnergyIP Distributed Energy Management System [DEMS] and Spectrum Power)
Smarter Grid Solutions	Active Network Management (ANM) Strata
sonnen	Virtual Power Plant
Spirae	Spirae Wave DERMS
Stem	Athena
Sunverge Energy	Sunverge Energy Platform
Tesla	Autobidder
Tietoevry	Distributed Energy Solution (DES)
tiko Energy Solutions	VPP Systems
Veritone	Veritone Energy Solutions
VIVAVIS	Smart Grid Operation Platform
Yokogawa Group (PXiSE Energy Solutions)	PXiSE DERMS

Source: Gartner (November 2023)

Market Recommendations

The implementation of a DERMS solution is an investment in time and resources required to gain business value. CIOs must work with the business to sequence delivery of use cases before starting the DERMS selection process. Industry partnerships are evolving rapidly to make sure the investments in DERMSs and its implementation are generating economic value as margins tighten. CIOs must:

- **Understand** that a comprehensive DERMS platform that meets all requirements does not exist. DERMS solutions continue to develop with user input and use case maturity.

- **Reduce** risks by engaging early across the business.

- **Evaluate** the total DERMS solution including licensing and support fees alongside the vendor roadmap. Stress test the vendor roadmap against your strategy. Look for use cases that unlock early strategic value with data exchange, standards and security adequately covered within prioritized use cases.
- **Watch for emerging partnerships** to assess which vendors are working in the business areas most relevant. Vendors and customers are defining new and more robust use cases as extensions of energy availability, orchestration and management topics.

Evidence

Gartner received vendor briefings and associated material from 16 DERMS vendors (most have global reach, but some are only regional) during August-October 2023. Gartner also surveyed secondary research sources for information on market trends and vendor activity.

Gartner analysts acquired insights from a few hundred utility organizations who are selecting a DERMS system through the Gartner inquiry process, one-on-one meetings at events and customer reviews on Gartner's Peer Insights page. These provided directional support for opinions derived from earlier data.

[1] EIA Explores Effects of Inflation Reduction Act on the Annual Energy Outlook, U.S. Energy Information Administration (EIA).

[2] An Overview of Distributed Energy Resource (DER) Interconnection: Current Practices and Emerging Solutions, The National Renewable Energy Laboratory (NREL).

[3] EPRI IEEE 2030.5 Client User's Manual, The Electric Power Research Institute (EPRI).

[4] Understanding the California Duck Curve for Daily Load Projections, Aurora.

[5] Proposal for Data Exchange Standards and Protocols D5.5, EU-SysFlex.

Note 1: Common DER Capabilities

- Visibility of the network to identify operational margins available
- Enrollment of DERs in available programs for operational controls
- Contract DERs
- Forecast likely operational margin issues
- Forecast DER capacity that can be utilized for control purposes
- Intelligent operations in a hybrid environment of distributed and centralized intelligence
- Sense, decide, and act: to make decisions and send out optimized control instructions to controllable DER
- Compensate DERs for the provision of services (e.g., contractual terms or market trading arrangements)
- Accurate measurement and verification, settlement and record keeping of DER participation in network control
- Ability to store historical data and perform data analytics to optimize DERMS performance
- Secure protection against cyber risks and the provision of safe network operations and secure supplies to customers

Document Revision History

Market Guide for Distributed Energy Resource Management Systems - 11 July 2022

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Recommended by the Authors

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GE Vernova	GrisOS DERMS; GE Digital DER Orchestration
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GridPoint	GridPoint Intelligence
Hitachi Energy	ABB Ability DERMS, ABB Ability Virtual Power Pools, e-mesh
Indra (Minsait)	Onesait Utilities DERMS
Itron	DER Optimizer; Distributed Energy Resource Optimizer (DERO); IntelliSOURCE Enterprise
Kiwi Power	Kiwi Core

Lockheed Martin	Smart Energy Enterprise Suite (SEEsuite), SEEload, SEEview, SEEgrid
mPrest	mDERMS
Next Kraftwerke	NEMOCS
Open Access Technology International (OATI)	OATI webSmartEnergy DERMS Solution
Oracle	Utilities Network Management System (NMS DERMS)
S&C Electric (Intelligent Power & Energy Research Company [IPERC])	GridMaster Microgrid Control System
Schneider Electric	EcoStruxure DERMS
Schneider Electric (AutoGrid Systems)	Flex
Siemens	Siemens DERMS (EnergyIP Distributed Energy Management System [DEMS] and Spectrum Power)
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