OpFlex Pilot Report

Pacific Gas and Electric

February 28, 2025

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Introduction

Pacific Gas & Electric (PG&E) submits this report in accordance with California Public Utilities Commission (CPUC) Decision (D.) 21-06-002[1] Ordering Paragraph 18 and Resolution E-5260[2] Ordering Paragraph 2.

This report outlines the results and lessons learned from PG&E's Distributed Energy Resource Management System (DERMS) rollout in 2024 to mitigate operational flexibility (OpFlex) constraints on the grid for Distribution-connected customers. The pilot addresses the use of dynamic limits based on near-term forecasted grid conditions to provide additional capacity beyond the existing PG&E provided static limits from the initial service connection planning study.

Learnings prior to the DERMS Flex Connect pilot related to OpFlex mitigation were detailed in PG&E Advice Letter 6612-E-C[3].

Flex Connect Overview

PG&E load and generation customers interconnecting to the Distribution grid are studied to ensure their requested capacity can be served by the existing infrastructure. In constrained areas, PG&E may not allow customers to connect at their full capacity until infrastructure upgrades are completed. For these constrained customers, PG&E's Planning Department can provide the customer with limits (Planning Limits) on their load based on long-term forecasts of expected system loading conditions that ensure there are no safety or reliability issues until the additional PG&E infrastructure is built. Often this infrastructure could take months to years to complete. The Flex Connect program offers dynamic operating limits based on day-ahead forecasted grid conditions as a bridge solution while PG&E builds out infrastructure to supply the customer's entire capacity request. Planning Limits are based on a multi-year forecast that extends months or even years ahead. Using dynamic limits based instead on day-ahead forecasts and real-time loading conditions can help unlock significant additional load serving capability for customers as the PG&E infrastructure is being built. However, Flex Connect may not be suitable for all customers or grid conditions. Customers must be able to adjust their load to participate, grid conditions should have adequate non-peak capacity relative to customer needs, and the value of the added capacity should outweigh the costs to implement the program.

As of January 2025, PG&E has two customers participating in the Flex Connect program, with more planned through 2025.

[1] Decision 21-06-002
[2] Resolution E-5260
[3] AL 6612-E-C

Flex Connect as an Operational Alternative to Mitigate OpFlex Constraints

The Flex Connect Pilot demonstrates an operational alternative to mitigate OpFlex constraints through the use of communications to DER sites and dynamic limits based on grid conditions. The definition of DER sites for Flex Connect can include traditional DERs like generation assets, but can also include any type of flexible load. The OpFlex mitigation use case described by the Rule 21 Working Group Four is analogous to the Flex Connect pilot in that both are meant to provide customers with less restrictive limits based on actual grid conditions versus long-term forecasted scenarios.

As described in Advice Letter 6612-E-C, PG&E identified four areas that should be incorporated into a DERMS platform to operationalize OpFlex mitigations. Because the Flex Connect program actually provides additional capacity versus curtailment and applies to both load and generation, the language of the original areas defined in the Advice Letter has been modified to align with the Flex Connect program for this report. Below is a high-level summary of PG&E's activities in each of these areas:

1. Demonstrate the Ability to Manage Load and Generation at Participating Facilities.
    a. PG&E has incorporated Flex Connect at two customer sites including a 6MW battery energy storage system (BESS) and a 4.5 MW EV charging station. PG&E has demonstrated the ability to manage load at both sites using local control systems and IEEE 2030.5 hourly day-ahead limit schedules of up to 72 hours.
2. Identify Triggers for OpFlex Actions
    a. PG&E uses day-ahead forecasts on constrained locations to determine the available capacity for constrained customers participating in Flex Connect and then dispatch limit schedules to participating customers. DERMS is integrated with PG&E's Advanced Distribution Management System (ADMS) and weather forecasting systems to enable this functionality. In addition, DERMS relies on the ADMS real-time operational connectivity model to trigger failsafe actions for abnormal conditions on the grid like switching or outages. Moreover, there are additional failsafes in place for communication losses to field devices or other integrated systems.
3. Develop Limit Calculations and Allocation Methodologies
    a. Limit calculations are created automatically using grid forecasts at constrained locations and the requested capacity of Flex Connect customers. In addition, there are specific failsafe actions that occur to send customers to their original Planning Limits for things like extended communication outages, or grid outage restoration activities.
4. Develop Operational Processes to Implement OpFlex
    a. PG&E has developed initial operational processes to analyze, enroll, commission, operate, and perform measurement and verification (M&V) for new sites. In addition, PG&E is evaluating improvements in the new business process to more proactively identify sites that may be good candidates for Flex Connect.

Challenges and Barriers to Implementing Operational Alternatives

While PG&E has successfully implemented the first stages of the Flex Connect program, there have been challenges and barriers to implementing operational alternatives as detailed below.

Technology Nascency:

- **Minimum Viable Product:** DERMS is still not an off-the-shelf product for utilities. PG&E worked with vendors to design, test, implement, and enable the functionality and integrations needed for its minimum viable product deployment of the four initial use cases for PG&E (IEEE 2030.5 Telemetry, Flexible Service Connection, Flexible Generation Connections, and Distribution Investment Deferral Framework Operationalization). As PG&E gains more experience with the product, enhancements will be made based on learnings to improve functionality, new use cases, ability to scale, and improvements in robustness as the system is more heavily utilized.
- **Customer Implementation:** Similarly on the customer side, although outside the direct responsibility of PG&E, the nascency of the technology has led to the initial customers having significant challenges and delays in making their controls and communications systems work. Troubleshooting in remote locations with remote disparate teams and the dependency on specific knowledge employees that are in high demand in other parts of their business can cause delays in implementation. Additionally, because of the variety in implementations at this time, costs can be significantly different between customers depending on the levels of integrations and coordination required on site.
- **Lack of Standards:** For the initial deployment there were no available standards to certify equipment involved in these systems. It's expected that this should improve with the recently published UL 3141, but there is still development required to ensure the testing schemes and implementations will work as expected with these new standards and specific customer site configurations. Similarly, the current version of the Common Smart Inverter Profile (CSIP) for IEEE 2030.5 also does not fully cover the use cases required. At this stage, this deficiency in standards and certifications also results in extended commissioning processes by the utility with customers to ensure the systems work as expected particularly under abnormal conditions.
- **Costs for Customers:** Due to the new technology and uniqueness of solutions, the costs for customers to implement communications and control schemes are relatively expensive (~$20k-$50k+) which makes it only viable for larger customer sites at this time. There's been feedback from certain customers who have costs even higher when factoring in additional complexity in their systems or potential customer experience improvements they may need to make with internal applications or implementation of the control logic of being "flexible". It is also unclear at this stage if potential future requirements around UL3141 or other certifications could cause excessive cost burdens for customers who do not have "standard" system implementations.
- **Long-term Customer Maintenance and Support**: It is still unclear what long-term challenges there may be to continue to support customers using third parties for control

systems and communications infrastructure. There is a potential risk in new technology for companies to stop supporting products, which may add additional costs/barriers for customers. PG&E is working with some customers on low-cost telemetry to resolve issues on the customer's side to make sure the systems communicate properly; however, it can sometimes be difficult with a variety of vendors who may install these systems to then support them after the initial installation.

Customer and Grid Specifics:

- **Load Flexibility:** Not all customers are a good fit for the required flexibility to participate in these types of programs. There may be processes or loads that cannot be flexible. Additionally, some EV charging stations have relayed concerns that they have contractual obligations with grant funding sources that require full availability. Participation in Flexible Connection programs make some sites ineligible for certain funding sources even if they are limited for only a small part of the year.

- **Program Fit:** There can be various reasons why a particular site or a particular grid condition may not be a good fit for Flex Connect. Below are some examples that PG&E encountered when implementing the program:
    - The benefits of a flexible connection not outweighing the costs for the customer
    - The customer is ok with planning limits provided through the standard service connection and planning process (e.g. the limits do not significantly impact customer operations).
    - Capacity work will be completed in a short time or in time to meet the customer's desired load ramp.
    - The available capacity on the grid is not sufficient even with Flex Connect for the customer needs
    - Certain types of grid restrictions cannot be currently handled by the DERMS system until future updates are made (i.e., state-estimation).
    - The customer applications for service (especially for EV charging stations) can be speculative, and projects may fall off.

- **Forecast Accuracy:** PG&E uses a support vector machine near-term day-ahead forecast to determine the available capacity for Flex Connect customers. For certain circuits with more variable load types (e.g. large frequency regulation market participating batteries, seasonal large plant processes, agriculture, etc.) it can be more difficult to accurately forecast loading. This leads to additional buffers in the calculations that can reduce the available capacity for customers. PG&E expects improvements to be made to forecasting capabilities to improve accuracy and thus efficiency of the system. Accurate forecasts will also reduce the impact of failsafe operations to avoid real-time grid overloads due to inaccurate load forecasts.

Process Nascency:

- **PG&E Process:** Through the Flex Connect pilot project, PG&E needed to develop new processes to identify sites, calculate expected benefits for customers, create agreements, and determine how to study and commission new sites. Many of these processes are manual and require significant coordination with internal and external stakeholders. As Flex Connect implementations grow, these processes will need to mature and become part of "normal business" to streamline the process and make it more cost-effective and efficient for both PG&E and customers.
- **Customer Process:** This is also a new process for customers and vendors in providing customer control and communication systems to adhere to PG&E signals and failsafe protocols. It's expected that as these processes mature it will be easier and more cost-efficient for customers to connect to DERMS systems and manage internal loads.

Interconnection Rule Recommendations for Supporting Operational Alternatives

As discussed in the Smart Inverter Operationalization Working Group (SIOWG) Report[4], service connections for generators and loads participating in programs like Flex Connect should have baseline Planning Limits (SIOWG calls these Firm Import/Export Limits) that are a guaranteed minimum capacity provided by the utility, and a capacity limit (SIOWG calls these Non-Firm Import/Export Capacity) up to which the customer can be provided a non-guaranteed capacity based on near-term grid conditions through programs like Flex Connect.

PG&E was able to implement this paradigm through the existing interconnection processes for Flex Connect. The Planning Limits are already included in either the interconnection agreement (for generation service) or the load limit letters (for load-only service). For Flex Connect, PG&E created amendments to interconnection agreements for generation customers, and additional supplemental agreements for load limit letters within the existing framework to provide more detail on the program requirements and participation. The concept of providing a non-guaranteed amount of service on Distribution is similar to the existing "as-available" option for Wholesale Distribution Access Tariff customers.

At this time PG&E does not have any recommendations for changing the interconnection rules for supporting operational alternatives as the current construct provides enough flexibility to provide this type of service at this stage. However, as PG&E gains more experience and learnings in this area, there may be opportunities for updates in the future.

[4] Smart-Inverter-Operationalization-Working-Group-Report-Feb.1.24.pdf

Feasible Timelines for Implementing Interconnection Rules to Support Operational Alternatives

PG&E believes that Flex Connect can be implemented today without changes to the interconnection rules to support this type of operational alternative. However, it may be beneficial to customers and the industry for the CA IOUs to align on implementation and program rules. PG&E believes it is feasible to align on these implementation details as the IOUs, customers, and vendors continue to increase their experience and maturity in the space.

Analysis of the Availability and Capability of Equipment to Implement OpFlex Solutions

The technology space for implementing OpFlex solutions is still nascent and creates challenges in implementation as described earlier. Nevertheless, PG&E has successfully implemented a functional utility system, has partnered with vendors to provide customer solutions, and is looking to scale the program significantly to provide more value for customers. It is expected that as installations increase and become more standardized, the industry will become more efficient at implementing solutions. Figure 1 provides an illustrative example of a Flex Connect Configuration for a site to help visualize some of the equipment and capabilities required to aid in the discussion.

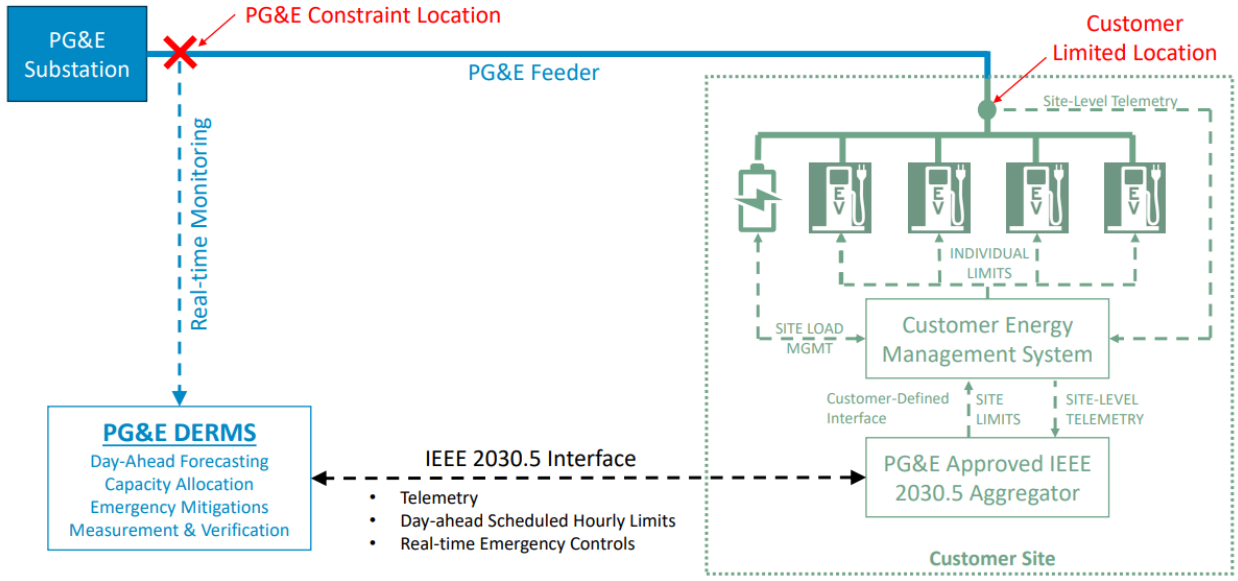

Figure 1: Illustrative Flex Connect Site Configuration

PG&E DERMS

The PG&E DERMS provides the foundation for the utility grid-level DERMS. It requires tight integration with ADMS for real-time grid conditions including switching and monitoring information, as well as integrations with other PG&E systems including weather forecasting and AMI data. As

discussed earlier, DERMS products are not "off-the-shelf" and require significant investments particularly when implementing a platform-level approach for intended scaling versus a one-off pilot approach.

- **IEEE 2030.5 Interface:** The PG&E DERMS includes a public internet facing IEEE 2030.5 interface for communications with third-party approved devices. This is the system used to send day-ahead scheduled controls (up to 72 hours) and real-time controls to customer sites. It also provides the interface to receive near real-time (~30 sec) telemetry from customers sites.

- **Day-ahead Forecasting:** PG&E DERMS provides a 72-hour day-ahead forecast based on a support vector machine algorithm and PG&E weather forecasts. This is a foundational piece of data from which all the subsequent calculations and limits are derived. PG&E is continuously working with its vendor to determine improvements to the forecast, as it provides the opportunity for more efficient dispatches. To mitigate for potential errors in the forecast, PG&E implements buffers in the calculations and real-time failsafes to avoid issues from errors in the forecasts.

  PG&E has taken an approach to provide customers with day-ahead forecasted limits versus real-time limits to better align with customer needs. Some customers benefit from advanced knowledge of limits for various reasons including bidding into markets, planning work, and providing notice of potential impacts. Real-time limits are possible within DERMS and are applied during certain failsafe scenarios within Flex Connect.

- **Capacity Allocation:** Available capacity is determined based on the known limits at the grid-constrained locations and the forecasted load/generation at those locations. This capacity can then be allocated to participating Flex Connect customers in that area. Currently PG&E only has one customer per constrained location but is exploring various ways to allocate constraints among various customers for the future.

- **Measurement and Verification:** DERMS captures real-time telemetry from participating customer sites and is able to compare that to the DERMS provided limits and dispatches to perform an analysis to determine both the adherence to DERMS dispatches and the benefit of participation within DERMS. It also provides historical and logging information for offline analysis and troubleshooting of the system. Some of the key metrics being automatically calculated for Flex Connect sites include:
  - Customer violations of the limits provided by DERMS
  - Customer benefits in terms of additional MWh used and provided via the DERMS integration beyond the original Planning Limits
  - Communication Health Metrics

- **Emergency Mitigations:** PG&E has implemented various failsafes in DERMS and customer equipment to account for potential abnormal conditions. PG&E had to develop these failsafes in concert with the vendors at both the utility DERMS-level and customer-level as they were not off-the-shelf capabilities. Moreover, the failsafes may differ depending on the type of service

being provided. PG&E is looking to implement failsafes for Flex Connect customer differently than that of grid-service vendors like those participating in the Distribution Investment Deferral Framework (DIDF) because one is to prevent further harm to the system (Flex Connect) while the other is actively benefiting the system (DIDF). As described earlier, this is an area for future growth and alignment across the industry as these failsafes currently all need to be verified through commissioning processes with PG&E. In addition, there needs to be ongoing analysis on the response capabilities of customers during abnormal conditions and PG&E may modify the failsafes required based on experience and lessons learned. The following describes the automatic failsafes implemented in the current DERMS product today. Additionally, PG&E maintains manual override capabilities as well in addition to these automated failsafes.

- **Communication Loss:**
  - Flex Connect: After 15 minutes (configurable) of continuous communication loss a Flex Connect Site will automatically go to the Default Planning Limits. When communications return, the Flex Connect site will retrieve the active schedule from Utility DERMS (likely the previously scheduled limits).
  - Grid Service (DIDF): There will be no automatic change to the previously scheduled dispatch for a DIDF site during a communication loss event.
  - There are four types of communication loss scenarios currently being monitored at PG&E:
    - Customer Energy Management System to Approved IEEE 2030.5 Aggregator (Local Site Communication Gateway)
    - Local Site Communication Gateway to Approved IEEE 2030.5 Cloud Aggregator
    - Cloud Aggregator to Utility Cloud DERMS
    - Utility Cloud DERMS to Utility on-premise ADMS
- **Power Loss:**
  - Flex Connect: When power returns, the Flex Connect site will automatically retrieve the active schedule from Utility DERMS (likely the Default Planning Limits).
  - Grid Service (DIDF): When power returns, the DIDF site will automatically retrieve the active schedule from Utility DERMS (likely the previously scheduled dispatch).
- **Abnormal Grid Switching:**
  - Flex Connect: The Flex Connect site will automatically be sent down to the Default Planning Limits by the DERMS application within a configurable amount of time (e.g. 45 seconds) for an abnormal grid switching event.
  - Grid Service (DIDF): There will be no automatic change to the previously scheduled dispatch for a DIDF site during an abnormal grid switching event.
- **Overload at Constrained Grid Device(s):**
  - Flex Connect: Flex Connect Site will be automatically sent down to Default Planning Limits for overloads at constrained grid devices within a configurable amount of time (e.g. <30 sec).
  - Grid Service (DIDF): There will be no automatic change to the previously scheduled dispatch for a DIDF site during an overload at a constrained grid device (this is

because the DIDF site schedule is a grid service helping alleviate the overload conditions).

Customer Sited Systems

There is no PG&E equipment at customer sites as part of the initial implementation of Flex Connect. The initial deployment relies on customer-owned equipment for communication and control capabilities. PG&E has also taken the initial approach to not implement physical assurances (e.g. additional circuit breakers / circuit breaker settings) to avoid added costs for customers. While this may change in the future if customer-only controls prove insufficient, for the initial pilot PG&E wanted to reduce costs for customers and evaluate the capabilities of customer-owned control systems. Furthermore, PG&E already implements real-time telemetry (~30 seconds) for these sites that can be used to monitor potential issues and take action if mitigations are required.

PG&E provides guidance for customers on the approved IEEE 2030.5 vendors available for use as well as requirements for participation in the pilot. Furthermore, PG&E reviews and approves the telemetry description and description of operations to ensure the monitoring and control systems are designed as expected. Prior to field operation, PG&E and the customer also go through a commissioning process to ensure the control systems operate within the given requirements.

Customer sited systems generally are composed of three main elements: The PG&E Approved IEEE 2030.5 Aggregator System, the Customer Energy Management System, and the Customer DER devices. As described earlier, these are not "off-the-shelf" system implementations and require close coordination between the customers, vendors, and PG&E at this time. The complexity and related costs for implementing these customer sited systems are heavily dependent on the customer's existing capabilities, types of devices under control, and the need to integrate with various other potential systems (e.g. CAISO markets, other vendor control systems, local device capabilities, etc.)

- **PG&E Approved IEEE 2030.5 Aggregator System:** PG&E currently has three approved IEEE 2030.5 Aggregator vendors. These vendors have Common Smart Inverter Profile (CSIP) certified devices and have also been tested to be interoperable with PG&E's CSIP-certified IEEE 2030.5 head-end. While all three vendors have been approved for telemetry through PG&E's Customer-Owned Telemetry program[5] for large generators, so far only one has completed interoperability testing with PG&E for the control application required for Flex Connect. PG&E is open to testing new vendors as well, and it is expected that multiple vendors may complete interoperability control testing later in 2025. The Aggregator system generally consists of a local site communication gateway device and a cloud head-end.
    - **Local site communication gateway:** This device often works as a translator between the IEEE 2030.5 signals coming from the utility (via the aggregator cloud system) and the local protocol spoken by the customer site energy management system or end devices. It may also be used for simple logic used for the failsafe requirements, or the storage of schedules to be applied to the end devices at the

[5] Customer-Owned Telemetry (COT) Procedure

appropriate time (since many end devices may not be able to store schedules of controls). The local site communication gateway communicates with the Aggregator cloud via public internet, which is most often provided via an integrated cell model on site.

- **Aggregator Cloud:** The aggregator cloud communicates directly to PG&E's DERMS cloud to receive and transmit IEEE 2030.5 messages with the utility. It also manages communications with the various devices under its control. Using an aggregator helps PG&E securely manage the number of outside connections to the PG&E system by consolidating various customers under a single aggregator communication path.

- **Customer Energy Management System:** This system is used by customers to manage, monitor, and control the use of their energy resources, integrating with the PG&E Approved IEEE 2030.5 Aggregator System for coordinated operation and control. Some customers may already have some type of energy management system, or through participation in the program may need to add and program additional control and monitoring devices to participate. The local failsafe mitigations described earlier are generally incorporated into a combination of the energy management system and local site communication gateway.

  As described earlier, the nascency of this space means that these solutions are not "off-the-shelf" and have so far shown to require significant development on the part of the customers and their vendors. However, it has also been found that the same customer-vendor combinations are able to develop and commission sites more quickly after working through initial challenges in the first few sites.

- **Customer DER devices:** These are the actual distributed energy resources owned by the customer, such as solar panels, batteries, EV chargers, and other flexible devices, which are monitored and managed by the Customer Energy Management System. For newly installed smart inverter devices, the functions like power limiting and dispatch are already included to be interconnected at PG&E via Rule 21. For non-smart inverter devices this functionality would need to be implemented (if not already) and tested appropriately. PG&E expects the majority, if not all, of the integrations for Flex Connect to go through systems like gateways or energy management systems, and not directly integrate with smart inverters.

Analysis of the Scalability of the OpFlex DER Operational Alternatives Studied in the Pilot

PG&E believes there is value in the capabilities provided via DERMS in better utilizing existing grid assets, providing a better customer experience, and being able to manage the increasing complexity of DERs on the grid. PG&E is investing in a DERMS platform versus various pilot point solutions for the purpose of building an inherently more scalable solution to align with this vision of

the need to orchestrate DERs across the grid. However, as discussed previously, there continues to be challenges in implementation both at the utility level, the vendor level, and at the customer level. To drive scale, there needs to be improvements in simplifying the experience for the customer, building trust with the new technology, reducing costs, and ensuring value creation for the customer and the utility. PG&E is continuing to evaluate the levers to drive scale to better leverage the existing capabilities of the grid.

Economic Viability of the OpFlex DER Operational Alternative Studied in the Pilot

Flex Connect enables beneficial load growth by allowing PG&E to increase energy throughput on existing assets, by serving incremental MWh with the same infrastructure as a bridge until new capacity is built. Earlier (albeit flexible) energization of participating customers improves the economic viability of their capital assets since they are able to run their business months or years earlier than without Flex Connect. The benefits of Flex Connect also benefit non-participating customers by applying downward pressure on rates due to increased energy throughput and asset utilization.

Lastly, Flex Connect for wholesale customers (WDAT) such as market-participating battery developers has shown to deliver considerable economic savings to these customers because they are able to adhere to operating envelopes via PG&E's DERMS system and no longer need to pay for certain expensive grid upgrades to support their presence on the distribution grid. These savings can be in the hundreds of thousands of dollars in upfront interconnection savings to the customer.

Joint IOU Metric Evaluation

The following metrics were developed in consultation with Energy Division, agreed to by the IOUs, and provided as Attachment A in each of the Supplemental Advice Letters (PG&E AL 6612-E-C, SCE AL 4017-E-B, and SDG&E AL 4806-E-B). PG&E has provided information on each metric below.

Over-Arching Metrics

1. Pilot adequately tests systems and scenarios to cover the DER Operational Alternatives discussed in Proposal F-1, such as limiting or eliminating exported energy, modifying advanced inverter functions, monitoring and reporting, and other functionality that supports grid operations.
    a. The PG&E DERMS platform has been tested and deployed in the field with the Flex Connect use case that limits the power output of DERs via an IEEE 2030.5 interface and local customer-owned control systems. Telemetry is provided through this same interface and is used by DERMS for measurement and verification of both potential violation of limits, as well as energy unlocked through Flex Connect. In addition, the DERMS is integrated with ADMS to both enable short-term forecasting using utility devices, as well as operating using the as-switched model to ensure proper operation under abnormal switching conditions.

2. Value engineering opportunities are considered throughout the process of piloting OpFlex DER operational alternatives.
    a. Value engineering opportunities continue to be considered throughout the implementation of the DERMS system. PG&E took a minimum viable product approach to limit costs and focus on the biggest drivers of value in the system. Additionally, PG&E is also investing in what it believes is a strategic platform in DERMS rather than investing in a one-off pilot project implementation.
3. Diversity, Equity, and Inclusion are considered in the creation and piloting of the systems to implement Proposal F-1 - such as ensuring that specific communities will not be disproportionately affected by curtailments, etc.
    a. One of the two existing Flex Connect customers is located in an under-represented community (as defined by the CalEnviroScreen[6]), however there was no explicit attempt to favor a particular type of community. Moreover, the goal of better utilization of existing infrastructure is geared toward reducing rate pressure for all PG&E customers including under-represented communities.

Demonstrate the Ability to Integrate Participating Generating Facilities into IOU Control Systems

4. DER locations and capabilities can be modeled in IOU systems.
    a. PG&E has demonstrated through its Flex Connect program that DER locations, capabilities, and programmatic contractual information can be modeled in PG&E's systems, specifically DERMS.
5. DER systems can be provisioned on IOU systems based on IOU's technical requirements.
    a. PG&E has demonstrated through its Flex Connect program that DER systems can be provisioned within PG&E's systems (i.e., DERMS) based on contractual data, asset information, model information, and PG&E's specified commissioning testing.
6. DER systems can provide status and telemetry to IOU systems as prescribed.
    a. PG&E has demonstrated through its Flex Connect program, and customer-owned telemetry program for large generators, that DER systems can provide status and telemetry to PG&E systems as requested via IEEE 2030.5. It should be noted that this information does not generally come from an inverter directly, but rather from other systems like energy management systems or separate onsite meters.
7. DER systems are interoperable with IOU systems.
    a. PG&E has demonstrated through its Flex Connect program, and customer-owned telemetry program for large generators, that DER systems can be interoperable with PG&E systems (i.e., DERMS). It should be noted that interoperability at this stage in the technology cannot be solely based on existing certifications or standards, but rather require additional specific testing with PG&E. With the evolution of certifications like CSIP and UL3141, it is expected that these certifications and standards can take the place of any additional interoperability testing by utilities.

[6] CalEnviroScreen 4.0 - OEHHA, SB 535 Disadvantaged Communities 2022

However, further work is required to determine the impact these new standards will have on the process and costs for customers.

8. IOU systems have near real time visibility of the grid and DER state (at maximum 1 minute granularity).
    a. PG&E has demonstrated through its Flex Connect program, and customer-owned telemetry program for large generators, that DER systems can provide telemetry back to utility systems in under 1 minute, with a 30 second interval set as the default.

Demonstrate the Ability to Control Participating Generating Facilities

9. IOU can send control signals via IEEE 2030.5 for control commands, limits, or schedules to DER systems.
    a. PG&E has demonstrated through its Flex Connect program that it can send control signals via IEEE 2030.5 for 72-hour schedules of varying power limits (Figure 2). For Flex Connect PG&E uses the IEEE 2030.5 DER controls and settings including opModMaxLimWInject, opModMaxLimAbsorb, setMaxDischargeRateW, and setMaxChargeRateW to limit the load and generation output of the system under control. These controllable limits provide an operating envelope in which the customer is allowed to operate their devices as they wish as long as they do not exceed the limits.

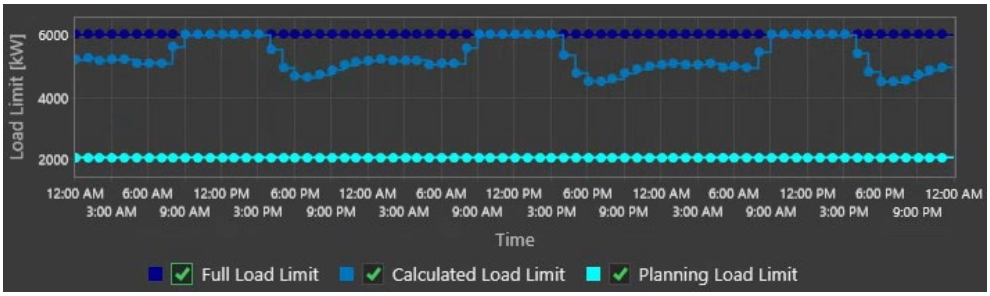

Figure 2: Example Flex Connect Limit 72-hour Schedule

    b. The DIDF program also uses the same DERMS platform and is testing the ability to send hourly schedules of varying dispatch signals. For DIDF, PG&E sends actual kW dispatches (versus only limits in Flex Connect) via the IEEE 2030.5 opModTargetW function.

10. DER systems can receive the IEEE 2030.5 control signals from IOUs and adhere to the commands.
    a. PG&E has demonstrated through its Flex Connect program that DER systems that have been commissioned and tested with PG&E can receive the IEEE 2030.5 control signals and adhere to the commands. Figure 3 shows the results of a Flex Connect site following the limits provided by DERMS via IEEE 2030.5.

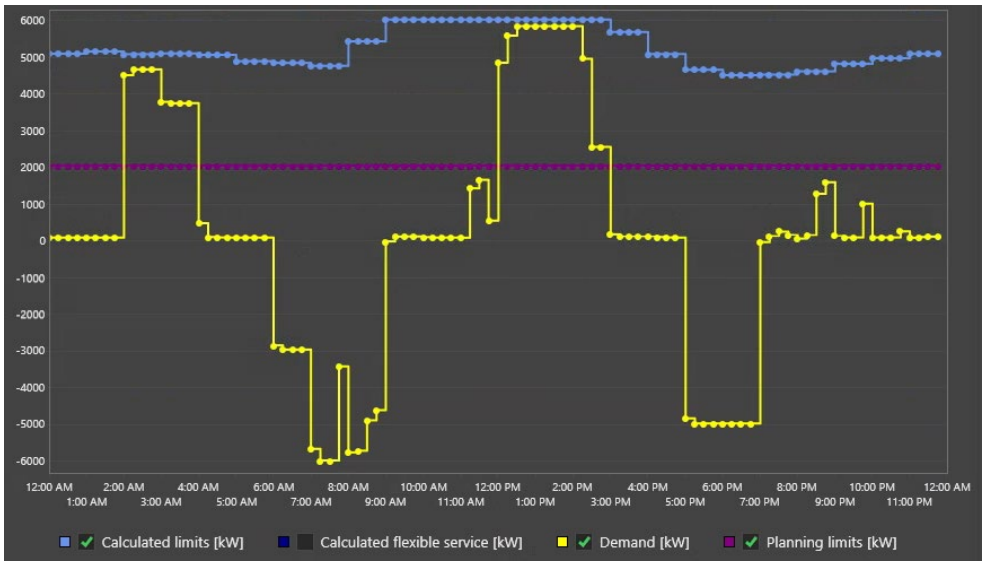

Figure 3: Actual DER site following limits provided by DERMS

11. IOUs can send multiple control schedules to DER systems.
    a. PG&E has demonstrated through its Flex Connect program that it can send control schedules that consist of multiple hourly time intervals, as shown in Figure 4. PG&E can update this schedule at any time, including cancelling it. There are still some potential gaps within the protocol for handling default values that are schedules versus static values (which are handled). PG&E is working around these issues with the vendors at local sites to implement variable default schedules when needed.

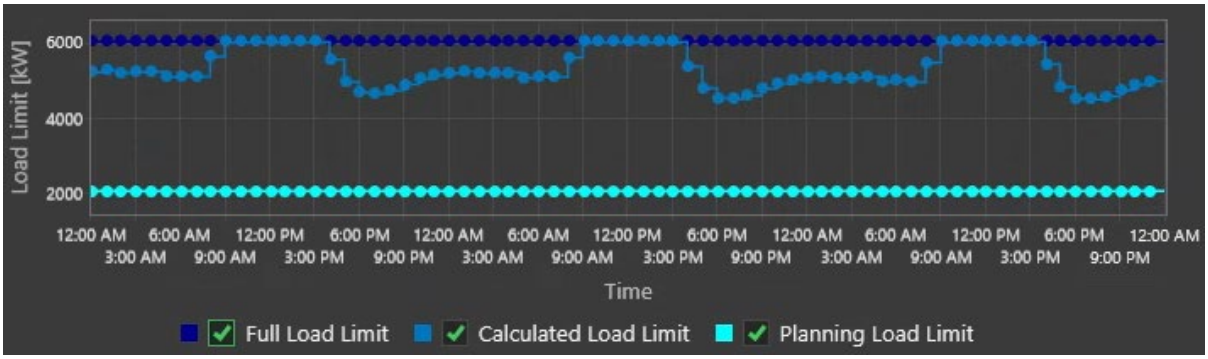

Figure 4: Example 72-hour DERMS schedule of limits transmitted via IEEE 2030.5 as compared to the original Planning Limits, and the full rated load of the site.

12. DER systems are capable of adhering to multiple control schedules, including responding properly to as-needed DER operational schedule changes.
    a. PG&E has demonstrated through its Flex Connect program that DER systems can adhere to updated or cancelled schedules.
13. DER systems can respond to control commands within 30 seconds (or prescribed response times).
    a. PG&E has demonstrated through its Flex Connect program that DER systems can respond to control commands in around 30 seconds. The following example from the real commissioning testing of one EV charging field site had DERMS send a limit

command to reduce load at 09:07:25 AM. At 09:07:48 (23 seconds later) DERMS received acknowledgement that the site received the commands, and at 09:07:57 (32 seconds later) metering at the site showed the expected drop in load to adhere to the limit provided (Figure 5). The response times can differ depending on the particular site location and communications infrastructure.

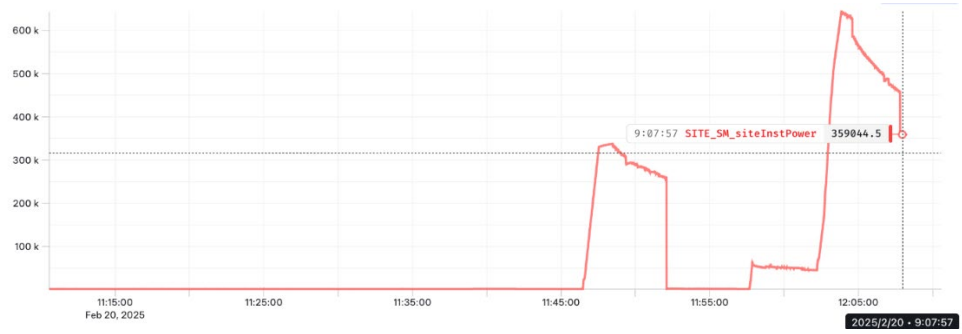

Figure 5: EV charging load responding to a real-time limit reduction from DERMS

14. Fail-safes for loss of communications or hardware failures are sufficient to avoid potential issues for the grid.
    a. PG&E has implemented the failsafes described earlier in the report for communication loss, power loss, abnormal grid switching, and overloads at constrained devices. The communication loss tests are also a proxy for certain types of hardware failures. PG&E is still gaining field experience with these failsafes to determine their efficacy and proper configurations. While no grid issues have occurred thus far, there have been nuisance failsafe issuances due to issues with communication that PG&E is working to improve.

15. Control system uptime is similar to existing SCADA uptime metrics for reliability, including:
    - Control System Availability (Availability (%) = (Total Operational Time / Total Time) * 100);
    - Mean Time Between Failures (MTBF) (MTBF = Total Operational Time / Number of Failures);
    - Mean Time To Repair (MTTR) (MTTR = Total Downtime / Number of Failures), etc.

a. The control system/communication uptime statistics for January 2025 are presented below for the two sites. There was one failsafe activation during the month of January for both sites due to a communication issue between ADMS and DERMS for about an hour.
    a. Site A:
        i. Control System Availability = 99.80%
        ii. MTBF = 1392.16 Min
        iii. MTTR = 2.84 Min
    b. Site B:
        i. Control System Availability = 99.73%
        ii. MTBF = 908.57 Min
        iii. MTTR = 2.45 Min

16. Contractual obligations are in place for DER systems to adhere to technical requirements for OpFlex mitigation (as necessary).
    a. PG&E created contractual terms with customers to participate in Flex Connect that would unenroll customers from the pilot at PG&E's discretion if customers do not properly follow the limits provided. PG&E did not place any added restrictions on customers other than disenrollment from the program because all PG&E customers are held accountable to stay within the agreed upon capacity regardless of whether they are Flex Connect customers or any other customer.
    b. PG&E has provided a copy of one of the contract templates for reference in Appendix A: Flex Connect Sample Contract. While the language for the contracts is the same for different types of customers, PG&E has created three versions of the amendment contracts thus far:
        i. Customers who receive load limit letters
        ii. Customers with an EV fleet contract
        iii. Customers with a small generator interconnection agreement (SGIA)

17. IOU systems can generate and implement DER management scenarios to support OpFlex objectives based on DER states, capabilities, and forecasts. When necessary, this can include temporarily overriding other DER control objectives such as market-based objectives from either the Distribution System Operator (DSO) or Independent System Operator (ISO).
    a. PG&E has demonstrated through Flex Connect that it can create near-term load forecasts that incorporate load and generation and allocate remaining capacity to DER systems participating in Flex Connect. The distribution constraints will have priority over wholesale system requests since violating a distribution constraint would cause a distribution outage thus making that asset unavailable to participate in the wholesale market. While the PG&E DERMS does not directly interface or have knowledge of customers' wholesale market participation strategy, as part of the commissioning process for market participating assets, it must be shown that any DERMS limits takes priority over any wholesale market dispatch request. For that reason, DERMS provides day-ahead schedules so that market-participating customers can then use those schedules to bid into the market appropriately to reduce the risk of not being able to respond to market requests. However, there may be infrequent times during failsafe conditions where DERMS will issue real-time controls that still need to be adhered to regardless of previous market obligations. In cases where market participating resources are constrained by DERMS commands it is the responsibility of the market participant to notify the CAISO per the standard outage processes defined by the rules of the market.

18. IOU systems can determine when abnormal conditions are relieved and revert DER operations to default operations.
    a. PG&E implemented the failsafes described earlier in the report for communication loss, power loss, abnormal grid switching, and overloads at constrained devices. PG&E is continuously working to improve the failsafe functionality, particularly to

reduce the recovery time and intervention required after failsafe conditions have ended. Currently the automated process to recover may take over 24 hours after the issue is resolved because of the nature of sending day-ahead forecasts, however PG&E has manual processes to speed the recovery time from these events and is looking to improve the automated recovery as well.

Identify Triggers for OpFlex DER Operational Alternatives (Curtailment, Increased Generation, etc.):

19. IOU System can identify or forecast abnormal switching scenarios and update DER constraints in near real-time (at maximum 1 minute granularity).
    a. PG&E has demonstrated through its Flex Connect program that DERMS can integrate with ADMS to have a real-time representation of the as-switched grid topology. DERMS uses this interface that updates data about every 30 seconds to identify abnormal switching that may affect Flex Connect assets and reverts those assets to their default planning limits. While PG&E cannot forecast abnormal switching due to unplanned events, for planned events PG&E has built in functionality to DERMS where Operations can schedule a time window in advance when DERMS will ensure customers are at their default planning limits if there is switching expected at that time due to the planned work.

20. IOU System can adequately forecast the impacts of changes to the DER in relation to grid conditions.
    a. PG&E's DERMS system creates a load forecast using a support vector machine algorithm that incorporates historical loading and weather data with forecasted weather data to estimate loading on the system over the next 72 hours. At this time, PG&E's DERMS uses a measurement-based system that does not work well in forecasting loading on a grid without much direct history of measurements via SCADA devices. PG&E is investigating the use of load flow and state-estimation within DERMS to see what improvements that may bring in terms of forecasting abnormal topologies. However, the tuning of these state-estimation models and parameters at scale is expected to be a multi-year effort.

21. Automation of trigger identification can be scaled across the system.
    a. The automated creation of Flex Connect limits or DIDF dispatches are inherent in the DERMS capabilities that PG&E deployed. PG&E is scaling the system on an as needed basis depending on where there are sites of interest to prevent over investment in the product. PG&E is also working to improve the automated creation of failsafe triggers with its DERMS vendor. Currently some of these failsafe configurations are done manually but there are planned improvements in the software by the end of 2025 to automate this type of functionality.

22. Informational systems are updated to provide the OpFlex capabilities of any particular facility.

a. The static capabilities of a customer DER site are shared among multiple systems at PG&E. The telemetry data from Flex Connect sites are provided to ADMS to provide additional situational awareness similar to the monitoring of other SCADA devices on the system. However, at this time, the dynamic changes to limits and schedules are only stored in DERMS. There are planned enhancements to also share some of this data with ADMS to help Operations in real-time potentially know the state of a particular DER participating in Flex Connect of whether it is operating under its default planning limit or has been provided additional capacity via Flex Connect.

Develop Methodology to Calculate DER Management Scenario Characteristics and Allocate Actions Appropriately (Curtailment, Increased Generation, etc.)

23. A process is developed to determine the amount of curtailment, increased generation, etc. required at each generating facility during an OpFlex event (circuit reconfiguration, etc.).
    a. PG&E has demonstrated through its Flex Connect program that it can use a load forecast to determine the amount of additional capacity a Flex Connect customer can be provided and then send it a schedule to follow. In case of a circuit reconfiguration, DERMS automatically identifies the change of topology and automatically sends the Flex Connect customer back to its default planning limits, which is analogous to an OpFlex event type.

24. Automation is developed to determine the amount of curtailment, increased generation, etc. required at each generating facility during an OpFlex event to be able to scale system wide.
    a. PG&E implemented a DERMS system that automatically determines load or generation limits for Flex Connect (or dispatches in the case of DIDF) for DER sites. PG&E is currently running a measurement-based DERMS which relies on having SCADA measurements at the constraint location. While this covers many potential constraint locations at scale, there may be times when the constraint is at a part of the circuit that is not directly monitored by a SCADA device, or topology changes make the SCADA data unreliable for future forecasting. For these types of instances, PG&E is looking at load flow and state-estimation capabilities to potentially fill this gap and will be evaluating this functionality in the coming years.

25. System-generated curtailment/generation set points do not create additional issues for the grid.
    a. PG&E has demonstrated through its Flex Connect program that thus far the DERMS generated set points do not create additional issues for the grid. However, this program is new and PG&E is still evaluating and learning from experience. In addition, PG&E also includes buffers in its calculations to help minimize the effects of potential errors in forecasts that could result in negative consequences for the

grid. Furthermore, PG&E has additional failsafes in place to react automatically if overloads are detected at constrained locations.

26. System-generated curtailment/generation set points are not overly restrictive to DER system customers based on grid behavior.
    a. PG&E is still gaining experience with the correct amount of safety margin, or buffer, to add to the calculations. When first commissioning a customer site the safety margin is left larger to allow time to test the system and grid effects. Over time that safety margin is re-evaluated to see if it needs to be adjusted either higher or lower based on the results. PG&E is also exploring the development of automated dynamic safety margins based on an analysis of the forecast accuracy to be implemented by the end of 2025.

27. Functional requirements involved in the DER management scenarios are recorded for future discussion.
    a. PG&E provides requirements for the 2030.5 communication system as part of its customer-owned telemetry program. The Flex Connect program uses that same infrastructure for communicating control signals to customer sites. In addition, PG&E provides customers enrolling in Flex Connect specific requirements around telemetry and control.

Develop Operational Processes to Implement OpFlex DER Operational Alternatives:

28. Develop engineering tools to analyze switching scenarios with various operational alternative capabilities of facilities.
    a. PG&E's DERMS system is aware of the as-switched grid topology via its integration with ADMS. Different types of switching scenarios will result in different actions for sites participating in Flex Connect. Because the initial load forecasts and failsafes are based on the constraints of the upstream equipment (e.g. feeder head constraints or substation transformer constraints), if there are changes in topology that change these devices, the Flex Connect site will automatically revert to its default Planning Limit. However, if the topology changes do not affect the Flex Connect site's source side connectivity, they are allowed to remain at their previously provided schedule. To prevent potential overloads if switching adds loads to the feeders or substation transformers, DERMS relies on real-time failsafes that are monitoring the capacity of those devices to trigger a return to the planning limit if an overload is detected. Operators also always have the ability to send customers down to their Planning Limits if needed for operational emergencies or planned work on the system.

29. Develop processes for Operators and Engineers to dispatch new settings to facilities.
    a. PG&E's DERMS system has the capabilities for Operations to cancel any existing schedule to return those customers to their default Planning Limits, as well as the

ability to send new schedules as needed. PG&E has created internal processes and trainings to inform Operations regarding this functionality.

30. Mitigation processes are in place and are adequate when facilities do not respond or inadequately respond to utility commands.
    a. As described earlier, there are various failsafes in place and testing in place to ensure facilities are adhering to utility commands. Moreover, PG&E has developed "compliance reports" within the DERMS system that automatically provide metrics around a customer's ability to stay within the given limits (Figure 6). PG&E's contracts are also structured so that PG&E can revoke a customer's ability to participate in Flex Connect if they are found to not be able to adhere to the given limits. In the worst case, upstream PG&E protective devices would operate due to overloads to prevent safety and equipment issues. This would create an outage for the customer as well as potentially other customers served by the same protective device. PG&E is expected to learn more about potential needs for further mitigation as they gain more experience with the technology and customer capabilities.

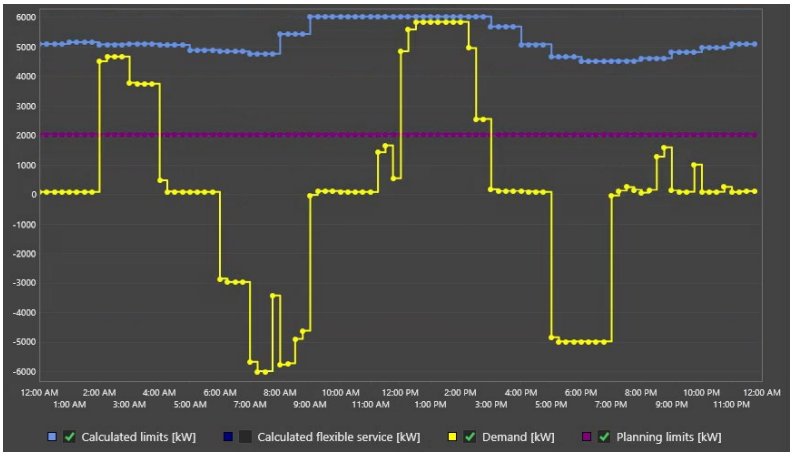

Figure 6: Example of the Compliance Report for a Flex Connect Site

Demonstrate Ability to Monitor and Report on OpFlex DER Operational Alternative Success

31. IOU systems can determine when DER management scenarios do not achieve objectives and record information regarding why.
    a. PG&E's Flex Connect system is meant to prevent overloads of equipment while providing customers additional capacity than the status quo. PG&E is tracking various metrics associated with these goals. In terms of overloads, PG&E has alarms in place and failsafes in place if overloads do occur. In addition, PG&E is tracking whether customers are adhering to the limits provided by PG&E to ensure they can remain in the program and are not creating additional risk on the system. In terms of the objectives for additional capacity, PG&E is tracking the amount of additional capacity unlocked by Flex Connect, as well as the portion of that

unlocked capacity that is actually used by the customer. PG&E has various ways of auditing the data including looking at historical information around the load and weather forecasts, the events, alarms, and telemetry from the system.

32. IOU systems have the capacity to store data on the characteristics, such as the length and operational alternatives executed, of the DER management scenarios during abnormal conditions for the purpose of reporting and/or using this data to assess the impacts of the scenarios.
    a. The PG&E DERMS platform stores data regarding the events and underlying data surrounding the dispatch of those events during abnormal conditions. PG&E uses this data for both reporting and troubleshooting in concert with the DERMS vendor.

Evaluation Metrics--Reflect on Lessons Learned and Assess the Potential for Scaling Proposal F-1

33. Lessons learned: key lessons learned from the pilot are identified.
    a. The key challenges and lessons learned were described in detail earlier in this report. At a high level it can be summarized as follows:
        i. **Technical Feasibility:** PG&E was successfully able to implement a production DERMS system to provide benefits to two customers thus far via the Flex Connect program.
        ii. **Technology Nascency:** DERMS is not an "off-the-shelf" product for the utility or customers. It can be challenging and expensive for customers to participate depending on the complexity of the integrations required. However, PG&E is working with industry and vendors to improve the DERMS product and offerings.
        iii. **Processes Still Developing:** Process improvements are needed for both the customer and the utility.
        iv. **Not a Panacea:** Implementation and benefits can be customer and grid specific. The following are some examples of why sites may not participate in a DERMS program at this time:
            1. Inflexible loads or schedules
            2. The benefits of a flexible connection not outweighing the costs
            3. The customer is ok with static limits
            4. Capacity work will be completed in a short time
            5. The available capacity on the grid is not sufficient even with Flex Connect for the customer needs
            6. Certain types of grid restrictions cannot be currently handled by the DERMS system until future updates are made (i.e., state-estimation).
            7. The customer applications for service (especially for EV charging stations) can be speculative, and projects may fall off.

34. Stakeholder feedback: Collect feedback from relevant stakeholders, including utility personnel, DER owners, and regulators, to gain insights into the pilot's effectiveness, areas for improvement, and the value proposition for future use of IEEE 2030.5 in the context of Operational Flexibility.
    a. Grant Structures: EV charging grants (e.g. NEVI or CEC funding) should still be accessible for sites not having 100% availability if programs like Flex Connect can still provide significant capacity for those sites.
    b. Cost Variability: Costs can vary significantly for customers depending on the complexity and integrations required. Some customers received quotes of near $100k to implement a system that needed to integrate with various entities including unique customer cloud applications, CAISO Rigs, local site controllers, DER devices, etc. However, generally it is expected these costs to be in the $20k-$50k range.
    c. Learning Curve: When working with the same developer and implementation team, the lessons learned from the first implementation have made the subsequent implementations much faster to build and commission.
    d. UL3141 Issues: Aggregators who have looked into UL3141 are concerned that the requirement to have systems be certified as a whole will make it difficult and costly to implement in the field since systems rarely have the exact same equipment at each site unless they are "cookie-cutter" sites from the same developer.
    e. Gaps in 2030.5: There are still some gaps in 2030.5 particularly around sending a default Planning Limit Schedule that varies hourly. Additionally, there is coordination required with the utility and vendors to ensure failsafes are properly implemented as they are not all inherent within the protocol.
    f. Reduced Burden for Operations: The PG&E Operations team is working closely with the DERMS team to ensure that Flex Connect does not create an increased burden for Distribution Control Center Operations and support teams.

35. Scalability: The potential and appropriateness of utilizing future EPIC-funded projects and/or GRC funds to expand the functionalities necessary for Proposal F-1 and scale up the pilot's results is assessed.
    a. Exploring local DER orchestration mechanisms, under EPIC 4.10, will help overcome scaling challenges by efficiently coordinating diverse DERs across various grid services and modes of engagement to meet distribution grid needs. Such coordination will ensure that the increasing number of DERs are operating optimally while maintaining grid stability and reliability. PG&E is also requesting funds in the GRC to increase DERMS scale and new capabilities to address the need to support the orchestration of DERs in this environment.

36. Additional DER operational alternatives that could assist in operationalizing and scaling proposal F-1 are considered for future testing.
    a. As described above, the EPIC 4.10 project is exploring local DER orchestration mechanisms with the goal of helping overcome scaling challenges by efficiently

coordinating diverse DERs across various grid services and modes of engagement to meet distribution grid needs.

37. Documentation and dissemination: Ensure that the learning outcomes, benefits, and challenges are well-documented through reports, technical papers, and input to standards development.
    a. PG&E has presented on its DERMS implementation and Flex Connect offering at various forums, however this report is the first formal paper describing the work done to date. PG&E is already working with industry partners and will be providing input to relevant standards including the planned CSIP updates.

Recommendations Regarding Scaling of DER Operational Alternatives as a Mitigation for OpFlex Constraints (Including ADMS and DERMS Barriers)

Scaling DER operational alternatives to mitigate OpFlex constraints needs to address several barriers relating to ADMS and DERMS, including:

- **Enhancing DER Visibility** to overcome the lack of comprehensive visibility into all DER assets by deploying advanced sensors, SCADA, and edge computing devices to monitor front-the-meter and behind-the-meter DERs.
- **Enabling Local DER Orchestration** to overcome scaling challenges by effectively coordinating heterogenous DERs across multiple DER grid services and modes of engagements in a cost-effective manner.
- **Fostering Interoperability and Standardization** by implementing open data communication standards and protocols such as IEEE 2030.5 enhances interoperability between DERs, the grid, and third parties.
- **Optimizing Data Analytics and Forecasting** by enhancing the forecasting of load and generation profiles to improve operational flexibility.
- **Incentivizing DER Participation** to encourage DER owners to enroll their devices in different load management programs to provide one or multiple grid services
- **Addressing Cybersecurity Risks** by implementing advanced threat detection and response strategies including secure communication protocols, and conducting regular cybersecurity audits.
- **Advocating for Policies Supporting DER** to enable DER scaling by collaborating with policymakers and industry to evaluate interconnection and compensation rules.
- **Improving Customer Engagement and Retention** by offering easy to understand and compelling incentives for customers with DERs and simplifying their customer experience to increase enrollments and scale DER programs and their impacts while at the same time ensuring cost effectiveness of DER programs and services vs alternatives.

Appendix A: Flex Connect Sample Contract

Amendment to EV Fleet Contract for Participation in Flexible Service Connection Pilot Agreement

Pacific Gas and Electric Company (PG&E), and _____ (Customer) hereby enter into this Flexible Service Pilot Agreement (Agreement) between PG&E and Customer. Customer and PG&E are sometimes referred to in this Agreement jointly as "Parties" or individually as "Party."

Customer recognizes that PG&E is required by its California Public Utilities Commission (CPUC) authorized tariffs to design its electric facilities to provide adequate capacity to meet the maximum demands of Customer's loads during normal, non-emergency conditions. It is also understood that to achieve this level of service reliability at Customer's facility, which is located at _____ (Site), capacity upgrades must be done to PG&E's distribution grid. Therefore, PG&E and Customer agree as follows:

1. SCOPE AND PURPOSE

    a. This agreement amends the EV Fleet Contract <enter FLEET ID> dated _____ to provide incremental capacity to serve new customer load in addition to what is permitted in the EV Fleet contract Exhibit A section.
    b. PG&E and Customer agree to deploy and operate a pilot flexible service connection solution that includes telemetry and automated dynamic control of the site equipment and loads in order to keep site demand within the dynamic capacity limits of the distribution grid (the Pilot).
    c. The Parties acknowledge and agree that Customer may have other sites. The Parties acknowledge and agree that the Pilot cannot be extended to additional sites beyond this Site without the prior written agreement of PG&E.

2. TERMS AND TERMINATION

    a. This Agreement and Pilot shall become effective as of the last date entered by a Party on the signature page of this Agreement (Agreement Effective Date).
    b. The Pilot Agreement shall remain effective until PG&E or the Customer provides 30-days notice to the other party of withdrawal in the Pilot at their sole discretion.
    c. If the Pilot is terminated by either party, the site would immediately revert back to the conditions and requirements specified in the EV Fleet Contract.

3. PROGRAM DESCRIPTION

    Customer Requirements:

    - Customer has controllable loads/generation that can be adjusted to meet the scheduled hourly limits provided by PG&E.
    - Customer is expected to follow new limit profiles within 15 Minutes or less for emergency 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/doing-business-with-pge/TD-2306P-01-A1.pdf).
    - Customer must follow all the relevant requirements as outlined in PG&E's Customer-Owned Telemetry Procedures available on PG&E's Distribution Interconnection Handbook website

(https://www.pge.com/assets/pge/docs/about/doing-business-with-pge/TD-2306P-01.pdf).

- Customer shall provide contact information for on-call support to address operational issues.
- Customer shall have local fail safes in place to revert to original load limits provided by PG&E in case of communications loss or other issues with the Pilot system.

PG&E will provide:

- Load limits provided by PG&E will be at or above original limits provided by PG&E in the EV Fleet Contract.
- On a day ahead basis PG&E will provide a schedule of hourly load limits for the following day's 24-hour period through the IEEE 2030.5 protocol.
- For emergency situations, revised schedules or control commands may be sent in real-time.

Testing Requirements:

- Prior to Pilot operations, PG&E and the customer will perform testing to confirm the functional requirements of the Pilot system.
- Field Commissioning is required prior to commencing the Pilot.
- Ongoing testing may be required at the direction of PG&E in coordination with the customer.

4. MILESTONE TABLE

The Parties agree to the following milestones to assist in the performance of duties under this Agreement. The milestones and due dates set forth below shall be considered non-binding and subject to adjustment. Should either Party not meet the milestone as of the prescribed date, such occurrence shall not be considered a violation of this agreement.

Item	Milestone	Responsible Party	Target Date
(a)	**Site equipment readiness**	**Customer**	
(b)	**Site Acceptance Testing**	**PG&E**	

5. SIGNATURES

IN WITNESS WHEREOF, the Parties hereto have caused this Agreement to be executed by their duly authorized representatives.

_____	PACIFIC GAS AND ELECTRIC COMPANY
By: _____	By: _____
Name: _____	Name: _____
Title: _____	Title: _____
Date: _____	Date: _____