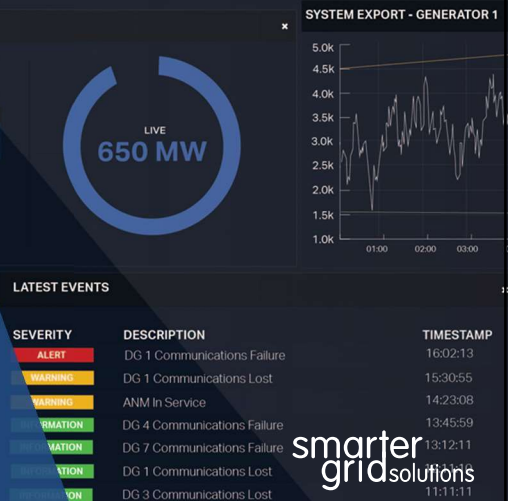


DERMS Presentation

June 2020

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Who are Smarter Grid Solutions?



Global software company with European Head-Quarters



Implementing and managing 1.5 GW of DER, with near-term projects to reach 3 GW



Continuous R&D on top of foundational platform ensures continued market leadership



Breadth and depth of team covering the technical and commercial aspects of the market



Our purpose is to develop and deliver the most flexible and scalable DER management software platform that enables energy companies to create and implement solutions for the transition to net zero carbon emissions.



Multi-use case DERMS interfacing to the grid and market unlocks the true value of DER



Flexible technology means ability for partners to create unique propositions / IP



World-class reference customers operationally using our technology



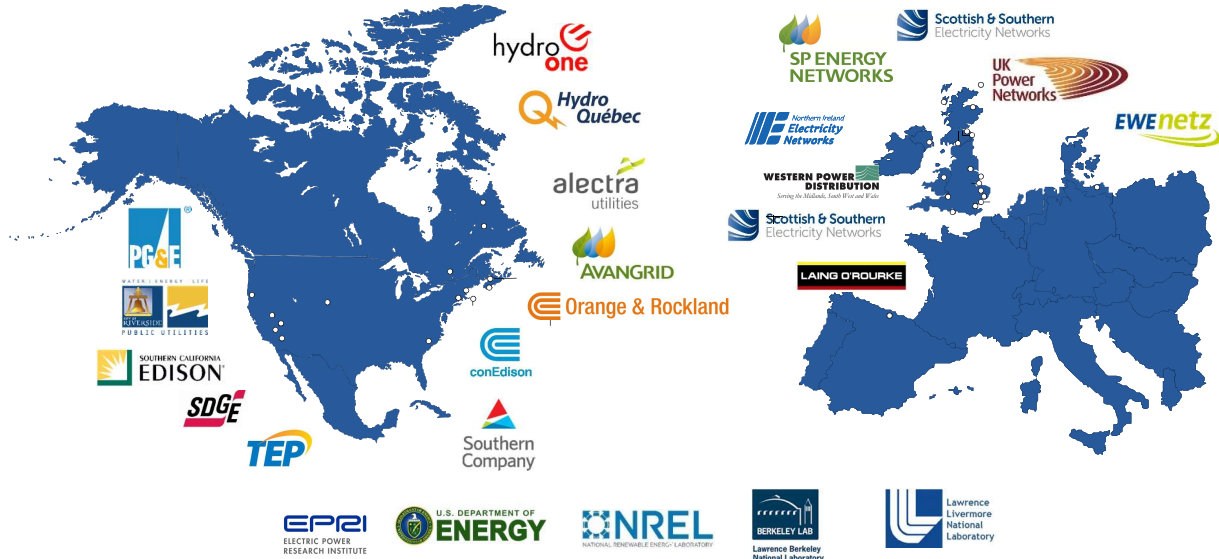
Flexible architecture to configure and scale deployments relevant to customer requirements

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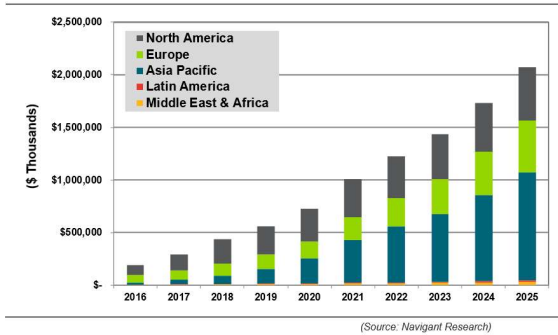
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SGS Customers



DERMS Technology

Distributed Energy Resource Management Systems (DERMS)



DERMS are software solutions that take advantage of the latest developments in IT to provide monitoring and control of renewables, storage, electric vehicles and other DER devices.

Navigant forecast that the DER management technology market is at \$194.3 million in 2016, growing at a compound annual growth rate (CAGR) of 30.0% to nearly \$2.1 billion in 2025.

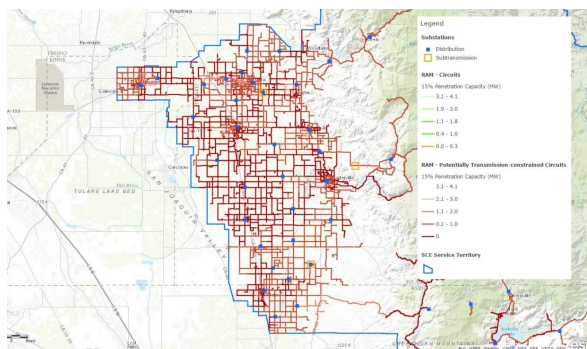
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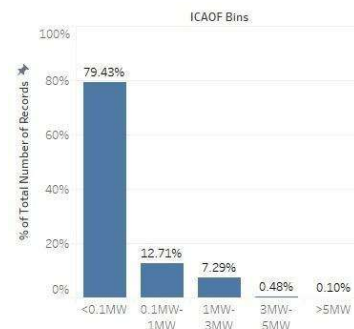
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Why DERMS? Why Now?

A: The distribution system is becoming overloaded and cannot accommodate more DER without either DERMS or massive upgrades.



SCE RAM Map



PG&E Hosting Capacity Preliminary Results

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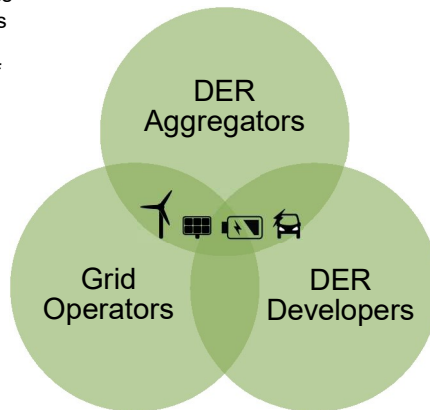
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Why DERMS? Why Now?

Regulators can expedite progress towards renewable energy targets and ghg reduction goals through expanded, low cost, expansion of "Hosting Capacity"

Grid Operators are afforded visibility and control of DER to the grid edge. Can use DER to provide "Non-Wired Alternatives" to solve grid management problems



Aggregators can create large blocks of DER to provide grid services and collectively bargain rates. Allows an integration pathway to ISO or Wholesale Markets

DER Developers can dramatically reduce interconnection costs and stabilize timelines to PTO. Provides options when faced with project killing upgrades

Example Architectures

A layered approach to control

Layering of control is fundamental to delivering flexibility from DER

ANM STR

Simulation and Optimization

Preventive Control Layer:

- Simulation and optimization based on forecast or real-time data to schedule or dispatch against target objectives

Real time Control and Automation

Corrective (ANM) Control Layer:

- Responds to external stimulus and DER status to issue real-time setpoints
- This layer delivers fast-acting autonomous control to ensure control actions or optimization objectives are delivered and enforced
- All DER control / dispatch is through this unique layer

ANM ELEMENT

Local DER Control

Fail Safe Control Layer:

Using distributed algorithms to monitor DER compliance, communications health and implement locally autonomous fail-safe controls

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Example Architecture: Utility DERMS

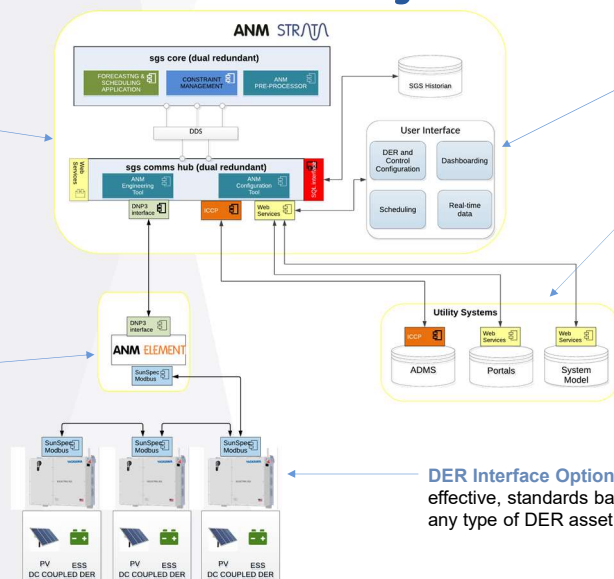
Application host environment delivering fast-acting, real-time, deterministic autonomous dispatch

Distributed grid edge intelligence for fail safes and localized onsite optimization

User interface, historian and reporting tools

Interoperability with existing and third party systems (e.g. optimization) to build out full DERMS / EMS system of systems

DER Interface Options to provide a cost effective, standards based approach to any type of DER asset

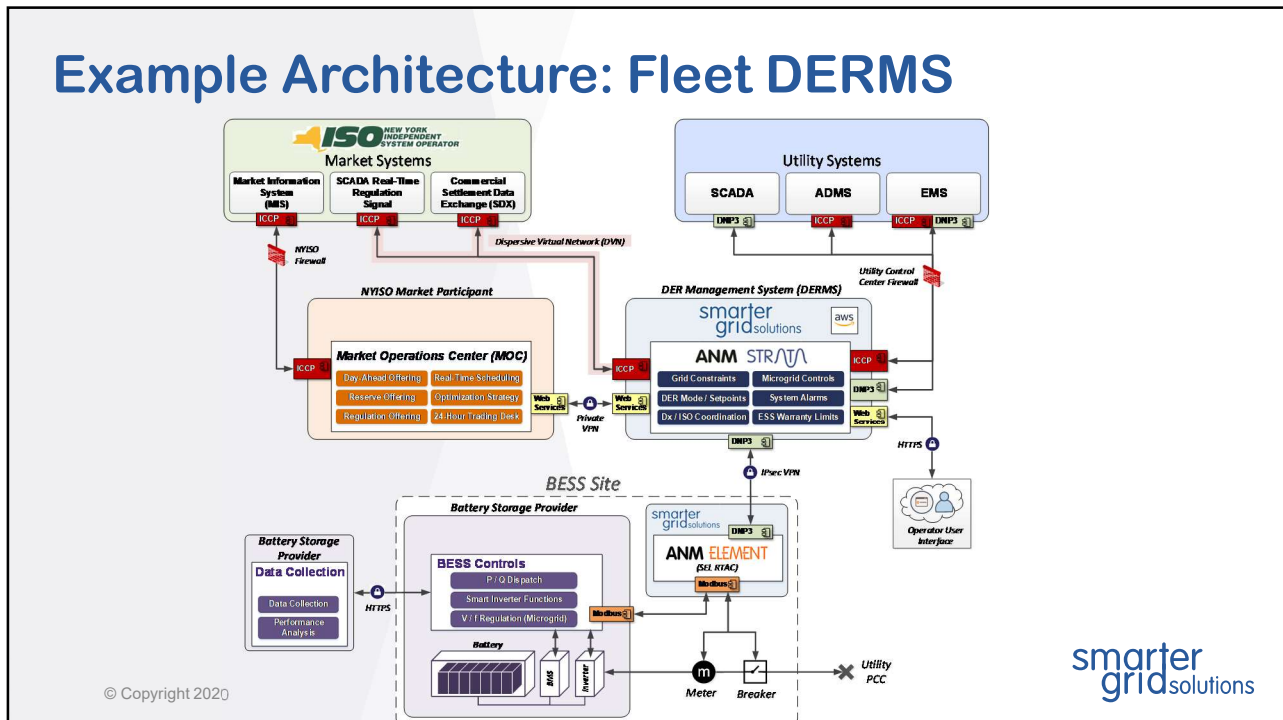


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Example Architecture: Fleet DERMS



ANM STRATA

Seamlessly integrating and controlling DER of any size and type and in any location.

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ANM ELEMENT

Real-time monitoring
and control of DER at
the grid edge.

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PREV	20.10.2018 10:12:40	Menu	NEXT
4600 Target SP		4600 Rated Power	
3000 kW		200 Amps	
ANM ELEMENT		CURRENT STATE: GENERATING	

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Applications

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Applications and Benefits of DERMS

Applications / Use Cases

- Enhance network visibility and controllability
- Real-time constraint management (thermal overloads, voltage excursions and fault levels)
- Optimizing and dispatching network / flexibility services
- Grid flexibility service coordination
- Grid optimization
- Congestion management



Utility DERMS

Benefits / Value

- Enable customer DER connections
- Avoid or defer grid upgrades
- Meet grid modernization objectives
- Achieve output measures and incentives
- De-risk onboarding of DER at scale
- Enhance reliability and stability

- Virtual Power Plant
- Battery management and dispatch
- Hybrid DER portfolio optimization
- Optimization driven coordination of market, network and local objectives
- Export limitation (e.g. over-connecting DER on a connection agreement)
- Local energy system



Fleet DERMS

- Enable new business models (e.g. fixed price energy, reliability solutions, Energy as a Service etc.)
- Stack revenues from disparate DER assets
- Combine delivery of network services, local site optimization and market participation
- Securely and efficiently manage the "physical" requirements sites and assets

- Grid connected mode:
 - Export limitation
 - Market interface
 - Energy optimization
- Islanded mode:
 - Disconnection, load re-balancing and re-synchronization
 - Black start
 - Load and renewable management



Microgrid DERMS

- Enhanced reliability
- Improved asset utilization in grid connected mode
- Access revenue streams from system operator and wholesale markets
- Efficient monitoring and management of DER fleet

Renewable and Distributed Generation

Problem

- Customer connections creating bi-directional power flows and operational constraints (thermal, voltage, fault level) triggering network reinforcement
- Impacts on the transmission system (e.g. congestion) and system operation (e.g. balancing and network services)

Solution

- DER control as an alternative to network reinforcement
- Market based using preventative control methods (e.g. Forecasting, optimising, and dispatch)
- Standards based using corrective control (e.g. Real-time monitoring and rules enforcement)
- Fail safe (e.g. DER non-compliance and comms failures)



Energy as a Service

Problem

Energy as a Service (EaaS) extends VPP capabilities to facilitate new business models. EaaS allows customers to buy their energy in a more predictable manner disconnecting charges from kWh consumed. To achieve that, DER require sophisticated optimization and artificial intelligence to maximise market and revenue opportunities.

Solution

ANM Strata provides the platform to connect to any DER hosts a full optimization suite, allowing customers and partners to create and deploy their own IP. ANM Strata operates autonomously across time horizons and with back-ups and fail safes for critical and 'on grid' applications allowing new propositions to be created for reliability, reduced DER costs and site optimization.

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Virtual Power Plants

Problem

Virtual Power Plants (VPPs) present an opportunity for DER to be aggregated and optimised to deliver DER owners and operators revenues from grid management and market participation. To achieve maximum flexibility VPPs require to integrate all types of DER assets and operate across multiple time horizons.

Solution

ANM Strata supports a broad range of IT, IoT, OT and DER specific protocols providing the platform to orchestrate utility scale and residential DER together. ANM Strata supports all DER of any size or type to be aggregated and scalable to millions of devices. ANM Strata extends beyond traditional VPP capabilities to enable fast-acting services, critical services, and locational network services.

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Microgrids

Problem

When operating interconnected the problems relate to coordination of DER to keep the network within operational (thermal and voltage) limits and have DER primed ready for a potential disconnection event. When islanded, the DER transition to performing a grid stability function managing frequency to avoid black-out.

Solution

ANM Strata provides the ability to manage DER with different capabilities across different time horizons. It schedules DER to absorb as much renewable energy when it is available or ready for a disconnection event. After transition, ANM Strata continues to schedule DER but allows renewable generation to export as much energy as possible, curtailing output in real-time only when the edge of the stability envelope is reached.

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Case Studies

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Avangrid (FICS)



Problem

Avangrid was receiving customer feedback related to the high cost and timescale of DER interconnection being driven by the need for grid upgrades.

Solution

Using ANM Strata, Avangrid introduced flexible interconnection methods demonstrated and proven in the UK. Customer interconnection agreements were amended to incorporate the fast-acting, autonomous control methods used by ANM Strata to minimise curtailment actions.

Result

The project demonstrated the capability of ANM Strata to doubled grid hosting capacity and reduce customer need for capital expenditure.

GIE (Con Edison)



Problem

Con Edison required peak load relief services in New York and as part of a REV demonstration project sought to prove the case for using batteries in a stacked revenue arrangement to reduce the cost of the service. GIE therefore required a solution to aggregate utility scale batteries for Con Edison to dispatch and trade residual capability in the NYISO.

Solution

ANM Strata was deployed and integrated with Con Edison systems and control room processes. ANM Strata provides automated optimization of the batteries and aggregates the capability to a trading desk. ANM Strata is also interfaced to the NYISO market.

Result

ANM Strata was successfully integrated with the operational systems of Con Edison providing the capability to schedule the batteries for network services as a Non-Wires Alternative. This reduced cost of network services to Con Edison. The interface to the NYISO to trade residual 'non-critical' battery capacity allowed GI Energy to stack revenue streams from the batteries increasing return on investment.

Tuscon Electric Power



Problem

In collaboration with EPRI, our customer sought to demonstrate the technologies and processes to handle mass consumer take up of PV and other consumer level DER. The DERMS was required to demonstrate connectivity and control of all consumer types of residential DER (PV, storage, EVs) connected via a range of protocols and standards.

Solution

ANM Strata was deployed in a private cloud architecture to integrate PV using Sunspec Modbus, and Powerwalls and EV charging using OpenADR.

Result

Successfully demonstrated the integration of all DER devices and the process to scale up to 400,000 customers.

Southern California Edison (EASE)

Problem

With state mandates for renewables and energy storage, California has experienced an upsurge in the volume of DER connecting to the network. The process for connection, all the way from planning consent to grid connection and being energised, took weeks even for residential scale DER. Southern California Edison wanted to streamline the connection process for millions of DER (e.g. 6GW+ of Solar PV) and onboard the DER for control and optimization.

Solution

Smarter Grid Solutions worked with partners to automate the entire interconnection process. ANM Strata was used to implement auto-discovery and self-provisioning of DER assets into control schemes.

Result

ANM Strata was used to connect of 100s of DER devices per day, reducing interconnection times to 5 days.

UK Power Networks (ANM Roll-Out)



Problem

UK Power Networks operate the Distribution Network across the south east of the UK, including London. As part of their vision to be a world-leading DSO, they required a multi-use case DERMS, with ANM capability, to deliver a broad range of use cases across their business. Use cases include flexible connections, flexibility services, coordinated services with National Grid, and optimization of the network with power electronics.

Solution

UK Power Networks selected ANM Strata as the core ANM platform for DER integration and to support multi-layered control of DER. ANM Strata was selected because of its ability to integrate all types and sizes of DER, operate as a multi-use case DERMS hosting multiple different control schemes, and orchestrate use cases across different time horizons. ANM Strata was integrated with advanced online simulation tools and a flexibility market platform.

Result

ANM Strata is currently being deployed across the licence area and will be operational in October 2019.

Q&A