Implementing DERMS @ PG&E

March, 2026

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Grid Research Innovation & Development

Building the grid of the future, today.

DERMS Current Status & Roadmap Overview

Initial DERMS use cases focused on maximizing capacity utilization on constrained distribution circuits. Over time, DERMS will scale to orchestrate DER aggregations into virtual power plants (VPPs) to unlock benefits to the grid, energy system, and customers.

To Date (2023-2025)	Current (2026)	Next GRC - (2027-2030)
Deployed foundational cloud DERMS platform including IEEE 2030.5 DER headend	Scale Flex Connect program for operational flexibility geographically and across more customer types	Ubiquitous deployment of DERMS across service territory (where value add)
64 customer-owned telemetry sites 1MW+ DERs to comply w/ Rule 21 via 2030.5	Enable grid and program mgmt capabilities for emergent DER programs including EV managed charging pilots (V1G)	Develop VPPs by orchestrating heterogenous DERs to solve one or multiple grid constraints
Operated **five** flexible service connections (Flex Connect) sites, adding **~5000 MWh** of new load and **two** NWA/Deferral procurements	Extend forecasting and constraint management down to the service transformer	Scale VGI use cases including V1G and V2X
Provide Dx Ops w/ visibility of flexible capacity available from Demand Response programs at the feeder level	Pilot data sharing between Dx & Tx and ISO to ensure reliable and resilient grid operations	Integrate DERMS w/ grid edge computing platforms to optimize at the hyper local level

DERMS Crawl / Walk / Run Approach

PHASE 1
(MVP)

Situational Awareness:
- **DER-aware as-operated model**
- **Real-time system visibility**
- **Forecasted system conditions**

- Limited Geography
- Measurement Based
- Out of the Box Forecast Models
- As-switched network model

DERMS Functionality:
- **Constraint Management**
- **DER Program Management**
- **DER Optimization and Dispatch**
- **Measurement and Verification**

- Measurement Based Constraint Engine
- Program Management for MVP Use Cases
- Single DER Site or Single Aggregator Dispatch

Monitoring and Control Interfaces

- Cloud Based 3rd Party Integration
- SCADA and 2030.5 Interfaces

Change Management:
- **Operational Structure and Processes**
- **Internal / External Interfaces**
- **Policy/Tariff Updates**

- Project Engineers minimize impact to operations

Prove DERMS can deliver value at a limited scale before wider deployment:

- **Build foundational platform** that can flexibly scale toward the long-term DER management vision
- **Validate value proposition** of each use case through MVP implementation before creating standard customer offerings, modifying tariffs or pursuing regulatory changes
- **Operate MVP w/ manual processes and limited user group** before developing standard business process for broad application
- **Rules-based analysis and day ahead forecasting** vs real-time power flow-based solution due to dependencies on future ADMS capabilities (R3)
- **Pilot customer agreements** for flexible service/interconnection (find customers willing to work through new technology & processes)

Overview of DERMS Initial Use Cases

Initial Use Cases Manage Grid Constraints

- **Address near-term challenges**
- **Create key foundational capabilities**
- **Value creation is achievable by the end of 2024** w/MVP in targeted geographies

Use Cases:

1. **1MW+ DER Telemetry for Operations Implemented in 2023**
   - Compliance with IEEE 2030.5 customer-owned telemetry CPUC mandate provides more cost-effective solution for large DER interconnection customers
2. **Flexible Service Connections**
   - Allows new load customers such as EV fast charging to connect sooner with more capacity as bridge solution until grid upgrades are completed
3. **Flexible Generation Interconnections**
   - Allows DER developers to avoid system upgrades via a more flexible and cost-effective interconnection process.
4. **Operation of Capacity Deferral Solutions (i.e., NWA)**
   - Dispatch DERs to defer distribution capacity projects

Site Recruitment | **Commissioning** | **Operation**

Customer Benefits
Flex Connect Real World Site Example

EV Fleet Customer Gained Additional Capacity 18 mo early

Single Month Benefit (January 2025)

+137 MWh
Usage Above Planning Limits

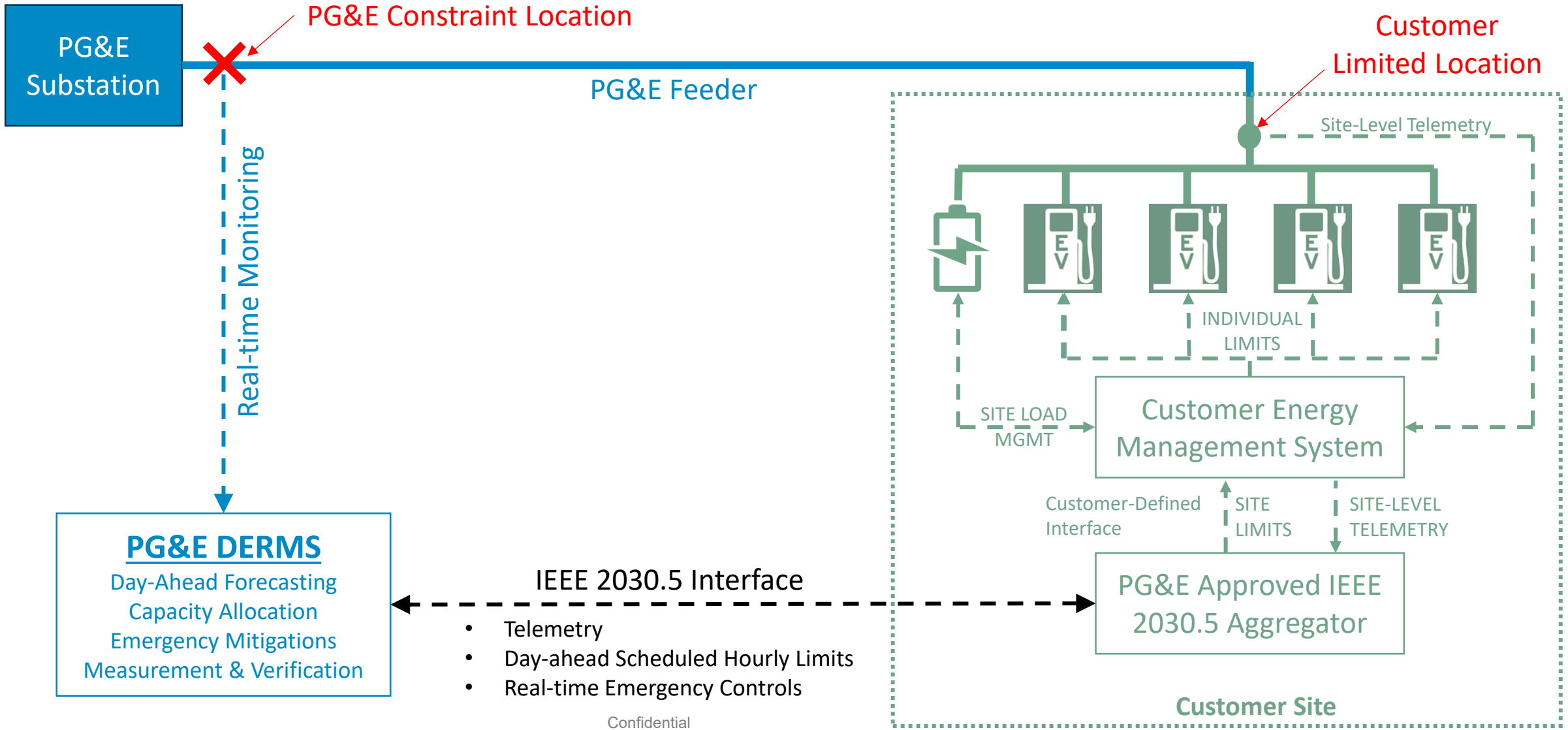
~68k miles

2.6 MW
Average Limit Increase

90%
Time with Added Capacity

Estimated reduction of $1M in fuel costs and 8,000 tons of CO_2 over the 18 months of early energization

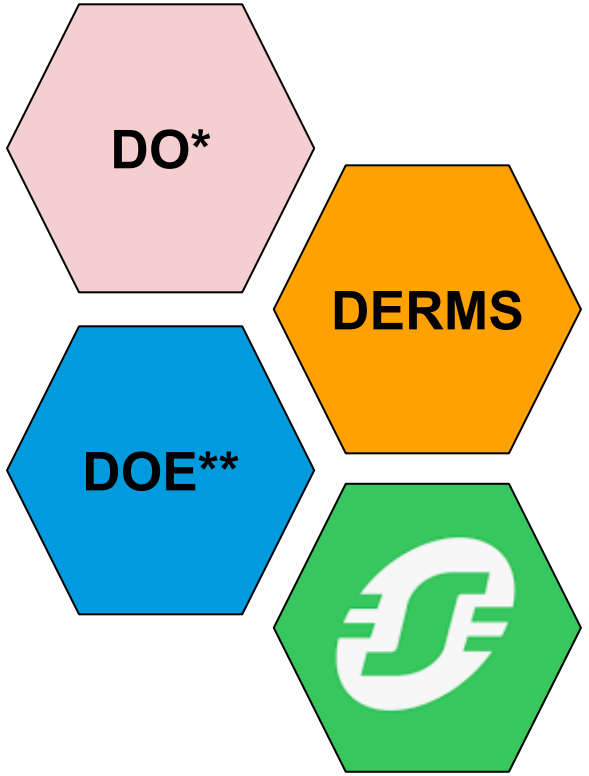
Flexible Service Connection Pilot – Illustrative Site Configuration



Integrating DERMS with Operations

Operation (Automatic)

1. Run Forecast
2. Create Day-Ahead Schedule
3. Dispatch to Customer
4. Operation / Fail-safe Monitoring
5. Review Compliance and Benefits



*Distribution Operator
**Distribution Operations Engineer

Flexible Service Connection
24hr ahead DER customer import limits

Microsoft Azure

Customer & DER Data →

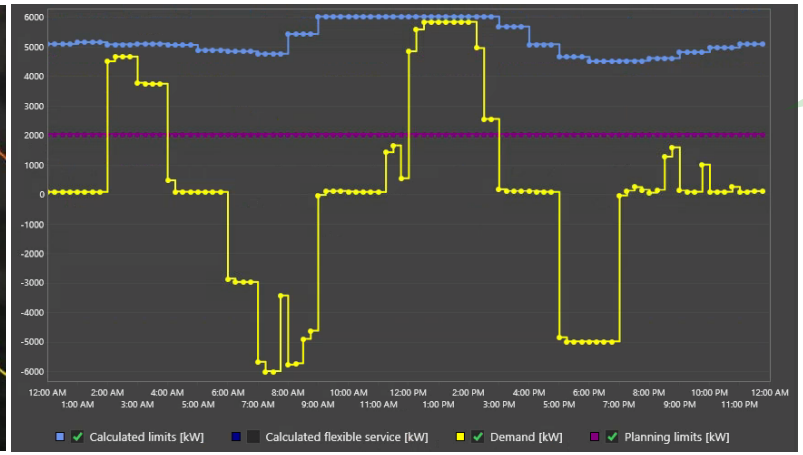
DER Contract Info →

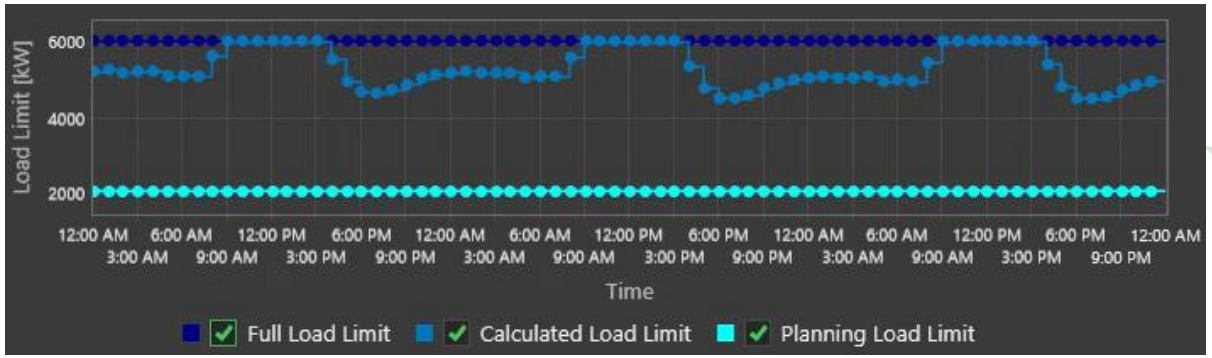
As-Operated Network →

Historical Data →

Weather Data →

EcoStruxure DERMS

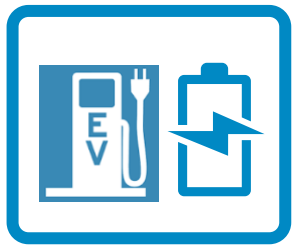




Measurement and verification for benefits and compliance

Controls →

← **Telemetry**



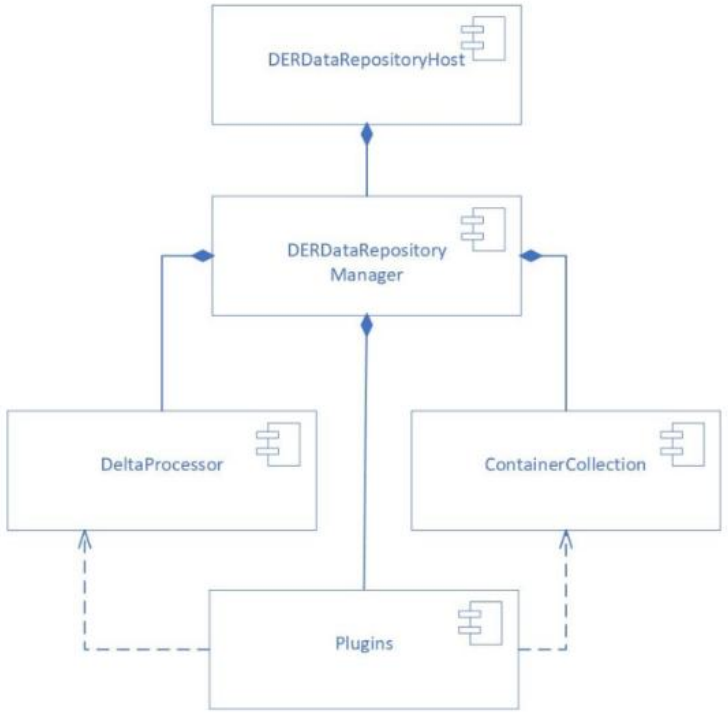
Detect capacity constraints and determine dynamic site limits within DER contract parameters

Unlocks more capacity on the grid, increases utilization, and allows more customers to connect sooner

EcoStruxure Grid DERMS functionality at PG&E

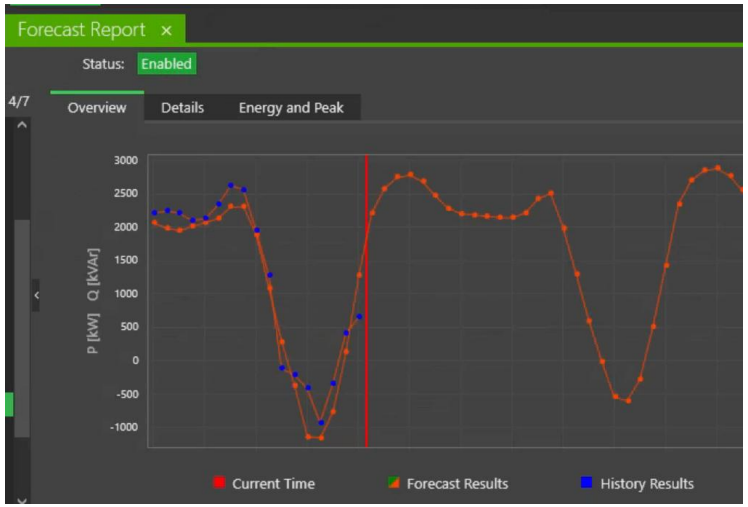
EcoStruxure DERMS v3.10.1

1. DER Data Repository



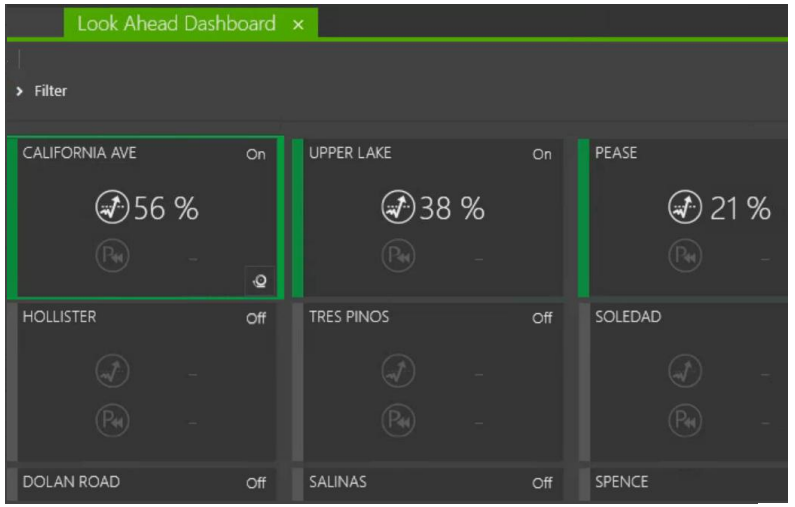
- In-memory data model for DERMS
- On top of the network model
- DER, DERGroup, DERContract, FlexibleConsumption/Generation, etc.

2. Forecast



- SCADA history (90 days)
- Weather history & forecast (5 days)
- AI-based (SVM) load forecast, in 1-hour intervals
- Trained once with large set of input data (90+ days); afterwards, it uses the parameters of the trained models
- Runs automatically (daily)

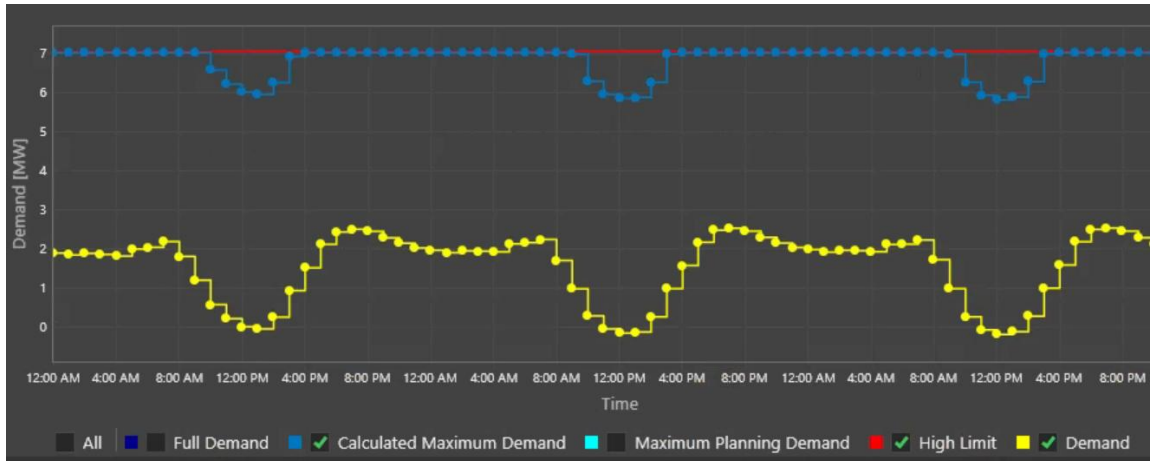
3. Look Ahead



- Forecast results and network model
- Calculates state in grid
- LA Dashboard - displaying circuits from entire network down to the feeder level
- Color - whether violation detected
- Icon – symbol if there is an Alarm
- Enable/disable the execution of DOL and LAF applications

EcoStruxure Grid DERMS functionality at PG&E

4. Dynamic Operating Limits (DOL)



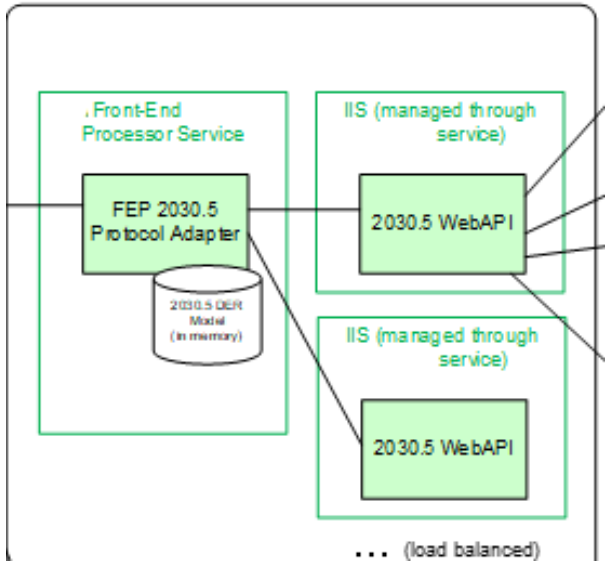
- For Use Case #2 & #3 (DERs Should Do-No-Harm)
- Calculates DER site limits per forecasted feeder load
- Hourly schedules for 3 days starting at midnight
- Runs automatically (daily, 8am), including automatic sending new limits via 2030.5

5. Look Ahead Flexibility (LAF)

- For Use Case #4 (DERs as a Grid Service)
- Calculates when DER site needs to be engaged to resolve overload/reverse flow
- Runs automatically (daily 8am), including automatic sending new limits via 2030.5
- Can use the same DER site as DOL

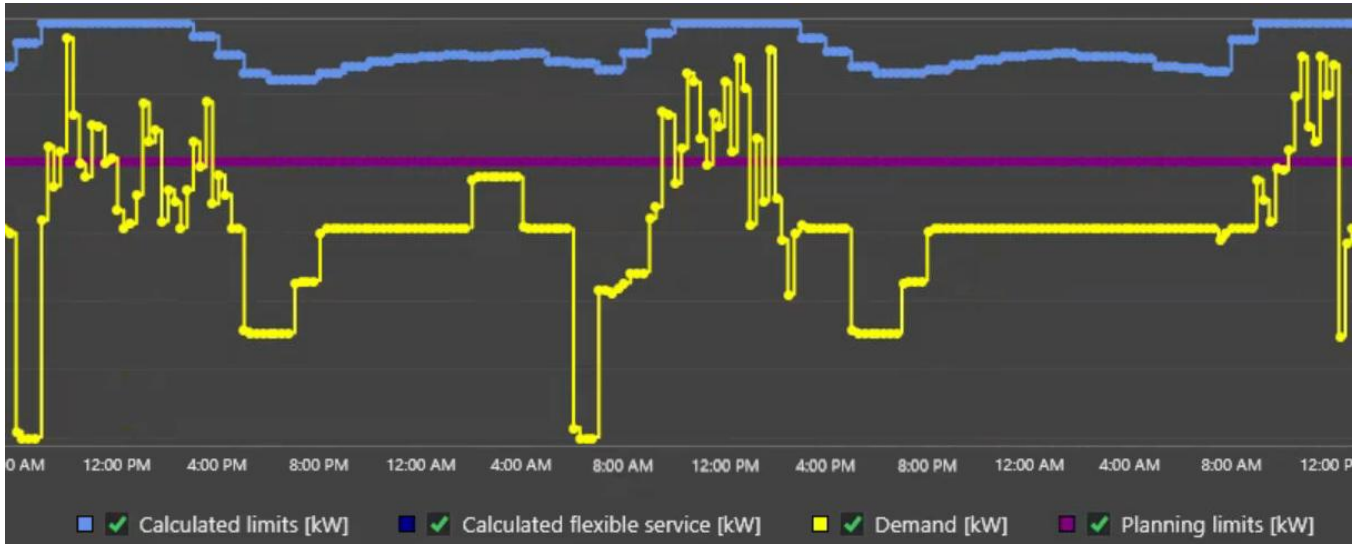
EcoStruxure Grid DERMS functionality at PG&E

6. IEEE 2030.5 HeadEnd Server



- SunSpec certified
- 2030.5 WebAPI Adapter
- Direct & via aggregator communications

7. DER Compliance Report (M&V)



- 2030.5 Telemetry & meter data from CDW system
- Site planning limit
- DOL/LAF executed controls (Calculated limits)
- Demand
- Total hours out of compliance in selected period per DER site
- Released Energy
- Achieved Energy

What We've Learned Thus Far

- **Strong partnership with a primary software vendor across ADMS & Grid DERMS**
  - Allows for easier integration of systems -- crucial for sending data between systems (e.g. telemetry, forecasts, device info)
  - Cloud-hosted PaaS allows for faster iteration (outpacing ADMS release schedules)

- **Minimize impact on real-time operations (e.g., Distribution Operators)**
  - Invest in features (e.g., automation), testing, and failsafes that remove real-time operations needs
  - Fit into existing processes where possible (e.g., how DOEs schedule clearances in advance)

- **Prioritize customer pain points**
  - FlexConnect program brings customer sites online 12-24 months faster (vs. waiting for upgrades)
  - EV fast charging and fleet charging are growing use cases with sophisticated customers (good early adopters with path to scale)

Challenges
Utility and Customer Related

Technology Nascency

- DERMS is still a developing space on the Utility side – use cases need to be clear
- Customer implementations are not off-the-shelf and can be expensive depending on the complexity of integrations required
- Failsafe requirements are not fully captured in existing standards
- Standards and certification processes need to evolve

Flexibility Requirements

- Not all customers are a good fit for flexibility needs to participate in these programs
- Not all grid conditions are a good fit for the flexibility needs of customers

Process Nascency

- PG&E processes are evolving to help faster identify sites, calculate expected benefits, create agreements, and commission and operate new sites. The goal is to have these be part of “normal business” processes in the future.
- Customers and vendors are also learning how to provide these types of services where implementation, pricing, and maintenance models are still evolving

Future Operational Model (what we know today)

New roles, responsibilities and cross cutting collaboration will be required to operate DERMS however it is still early days (agility and flexibility are needed)

DER Program Operations (legacy Demand Response Operations)

- Creation, Program Management & Operations new Load Mgmt programs (e.g. multi-use VPP)
  - Enrollment, resource creation, forecasting, dispatch, market integration, M&V etc.
- Novelty
  - Granular level of aggregation based on grid topology
  - Balancing priorities (Dx. v Market)
  - More frequent dispatch (vs emergency only)
  - Higher reliance on DER (vs opt out)

Distribution Grid Operations (control center)

- Incremental responsibilities
  - Managing “constraints by design”
  - Monitoring and dispatch of DERs
- Novelty
  - New types of alarms & contingencies
  - Dynamic grid conditions caused by DERs under market influence
  - Interaction w/ use limited, customer owned resources with variable availability (e.g. time of day/year)

Considerations and discussion points

- Integration of two utility operations functions that have had limited interaction historically will be a significant undertaking
- Automation and technical integrations across functions will be required to manage complexity

Questions?

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DERMS scaling progression: Crawl / Walk / Run

Future DERMS Phases: Scaling factors

- Geographical
- Functionality and level of complexity (e.g. power flow based vs rules based)
- Additional use case (e.g. expansion to cover DR and VGI use cases)
- Additional DER types and protocols
- Ops integration & process maturity