

PG&E Flexible Service Connection

Program Overview

March 2024



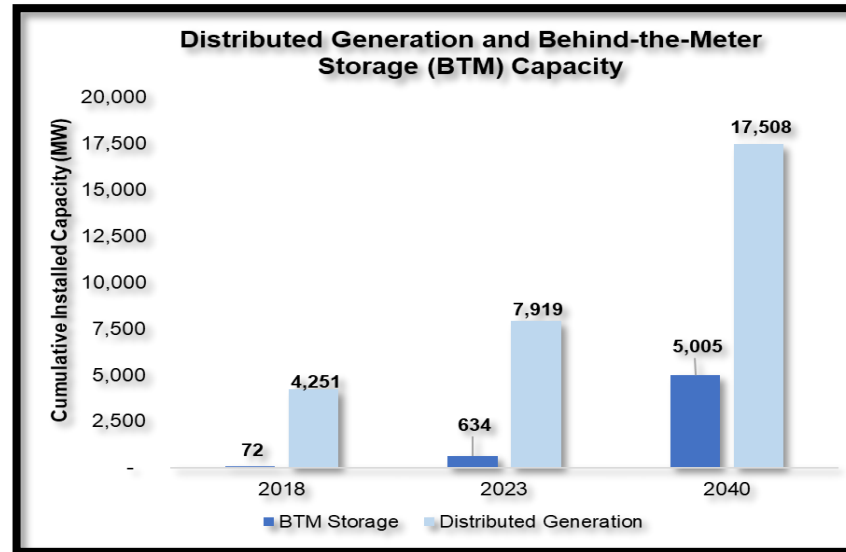
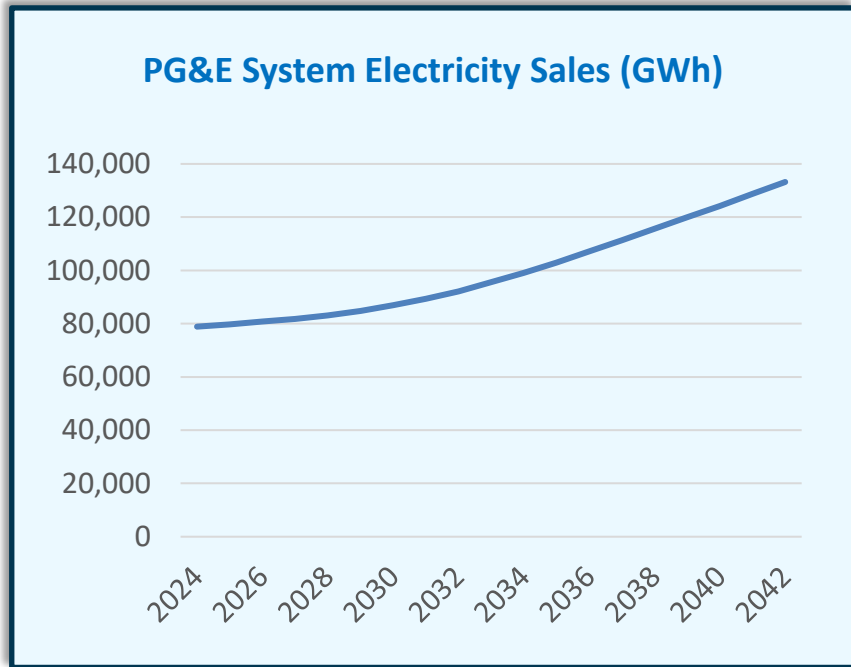
Together, Building
a Better California



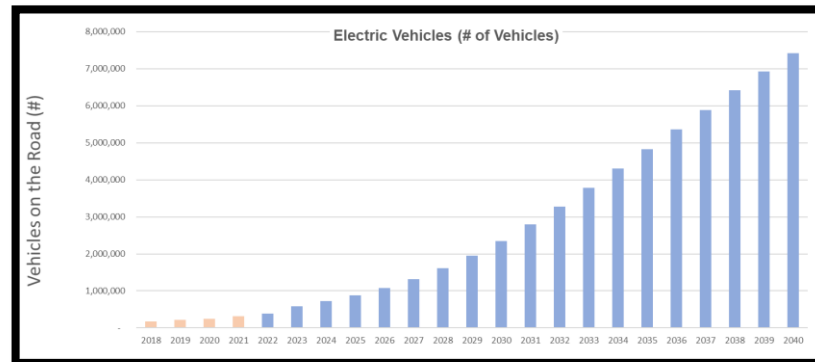
Context Setting: The need for new DER Management Tools & Processes

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.

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



PG&E's Flexible Service Connection Concept

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



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 EV industry goals

Timely Energization

Cost Effectiveness

Manage Grid Constraints



Flex Serve Program Overview

Flexible Service Connection will allow customers with controllable loads to connect to the system without waiting for a service upgrade and will increase the utilization of existing grid capacity

Flexible Service Connection Overview

- **What:** Flexible Service Connection will enable customers with eligible loads to connect sooner by dynamically managing consumption based on grid availability until infrastructure projects are completed
- **How:** PG&E's DERMS will connect to the customer's energy management system and send automated hourly limits, that cannot be exceeded, based on the day ahead loading of the constrained PG&E equipment (e.g. substation transformer)
- **When:** Targeting Q2 2024 for the first pilot sites to be connected

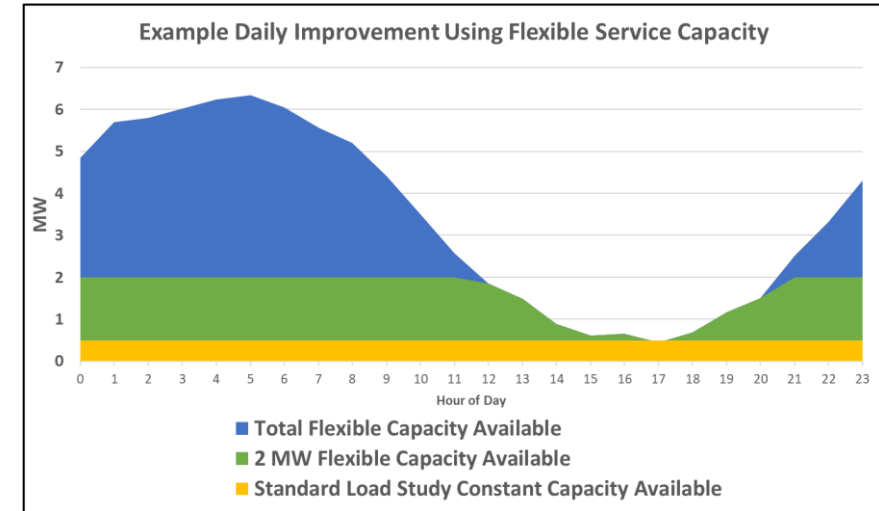
Customer Experience Outcomes

Today

- Potential wait times of 2 to 4 years+ if grid upgrades are required
- Static load limits agreed upon at a fraction of request (if available)

Future enabled by DERMS

- Customer submits application and receives a distribution of availability to serve proposed load
- Option to connect immediately while autonomous load reductions occur only on the most constrained hours of the year



Daily Constraint Improvement Example

| Standard Load Study Capacity Available | 2 MW Flexible Capacity Available | Total Flexible Capacity Available |
|----------------------------------------|----------------------------------|-----------------------------------|
| 0.5 MW (constant) | 0.5-2 MW (time dependent) | 0.5 to 6.0 MW (time dependent) |
| 12 MWh / Day | 39 MWh / Day | 82 MWh / Day |



Real World Example of Potential Benefits

| Month --> | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
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| 7 | 71% | 71% | 71% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 71% | 71% |
| 8 | 71% | 71% | 71% | 20% | 20% | 20% | 20% | 20% | 20% | 20% | 71% | 71% |
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STATUS QUO: Planning Limits for 3.8MW EV Charging Station

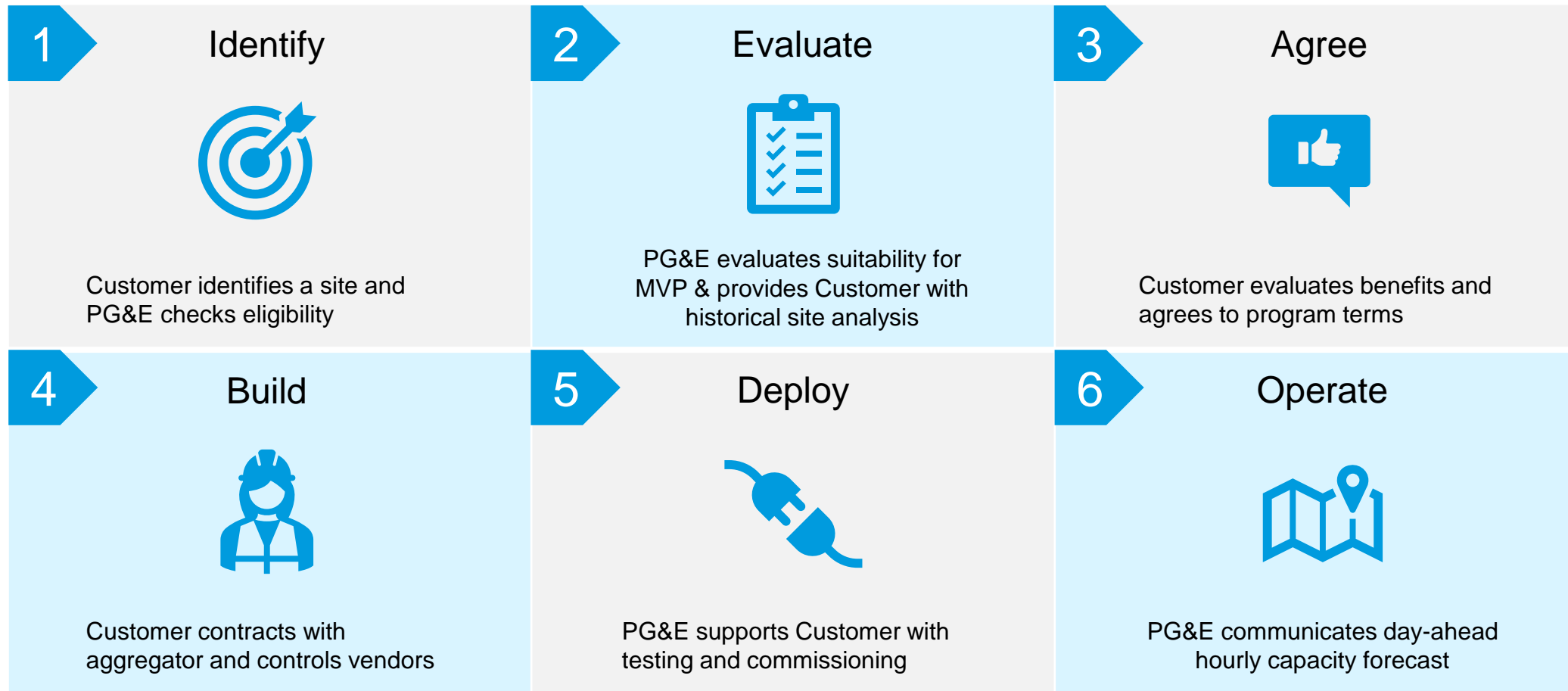


| Month --> | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
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| 16 | 100% | 100% | 100% | 100% | 100% | 100% | 89% | 94% | 83% | 100% | 100% | 100% |
| 17 | 100% | 100% | 100% | 100% | 100% | 100% | 75% | 83% | 71% | 100% | 100% | 100% |
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| 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

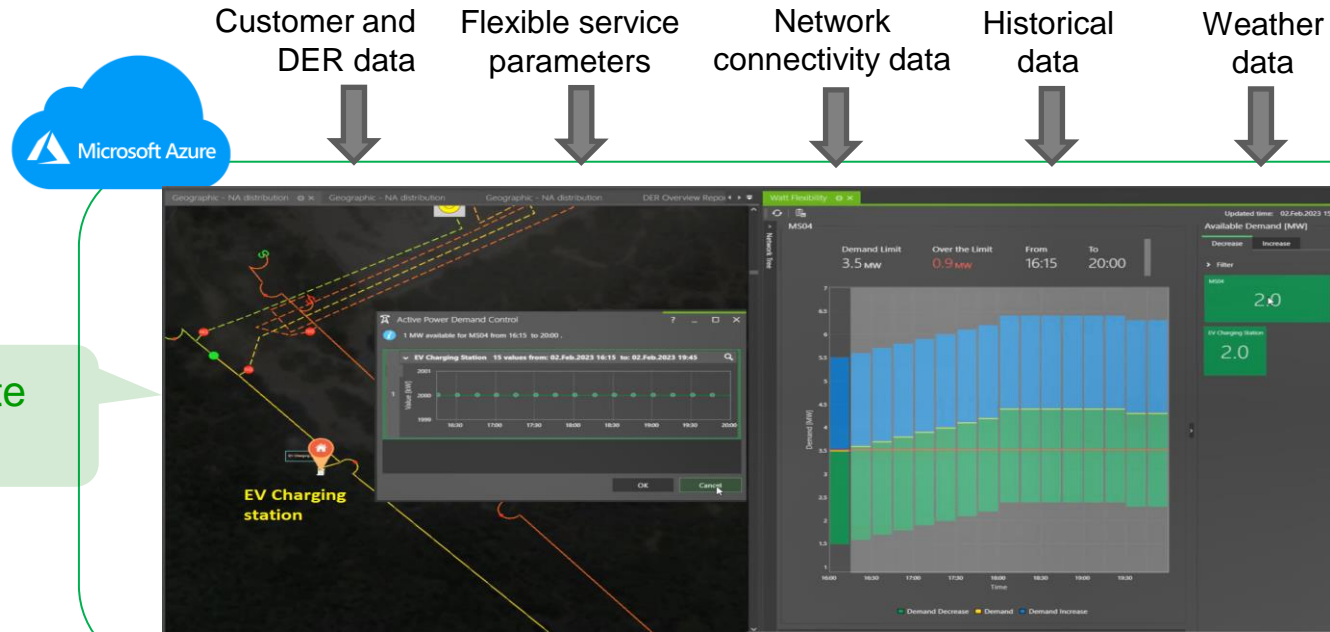
In 2024 PG&E will be working to standardize customer engagement and site evaluation processes based on initial learnings



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

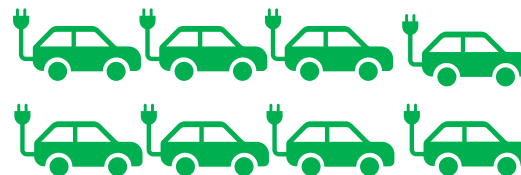


Detect feeder loading capacity constraints

Re-calculate flexible capacity

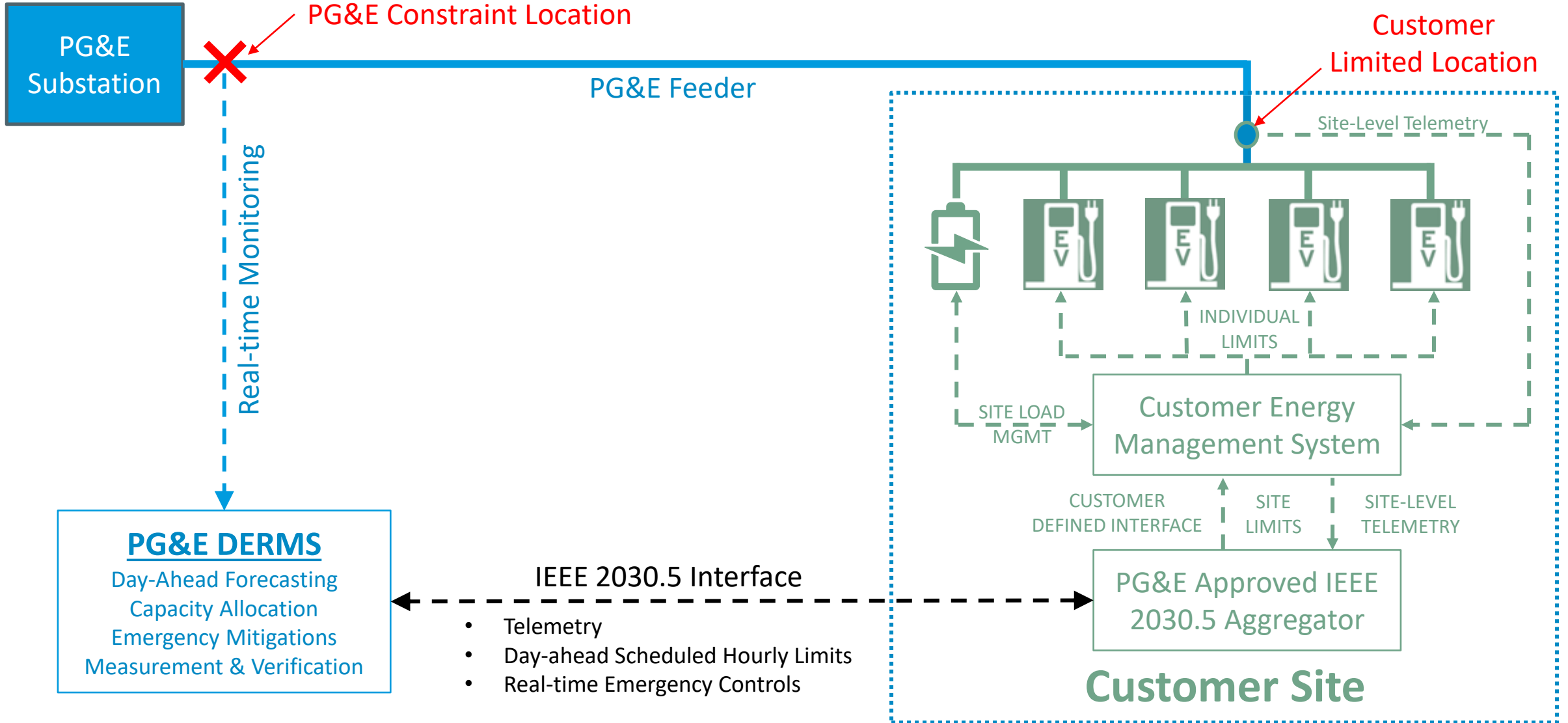
Telemetry

Dynamic site limits





Illustrative Site Configuration



Agility is required to rapidly iterate toward a future end state

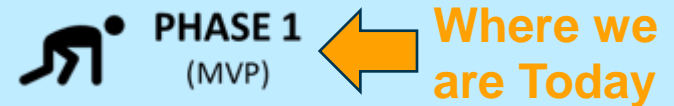
Capabilities, technology and processes are still being developed and require validation and further evaluation prior to scaling

Key Customer considerations:

- Value vs cost
- Customer experience impacts
- Local site technology readiness and timing
- Ability to adhere to dynamic limits

Key Utility considerations:

- PG&E technology and DERMS readiness – Forecasting, dispatching, and integrations with 3rd-party and internal systems
 - Key enhancements based on initial deployment already identified
 - Geographic expansion of DERMS capabilities
- Building confidence in customer-owned solutions and ensuring failsafes and contingencies
- Operational integration
- “Next-customer” considerations



Thank you



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Utility vs Customer Responsibilities

- 1) Preliminary Site Analysis
- 2) Aggregator Approved Vendor List
- 3) Customer Participation Agreement

PG&E

- Site analysis
- Testing and commissioning
- Automated day-ahead schedule w/ hourly limits
- On-going technical and program support

Customer

- Signed agreement
- Control system & Metering
- Aggregator integration
- Telemetry
- Single Line Diagram & Description of Operations

Flex Connect Preliminary Site Analysis

Substation: PG&E Existing Customer Constraint (MVA): 0MW from 0300 to 2100 3MW from 2100 to 0300
Feeder: Customer Capacity Need (MVA): 4.5

Summary of Findings:
The site at [redacted] is constrained by loading limitations on the feeder head of [redacted]. Analysis of the past 5 years of available historical loading at the feeder head shows that in a Minimum-case (worst case) at max loading, the site will most likely experience times of curtailment at varying levels over the entire year, especially in the peak hours. However, the Flex-Connect Program may still provide additional capacity dynamically beyond the fixed limit of 0 MW from 0300 to 2100 and 3MW from 2100 to 0300 during these constrained times. In average case, May-Oct are most likely periods of curtailment, highest during peak periods and full capacity during unconstrained times in the morning & night hours from Jan - April and Nov - Dec.

Note, the findings are based on historic data and do not fully take into account load that other customers may have reserved but are not fully utilizing. Therefore this represents PG&E's understanding of historic load, but does not guarantee future loading will match historic loading profiles.

Analysis - Monthly Historic Capacity Availability by Hour of Day over 5 Years

Minimum Ability to Serve 4.5 MW (Historic Worst Case Scenario)
Results given as % and MW of 4.5 MW Served

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
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| 31 | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% |

Average Ability to Serve 4.5 MW
Results given as % and MW of 4.5 MW Served

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|------|------|------|------|------|------|------|------|------|------|------|------|
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*These DER developers have certified-interoperable gateway/aggregator connections of their own.

NOTE: PG&E does not endorse any vendor, product, or service but certifies the interoperability of their devices or services with PG&E's IEEE 2030.5 headend server. PG&E does not attest to the cybersecurity and cyber hygiene of, or recommend, any certified interoperable vendor. The material is for informational purposes only.

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Customer-Owned Telemetry

Attachment 1, Certificate

PG&E has tested and certified the interoperability with PG&E's Control System. The list of certified-interoperable vendor vendors to provide COT solutions, aggregator vendors; however, new interoperability with PG&E's CSIP, additional time and costs for the IC.

For vendors wishing to certify inter to use a gateway or aggregator pilot, contact PG&E for a cost estimate and timeline to complete. CONTACT: DERComms@PG&E.com

The following are certified-interoperable:

- 1. Applied Systems Engineer**
Website - <https://www.aseng.com>
systems.com/california-utility-solutions
Contact: Catherine Hugoo, Specialist
Phone: 408-364-0500
Email: Support@ase-system.com
- 2. Kitu Systems Inc.**
3760 Corvay Street, Suite 100
San Diego, CA 92111
Email: Sales@kitusystems.com
Phone: 619-569-2208 x7

3. PROGRAM DESCRIPTION

Customer Requirements:

- Customer hourly limits
- Customer interconnection situations.
- The Site must follow the limitations provided by PG&E through either scheduled or real-time commands.
- Customer must utilize a PG&E certified-interoperable aggregator solution to provide required telemetry data and receive PG&E commands and schedules via the IEEE 2030.5 protocol. A list of certified-interoperable aggregator vendors can be found on PG&E's Distribution Interconnection Handbook website (<https://www.pge.com/assets/pge/docs/about/distrib-business-with-pge/7D-2308P-01-A1.pdf>).