SunSpec Webinar

April 17, 2025
1:30PM PST

Unlocking Grid Flexibility: Updates on Flexible Service Connection & 2030.5 CSIP Test Procedures

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Today's speakers

Vish Ganti
President & COO

DER SECURITY

Tom Tansy
CEO

DER SECURITY

Adarsh Madhavan
Flex Connect
Program Lead

PG&E Pacific Gas and Electric Company

Pradeep Mishra
Founder
(Australia)

AuRion Systems

Ben Schwartz
Policy Manager

Clean Coalition

The Alphabet Soup

1. Distributed Energy Resources (DERs)

Distributed energy resources (DER) include responsive generation, storage, or load connected at the distribution system level. Responsive means that the operation of the assets can be managed to provide one or more grid services. *U.S. Dept of Energy*

2. Hosting Capacity

Hosting capacity is defined as an estimate of the amount of DER that can be accommodated anywhere on the distribution system without adversely impacting power quality or reliability under existing control configurations and without requiring infrastructure upgrades – *EPRI*

3. Dynamic Operating Envelopes (DOE)

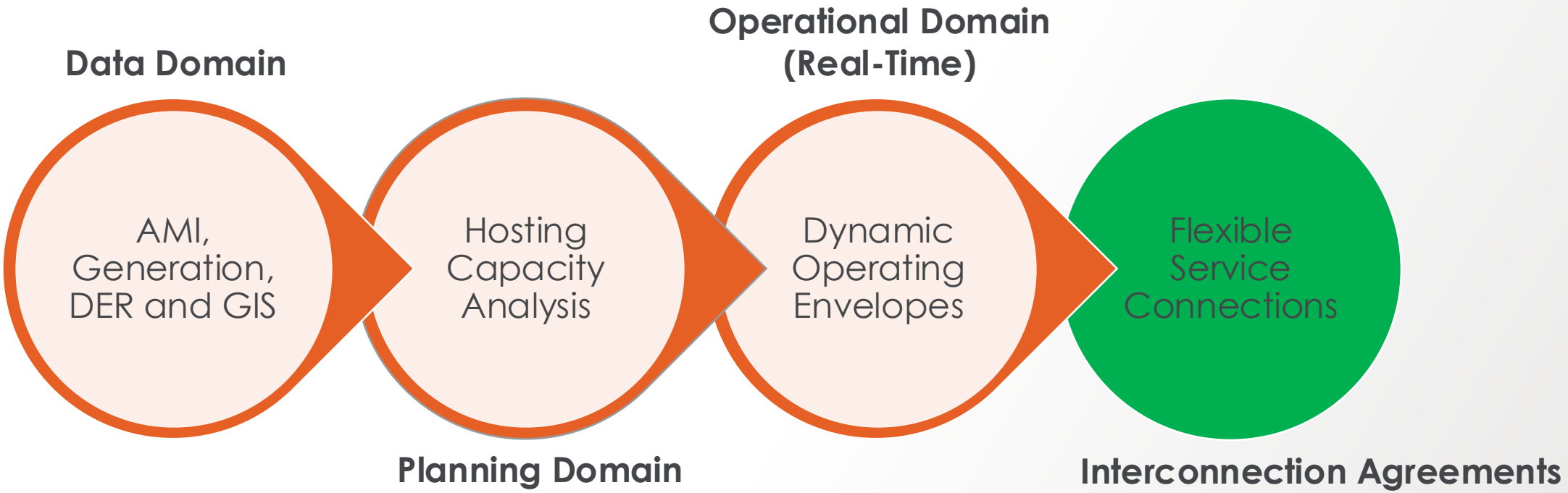
Operating envelopes are the "**technical & operational limits**" within which customers can import and export electricity as set by the physical constraints in the local network.

What are Flexible Service Connections?

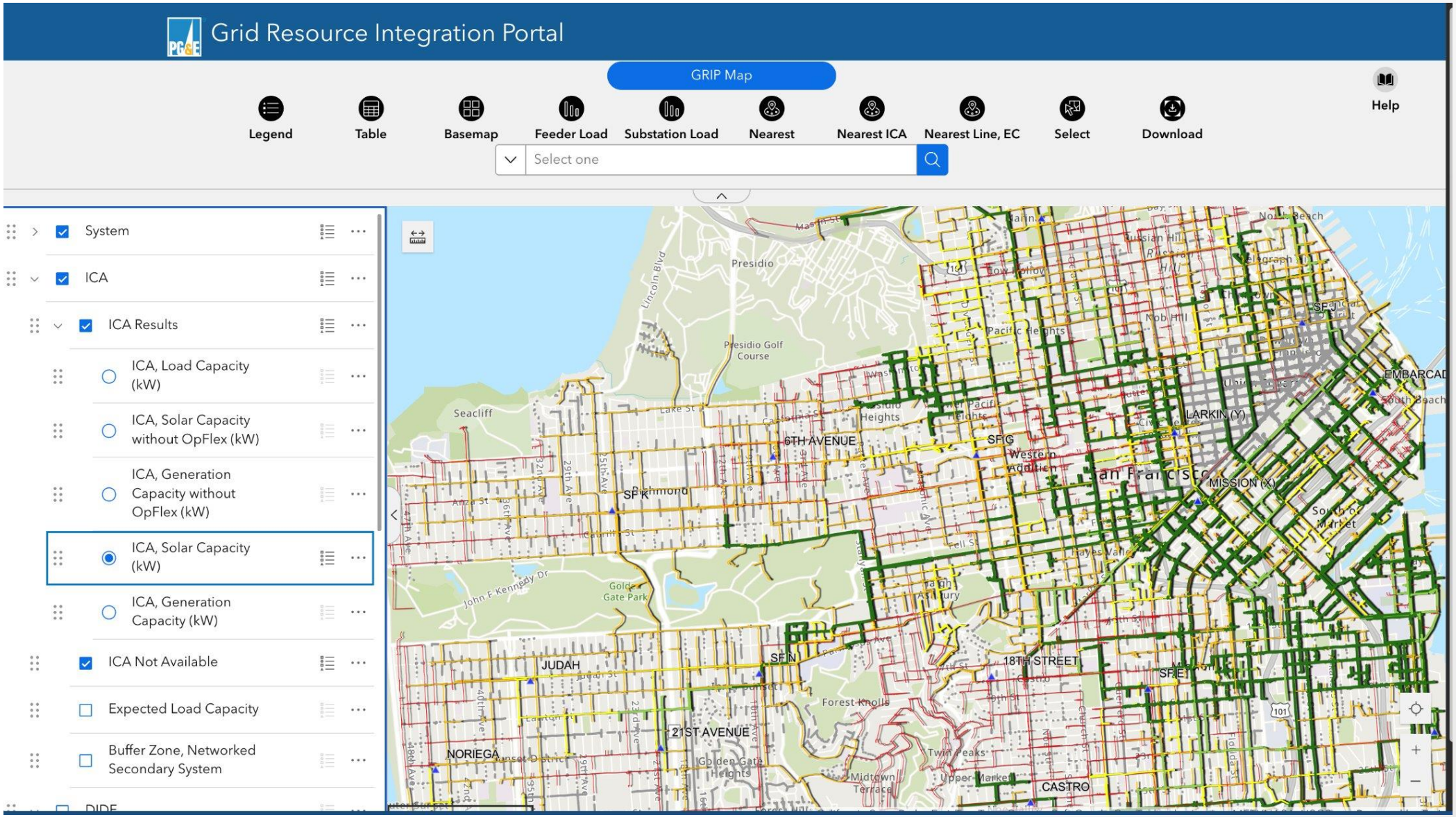
- Contracting Mechanism
- Business Problems/Model
- Enabling Technologies

Flexible connections manage grid 'traffic' similar to how HOV lanes optimize highway capacity without building entirely new roads.

Data Enabled Business Model



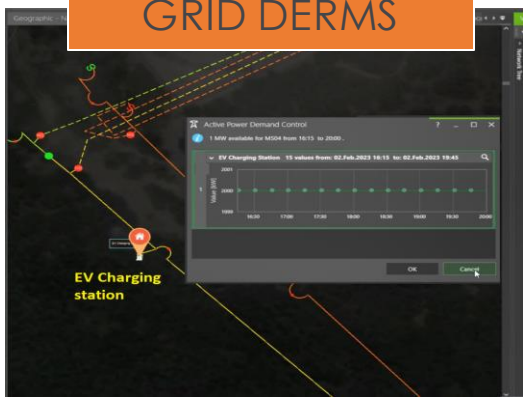
Hosting Capacity: Grid Capacity ArcGIS Maps



Source: https://grip.pge.com

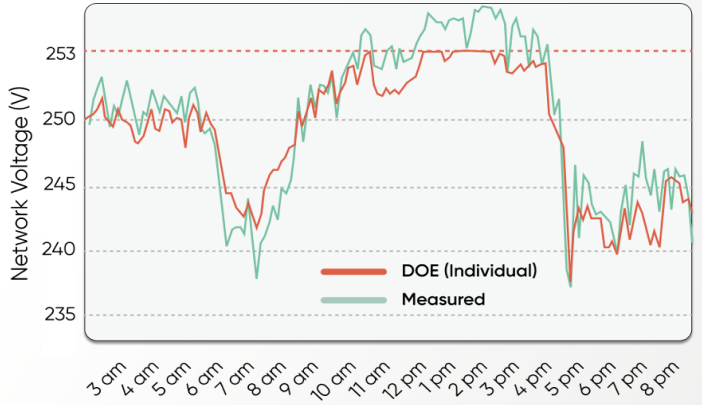
Dynamic Operating Envelopes (DOE)

GRID DERMS



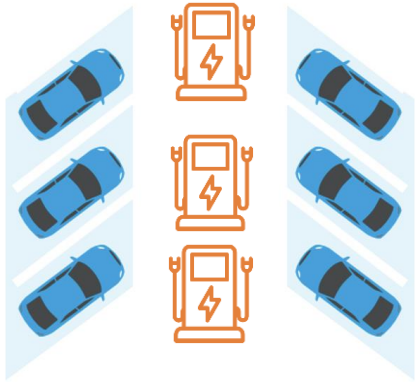
DOEs

PCC
(Service Point)



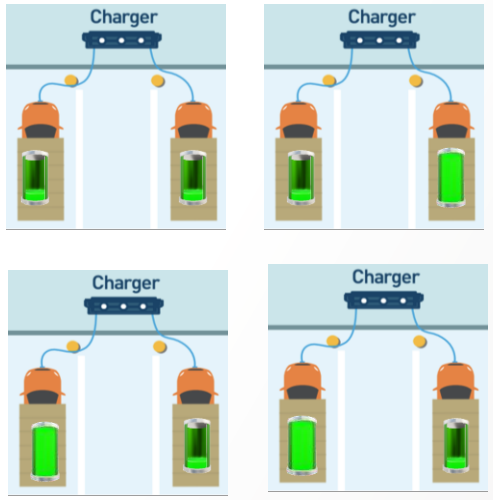
Curtail Charging

Level-2 EV Chargers



Curtail or Discharge

V2G Charging

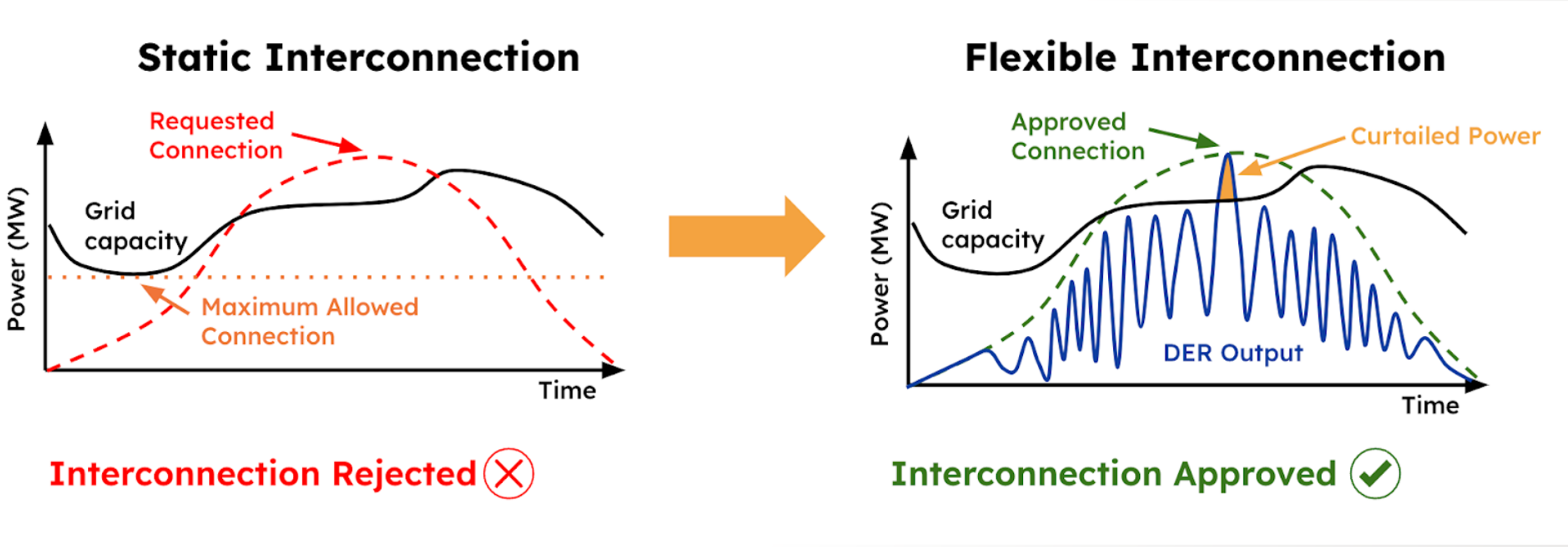


Curtail or Discharge

Solar + Storage + Flex Loads

Datacenters C&I Facility Residential

Static vs. Flexible Interconnections



EPRI & Camus Energy

Moving from static to dynamic operating envelopes represents one of the most significant changes to the customer connection model in a hundred years

PG&E Flexible Service Connection

Program Overview

April 2025

PG&E | Grid Edge Innovation

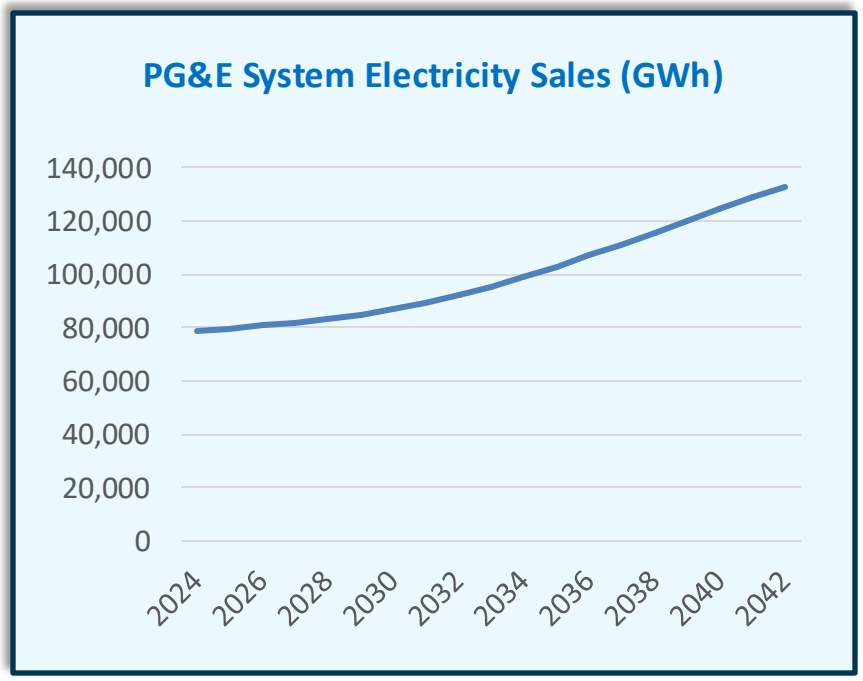
Grid Research Innovation & Development

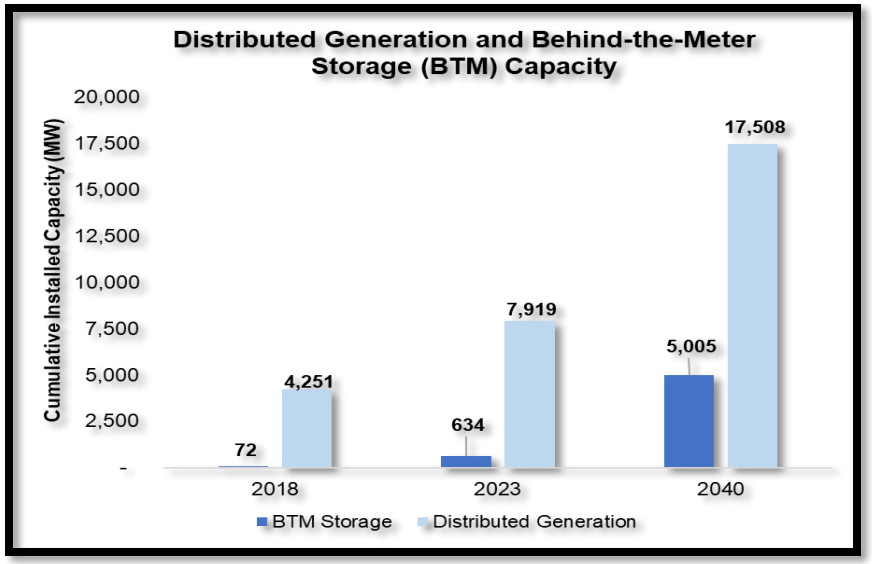
Building the grid of the future, today.

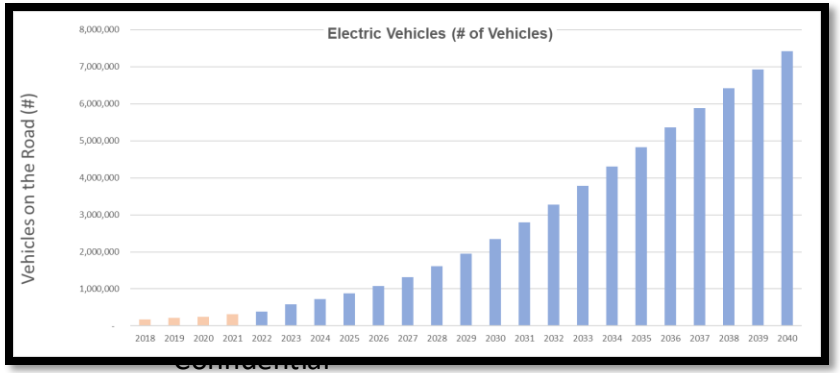
The need for new DER Management Tools & Processes

PG&E anticipates increased load driven by EV adoption and building electrification – coupled with continued adoption of distributed solar, significant growth of behind-the-meter storage and flexible loads such as EV charging.

New tools and processes to orchestrate Distributed Energy Resources (DERs) are necessary to safely and effectively operate the grid.







7/25 PG&E Innovation Summit announcing DERMS Initiative

Source: PG&E's Spring 2023 Annual Load Forecast

DER Orchestration Vision Enabled by DERMS

Present focus has been on uses cases to maximize capacity utilization on constrained distribution circuits. Over time, focus will expand to orchestrating DERs across multiple value streams (e.g. customer, grid, system)

Now (2023/2024)	Mid-Term (2024-2027)	Longer-Term (2028-2030)
Deploy foundational DERMS platform including 2030.5 DER headend for low-cost telemetry	Scale DERMS capabilities to the entire system rather than spot locations	Simplify customer experience via a single PG&E interface and engagement platform
Implement initial use cases to enable EV fast chargers' maximum capacity on constrained circuits (Flex Connect)	Transition demand response and load management programs to Enterprise DERMS	Optimize customer value of DERs for energy markets, transmission and distribution needs
Dispatch contracted DERs as a non-wires alternative to capacity projects	Enable electric vehicles as flexible loads via managed charging and V2X	Evolve DERMS into a grid edge computing platform to automatically optimize at the hyper local level
	Orchestrate DERs and LM across multiple value streams	
	Integrate real-time pricing pilots and initiatives to utilize DERs as a system resource	

PG&E's Flexible Service Connection Concept

Flexible Service Connection is a bridge solution that aims to allow customers with controllable loads to connect to the system without waiting for a service upgrade

Customer Value

Quicker connections

- Avoid Long Wait Times
- More Available Energy
- Improved Utility Partnership

Distribution Value

Improved customer experience

- Unlock Available Capacity
- Higher Grid Utilization
- Operational Flexibility

Energy System Value

Support industry goals

- Timely Energization
- Cost Effectiveness
- Manage Grid Constraints

Real World Example of Potential Benefits

Hour of the Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	71%	71%	71%	20%	20%	20%	20%	20%	20%	20%	71%	71%
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2	71%	71%	71%	20%	20%	20%	20%	20%	20%	20%	71%	71%
3	71%	71%	71%	20%	20%	20%	20%	20%	20%	20%	71%	71%
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23	71%	71%	71%	20%	20%	20%	20%	20%	20%	20%	71%	71%

STATUS QUO: Planning Limits for 3.8MW EV Charging Station

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3	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
4	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
5	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
6	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
7	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
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16	100%	100%	100%	100%	100%	100%	89%	94%	83%	100%	100%	100%
17	100%	100%	100%	100%	100%	100%	75%	83%	71%	100%	100%	100%
18	100%	100%	100%	100%	100%	100%	59%	68%	64%	100%	100%	100%
19	100%	100%	100%	100%	100%	100%	63%	66%	56%	100%	100%	100%
20	100%	100%	100%	100%	100%	100%	64%	66%	59%	100%	100%	100%
21	100%	100%	100%	100%	100%	100%	75%	76%	73%	100%	100%	100%
22	100%	100%	100%	100%	100%	100%	85%	87%	84%	100%	100%	100%
23	100%	100%	100%	100%	100%	100%	85%	94%	88%	100%	100%	100%

FLEX CONNECT: Can Support Full Request ~90% of the time on Average

Key Takeaway – If a customer can reduce consumption for 3 months during 3-11PM we can serve their full load request

Real World Example of Potential Benefits

Hour of the Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%
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23	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%	60%

STATUS QUO: Planning Limits for 5MW EV Charging Station

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22	100%	100%	100%	94%	81%	74%	64%	60%	64%	62%	100%	100%
23	100%	100%	100%	97%	84%	81%	71%	64%	67%	67%	100%	100%

FLEX CONNECT

Key Takeaway – Some sites can still have access to partial power despite being limited to 0MW during the daytime hours

Flexible Service Connection Operations

24hr ahead DER customer import limits

Enabling customers with eligible loads to connect sooner by dynamically managing consumption based on grid availability

Customer and DER data

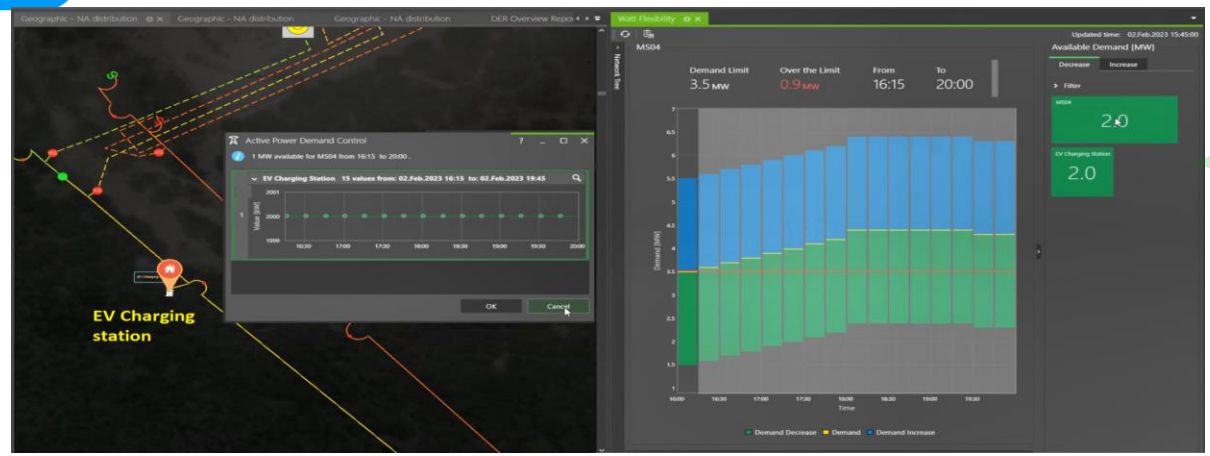
Flexible service parameters

Network connectivity data

Historical data

Weather data

Microsoft Azure



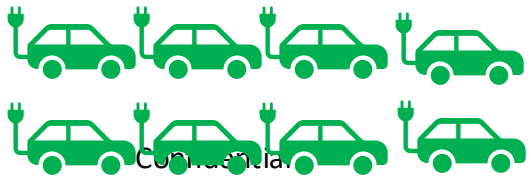
Determine dynamic site limit

Detect feeder loading capacity constraints

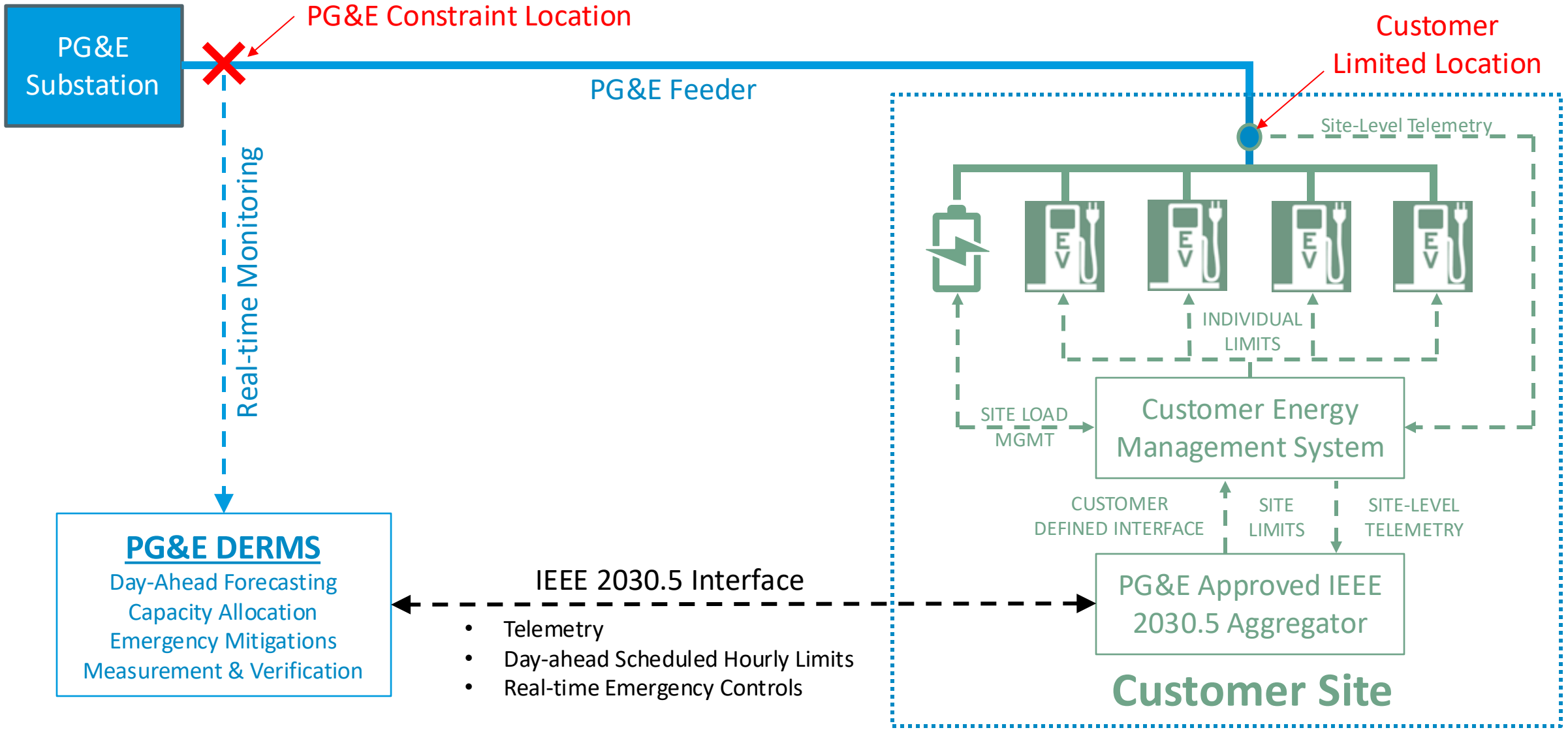
Re-calculate flexible capacity

Telemetry

Dynamic site limits



Illustrative Site Configuration



Customer Journey for participation in Flexible Service Connection MVP

In 2024 PG&E will be worked to standardize customer engagement and site evaluation processes based on initial learnings

1 Identify

Customer identifies a site and PG&E checks eligibility

2 Evaluate

PG&E evaluates suitability for MVP & provides Customer with historical site analysis

3 Agree

Customer evaluates benefits and agrees to program terms

4 Build

Customer contracts with aggregator and controls vendors

5 Deploy

PG&E supports Customer with testing and commissioning

6 Operate

Customer automatically adheres to PG&E day-ahead hourly limit schedule

Customer Site Considerations

Ideal Site

- Existing site, or in service in 2025/2026, or
- Long lead time for available grid capacity (2+ yrs)
- Flexible loads or local generation

Program Limitations

- Not all capacity constrained sites will be suitable for the initial pilot due to local grid configuration and loading

Results so far

PG&E Flex Connect Pilot Benefits Report

January 2025

Site Details

Site Name:		**Flex Connect Start Date:**	11/13/2024
Address:		**Requested Capacity:**	4.5 MW Charging
Asset Type:		**Existing Constraint:**	0 MW Limit 03:00-21:00 daily 3 MW Limit 21:00-03:00 daily

Flex Connect Participation Highlights

	This Month	Since Inception
	+137 MWh	+235 MWh
	68.7k miles (est)*	117.7k miles (est)
	2.6 MW Average Limit Increase	2.2 MW Average Limit Increase
	90% Time with Added Capacity	87% Time with Added Capacity

PG&E Flex Connect Pilot Benefits Report

January 2025

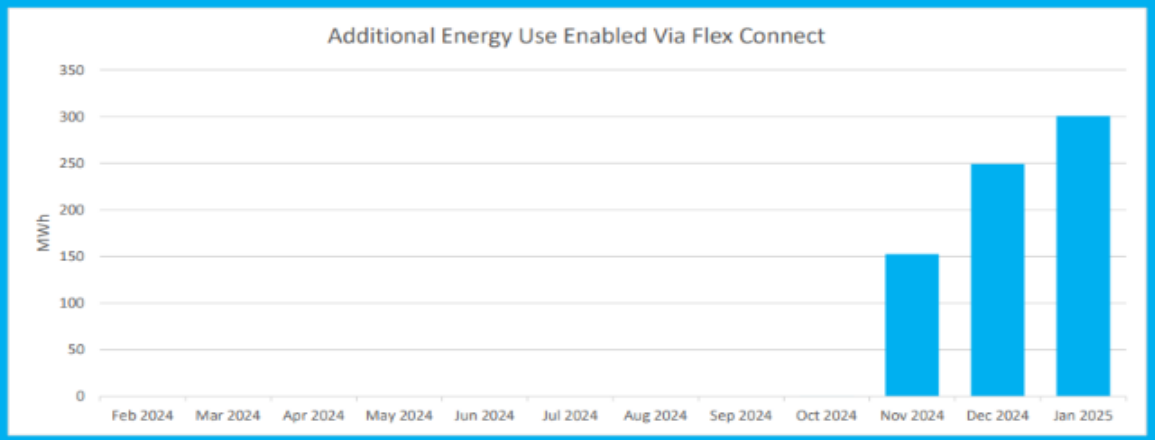
Site Details

Site Name:		**Flex Connect Start Date:**	10/31/2024
Address:		**Requested Capacity:**	6MW Charging
Asset Type:	Wholesale Market Participating Battery	**Existing Constraint:**	2MW Charging Limit 24/7/365

Flex Connect Participation Highlights

301 MWh
Additional Energy Use Enabled This Month

703 MWh
Additional Energy Use Enabled Since Inception



IEEE 2030.5 Protocol is used to enable all segments, time resolutions: Australia vs California

Market	Communication Window	Granularity	Customer Segment
PG&E FlexConnect	24 hour ahead	Hourly	Large Loads
Australia (Trials)	6 hours ahead	Hourly	Residential
Australia (Future)	6 hours ahead	5 mins	Residential

PG&E Launches Seasonal Aggregation of Versatile Energy (SAVE) Virtual Power Plant Program

Pacific Gas and Electric Company

NEWS PROVIDED BY
Pacific Gas and Electric Company
Mar 24, 2025, 13:00 ET

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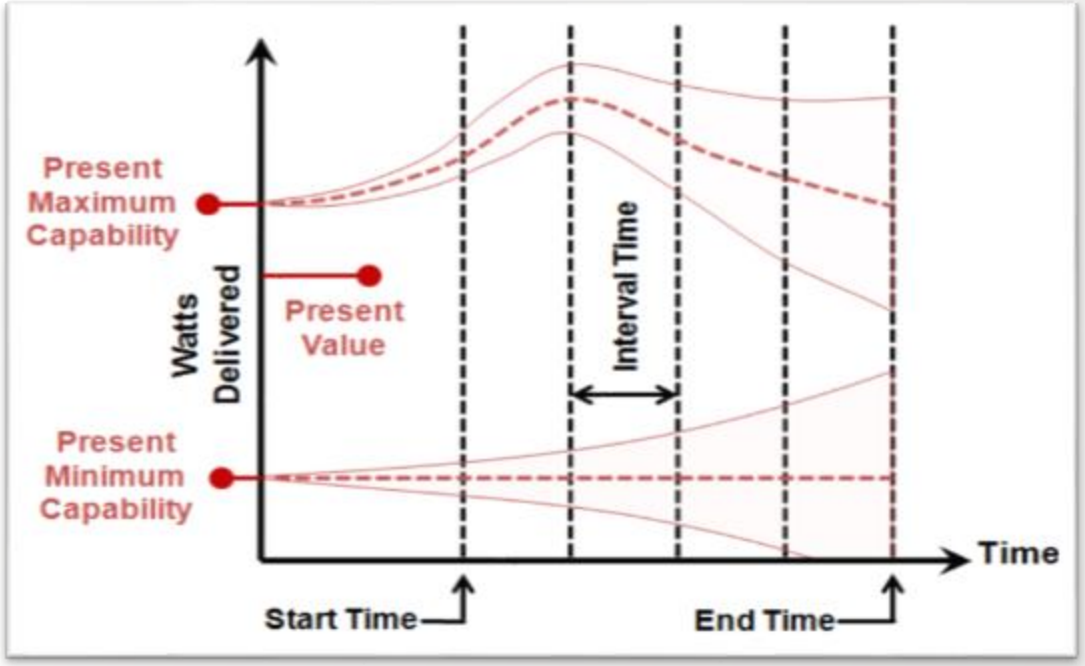


Flexible Connections: Policy Considerations

Flexible Service Connections

Resource Connections

- Streamlined generator interconnection
- Streamlined load energizations
- Dynamic vs. scheduled flexibility
- Maximizing BTM resource sizing

Key Policy Topics

Primacy :Who gets the dibs? Site Optimization to prioritize DOEs vs. Grid Services Events

Grid Upgrades: What happens when the Utility upgrades the grid

Terminology: Is there a standard language available to discuss flexibility?

Grid Services (VPPs)

- Deferred T&D
- Avoided T&D
- RA Reduction
- Grid Resilience
- Ancillary services

Flexible Connections: Policy considerations

- How can a customer request a flexible connection & determine where flexibility is valuable?
- If yes, how can the customer and utility determine the appropriate value stacking opportunities?
- For customers looing to connect both generation and load, should timelines be harmonized?
- How should compensation be structured to maximize flexible connection value creation?
- For example, if a resource defers a distribution upgrade, should it be paid continually, up-front, or until a right sized solution is required in the future?
- How will disputes be handled? Is a formal resolution process needed?
- What equity considerations or opportunities do flexible connections raise?

Panel Discussion

Vish Ganti
President & COO

DER SECURITY

Tom Tansy
CEO

DER SECURITY

Adarsh Madhavan
Flex Connect
Program Lead

PG&E Pacific Gas and Electric Company

Pradeep Mishra
Founder
(Australia)

AuRion Systems

Ben Schwartz
Policy Manager

Clean Coalition

SunSpec 2030.5/CSIP 2025 Working Group

Dylan Tansy
Executive Director, SunSpec Alliance

SunSpec 2030.5/CSIP Test Procedures Work Group

- SunSpec 2030.5/CSIP Work Group is being reconvened to oversee the update and maintenance of CSIP Test Procedures.

- **Calendar:**
  - Thursday, May 1, 2025, at 1:30PM PDT (First Meeting)
  - Thursday, May 15, 2025, at 1:30PM PDT
  - Thursday, May 29, 2025, at 1:30PM PDT
  - Thursday, June 12, 2025, at 1:30PM PDT
  - Thursday, June 26, 2025, at 1:30PM PDT

- **Agenda:**
  - Work Group Policies & Procedures
  - 2030.5 V2G Profile
  - Fix known CSIP issues
  - Modular 2030.5 Test Procedures Plan

SunSpec 2030.5/CSIP Test Procedures Work Group

- SunSpec 2030.5/CSIP Work Group is being reconvened to oversee the update and maintenance of CSIP Test Procedures.

- **Participation:**
  - First 3 meetings are open to the public
  - This is an Entity Work Group (1 company, 1 vote)
  - Membership in the SunSpec Alliance:
    - Use this link before May 17 to receive 10% discount on new membership: https://sunspec.org/register/contributing-member/?coupon=Membership10
    - Sign Up in Member Portal (must be signed in with member level account, contact membership@sunspec.org for assistance)

  - Limited Participation Agreement (LPA):
    - Sign Here
    - May attend meetings, may not vote
    - Government employees, non-profits, researchers & academics will be automatically accepted
    - Special exceptions may be made for small businesses & others as needed, contact membership@sunspec.org

SunSpec Membership

CSIP Update Work Group: IEEE P2030.5.1

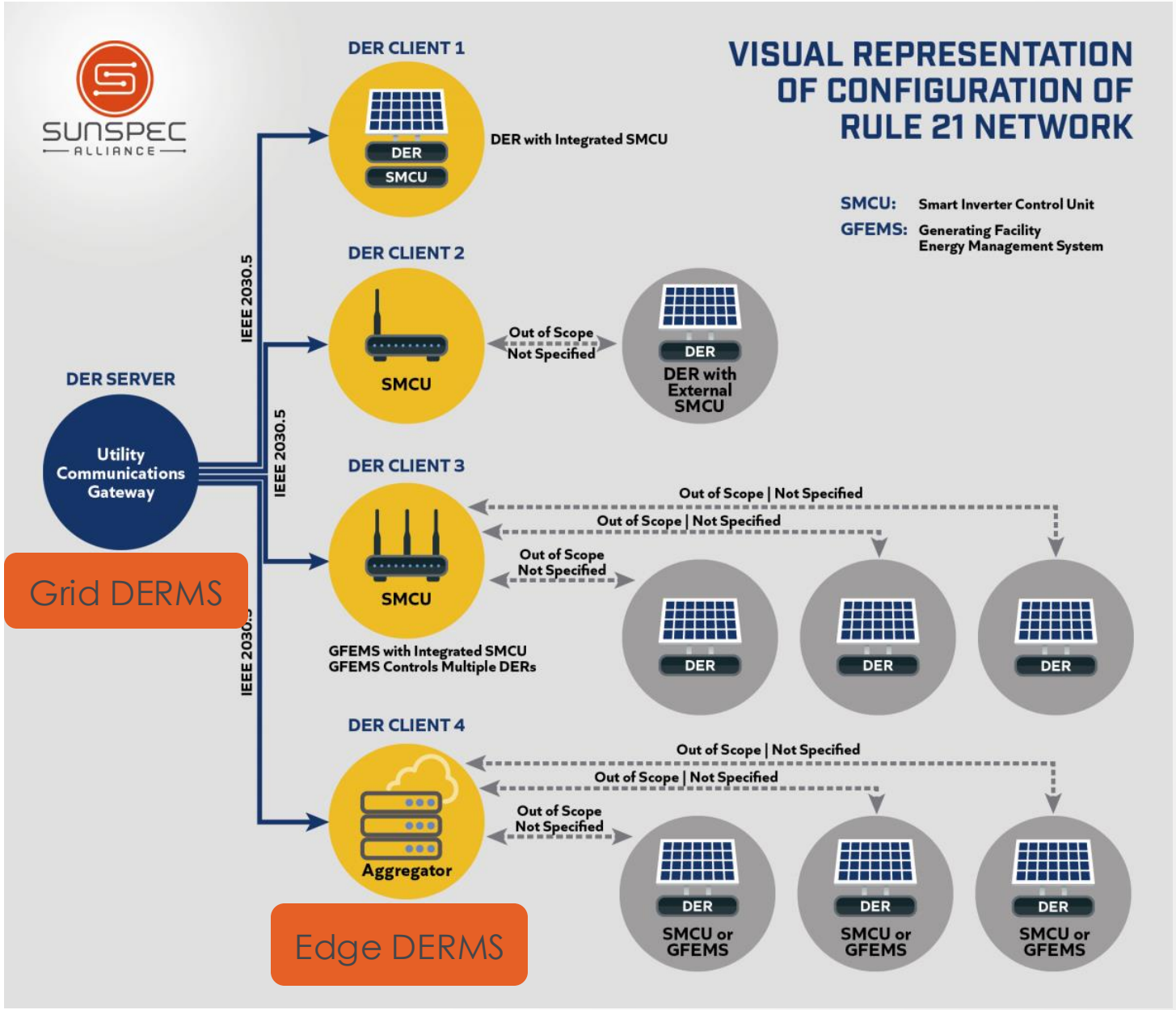
- IEEE P2030.5.1 Working Group (WG) is being formed to oversee the update and maintenance of CSIP, the Common Smart Inverter Profile. Attend the first meeting to learn more about the project and how you can participate in its development.

  - **Meetings will generally be held via Webex on Wednesdays at 3:00 PM PT with a monthly cadence.**
  - However, **the first four meetings have been scheduled** a week apart to allow time to sort through the initial logistics.
    - Wednesday, April 23, 2025, at 3:00PM PDT (First Meeting)
    - Wednesday, April 30, 2025, at 3:00PM PDT (may be cancelled if not needed)
    - Wednesday, May 7, 2025, at 3:00PM PDT (may be cancelled if not needed)
    - Wednesday, May 14, 2025, at 3:00PM PDT (may be cancelled if not needed)

- **If you are interested in following this project**, create an account and register your interest.
  I'm Interested in P2030.5.1

- Background: In response to Resolution E-5357, an IEEE Project Authorization Request (PAR) was initiated to adopt CSIP as an IEEE standard and to maintain it going forward. In early February 2025, the IEEE SA Standards Body (SASB) approved the PAR to create the P2030.5.1 Working Group with Gordon Lum as the working group Chair.
- **For more information on this project and its PAR:** IEEE SA - P2030.5.1

SunSpec Approved Reference Architecture



Q&A

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Adjourn