Welcome to Workshop #2

As you join, please complete our **pre-workshop survey**

Take the survey by visiting: bit.ly/HighDER2

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GRIDWORKS

2024 Future Grid Study

Workshop #2
Assessing Gaps

GRIDWORKS

March 12, 2024 | 11am-5pm Pacific
Virtual/Zoom

Overview of Future Grid Workshop Series

Workshop #1
Identify Operational Needs

- Focus: Scoping Question 1
- Develop list of future grid needs through panel discussions

Workshop #2
Gap Assessment

- Focus: Scoping Question 2
- Identify gaps between current operations and future grid needs

Workshop #3
Develop Recommendations

- Focus: Scoping Question 2
- Recommend to the Commission actions to address identified gaps.

Post Workshop:

Gridworks assembles workshop reports into the *Future Grid Study:*

- provides account of identified operational needs, gaps, barriers, and required actions.

Parties comment on Gridworks' *Future Grid Study*, forming a record for decision-making.

TODAY'S OBJECTIVES

A. Review the Operational Needs identified in Workshop #1

B. Share expert and party perspectives on the following question:

"What are the existing gaps and barriers in achieving the needs identified above within our current Distribution System Operator (Utilities)?"

C. Co-create a gap assessment

D. Lay the groundwork for the focus of our next workshop:

"What are the potential solutions in overcoming these barriers?"

AGENDA

#	Topic	Start Time
1	Introductions	11:00 am
2	Remarks from Commissioner Darcie L. Houck	11:10am
3	Operational Needs: Overview	11:15 am
	Operational Needs: Guided Discussion on Priority Needs	11:30 am
	lunch (30 min)	12:30 pm
4	Gap Assessment: Utility Panel and Q&A	1:00 pm
	break (15 min)	2:25 pm
5	Gap Assessment: Advocates Panel and Q&A	2:40 pm
	break (15 min)	3:50 pm
6	Discussion	4:05 pm
7	Next Steps and Closing	4:50 pm

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ANNOUNCEMENTS

Please complete this 2-question pre-workshop survey before we begin

Visit bit.ly/HighDER2 to take the survey or scan the QR code

Today's presentations and a recording of today's workshop will be available at gridworks.org/initiatives/california-future-grid-study/

We want you to participate actively. Please do so using the Zoom "raise hand" function, chat, and slido.

A summary of this Workshop will be prepared by Gridworks. Our summary will be distributed prior to Workshop #3

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HOW TO PARTICIPATE

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Slido will be used to gather responses to **two** questions throughout the workshop

1. Building our Gap Assessment
2. Providing Gridworks Feedback

Zoom

Please use the zoom chat to ask questions for our speakers. We will address these questions in the Q&A session following each panel.
If you wish to speak, please raise your hand in zoom
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Operational Needs Discussion:
Overview and Prioritization Survey

Jay Griffin, Gridworks

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Summary of Operational Needs

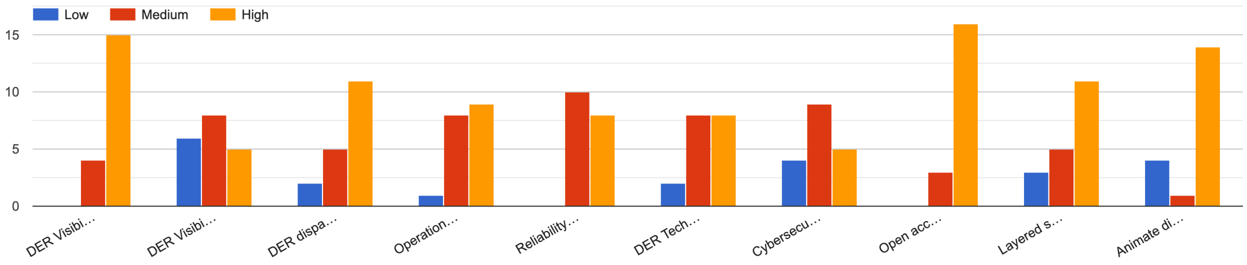
- **DER Visibility to Distribution System Operator**
- **DER Visibility to CAISO**
- **DER dispatchability/control**
- **Operational planning and analysis**
- **Reliability Coordination at T-D interface**
- **DER Technical Performance Standards**
- **Cybersecurity**
- **Open access to distribution system**
- **Layered system architecture from bottom-up**
- **Animate distribution-level markets/granular pricing**

- Gridworks compiled list of operational needs from Workshop #1 presentations and participant comments
- Grouped common themes under the ten topics in the summary document
- Topics reflect the feedback received in the workshop and include overlap in some themes
- Today's workshop will further discuss the list of operational needs and next steps

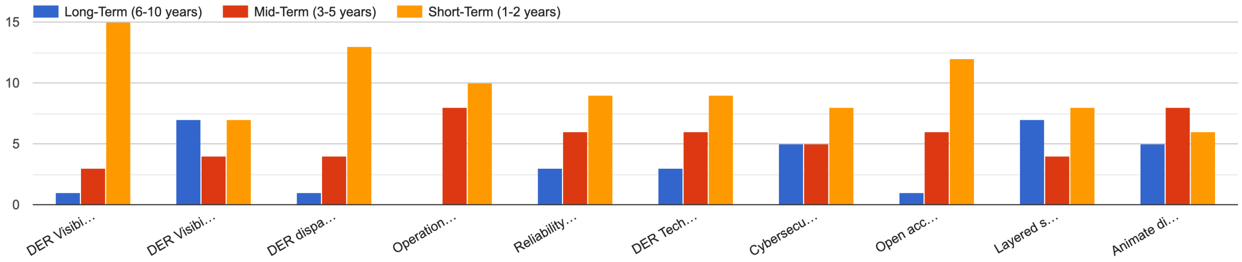
Pre-workshop Survey Results:

- **DER Visibility to Distribution System Operator**
- DER Visibility to CAISO
- **DER dispatchability/control**
- Operational planning and analysis
- Reliability Coordination at T-D interface
- DER Technical Performance Standards
- Cybersecurity
- **Open access to distribution system**
- Layered system architecture from bottom-up
- Animate distribution-level markets/granular pricing

In the meeting summary there are ten categories of operational needs. Please rate them according to importance.



In the meeting summary there are ten categories of operational needs. Please rate them by urgency.



Discussion on Priority Needs

1. If these are among your top priorities, please share why.
2. If these are not among your top priorities, which operational needs would you prioritize instead, and why?
3. Are there any operational needs missing from the list?

30 Minute Break

Please be back at 1:00pm

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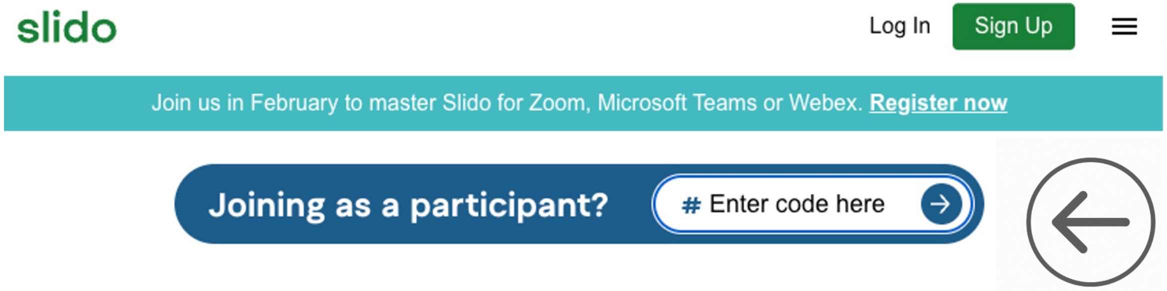

Using Slido:

- Use slido during our panel presentations to answer the workshop question anytime.
- You can view other responses after you submit your answer

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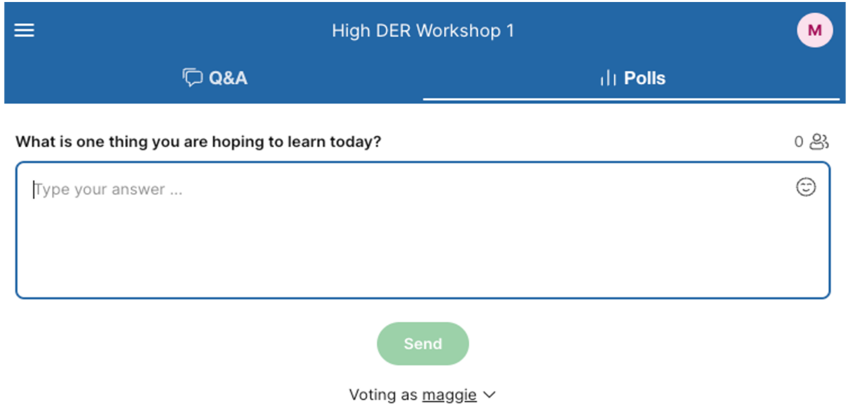

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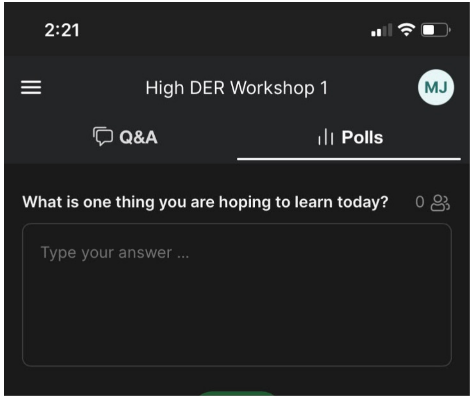

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Panel 1:
Utilities

Michael Barigian

Southern California Edison

Alex Portilla

Pacific Gas & Electric

Kirsten Petersen & Christopher Franco

San Diego Gas & Electric

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High DER: Future Grid Study, Workshop Two

Gap Analysis

March 12, 2024

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Agenda

- Overview of Future DSO Capabilities (SCE)
- Technology Progress by IOUs (Each IOU to present individually)
- Policy Gaps (PG&E)
- Recommendations (SDG&E)

Summary

Objective
To discuss the gaps to efficiently operate a high DER grid, unlock economic opportunities for DERs to provide grid services, limit market power, reduce ratepayer costs, increase equity, support grid resiliency, and meet State policy objectives

Status
As part of their Grid Modernization Plans, the IOUs are currently planning, developing, and deploying foundational technologies to enable future operational capabilities

Gaps & Challenges
- Key gaps include policies related to orchestration and the future grid "marketplace"
- EVs present some unique challenges and opportunities that are key to our vision, due to rapid development of technology, mobile nature of EVs, and the relative importance of individual customer behavior to their use

Recommendations
- The Commission and Stakeholders are recommended to focus initially on approaches to providing local grid services, which will establish a foundation on which more complex solutioning can later be explored
- Grid Orchestration is fundamentally required to support California's goals, including TE and decarbonization, but is imperative to do so at the lowest societal cost to our customers

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Overview of Future DSO Capabilities

DSO Enablement through Technology and Policy

Unlocking DSO capabilities hinges on the development of both Technology and Policy

Technologies
Putting in place the many necessary grid enhancements to enable sophisticated services

Policies
Establishing a supportive environment for the multi-faceted activities of a modern grid

Grid Modernization Capabilities Supporting DSO

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Capability	Description
DER Visibility	Real-time awareness of DER status and output. Monitor/model DER. Track DER performance and interconnection characteristics, state of charge, historical performance, aggregator data, data access, **cost of operation, real time prices**, **and manage confidentiality**
Short-term Forecasting	Highly granular forecast of DER output for next 24 hours. Ability to modify demand and utilize local resources to meet both local and system level demand will increase flexibility, strongly supporting resilience and reliability, even to the point of localized islanding
Advanced Grid Analytics	Analyze grid conditions (current and forecasted circuit loading, DER output, etc.) to identify potential issues and suggest remedies. System defense and restoration (cybersecurity, emergency load reduction, resiliency, black start)
Grid / DER Optimization	Optimize use of grid assets and DERs to provide maximum value. Unlock economic opportunities for DERs to provide grid services: SIWG, standard tariffs and contracts. Encourage investment in DERs and DER aggregation technologies. Enable DER owners to monetize the capabilities of their assets, **incentivize DER owners to support grid functioning and offset needs for grid investment.**
DER Scheduling and Dispatching Tools	Signal participating DERs to produce or consume a specific amount of power and energy at specified time (day-ahead and real time).
Advanced CAISO Coordination / Communication	Mutual sharing of DER schedules, operations, constraints. **Set appropriate rate for consumption and generation based upon cost causation to prevent market manipulation. Meet state policy objectives: meeting needs at each location, allow resources to be shared between locations, both locally and system wide, must avoid barriers to and appropriately encourage deployment of and utilization of DER**
Grid Infrastructure Orchestration	Real-time monitoring and automated grid control enabled by intelligent sensors, switches, protection, communication devices

***Bold text:** Capabilities dependent on policy development.

Technology Progress By IOU

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Where are Utilities Now?

The Utilities are on the precipice of a transition into a new energy landscape. While exciting, we are also paving a new pathway and need to be innovative and nimble

On track per their Grid Mod Plans. While we are each facing certain challenges, none are considered Technical Gaps that will prevent the deployment of tools

In process of deploying Advanced Distribution Management System (ADMS), early release in plan

DER Management System (DERMS) will be deployed over next several years with key functional requirements largely dependent on evolving market structures and regulations

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SCE's Technology Progress

SCE Status

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Capability	Description (Implementation Timeframe)
DER Visibility	Real-time Awareness of DERs (2024), DER Optimization (real-time prices not currently in-scope pending policy) (2026-2027)
Short-term Forecasting	DER Short-Term Forecasting (2026-2027), Microgrid Management (2027-2028), Advanced Load Management (2028+)
Advanced Grid Analytics	Distribution Management (2024), DER Dispatch to Mitigate Grid Reliability Issues (2027)
Grid / DER Optimization	DER Optimization (2026-2027)
DER Scheduling and Dispatching Tools	DER Scheduling and Dispatch (2024), Microgrid Management (2027-2028)
Advanced CAISO Coordination / Communication	DER Schedules, Operations, Constraints (2026-2027)
Grid Infrastructure Orchestration	Devices operational with continued deployment 2024+, Real-Time Monitoring (2024-2025), Adaptive Protection (2026-2027)

SCE's GMS Capability Roadmap & Deployment Schedule

Phase 1 ADMS		Phase 2 DERMS	Phase 3 Adv. ADMS & DERMS	Phase 4 Grid Platform
Release 0.5 (Complete) D-SCADA upgrade May 2021	Release 1 (Testing) Adv. DMS, OMS, & DERMS 2023-2025	Development 2026-2027	Plan 2027-2028	Plan 2028+
Back-office platform that is virtualized, scalable and highly resilient to support ADMS and DERMS	Advanced grid mgmt. functions, including automated fault location, isolation, and service restoration (FLISR), electronic switching, base DER mgmt., and mobile grid operations	PSPS automation, adaptive protection, DER short-term forecasting and optimization, secure field devices, and energized wire down event detection	Expand mobile grid operations, outage metrics, operator training systems, microgrid mgmt., and storm analytics capabilities	Expand load management, power quality management and substation device management capabilities
D-SCADA Functionality Infrastructure upgrade to support: • D-SCADA Operations • Red Flag / Load Shed • Distribution Volt Var Control • Tie Device Restoration Logic	**OMS Functionality** • Replace and Enhance OMS Functions • Fully Integrated Electronic Switching Management • Deploy Mobile ADMS field functions	**DERMS Functions** • Short-term Forecasting (Load & Generation) • Optimization Engine • Constraint Management	**Advanced ADMS Functions** • Storm Analytics • Mobile Grid Operations expansion • Outage metrics expansion • Microgrid Management	**Grid Platform Functions** • Adv. Load management • Substation device management • Power Quality platform
	DMS Functionality • Deploy Advance Distribution Network Analysis Functions • Deploy Assisted Switching (Fault Location Isolation & Service Restoration, Protection Validation) • Enhanced Volt Var Control • Base DER Management Functions (IEEE2030.5 aggregator dispatch)	**ADMS Functions** • Next generation integrated ADMS and DERMS • Wildfire/PSPS- GMS Integration • Automatic wire down detection & isolation • Adaptive Protection • Device Management	**Advanced DERMS Functions** • Operator Training expansion (high DER) • DER response to weather modeling and islanding	

Acronym Definitions:
ADMS: Advanced Distribution Management System
D-SCADA: Distribution Supervisory Control and Data Acquisition
DERMS: Distributed Energy Resource Management System
DMS: Distribution Management System
OMS: Outage Management System
PSPS: Public Safety Power Shutoff

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SDG&E’s Technology Progress

SDG&E Grid Modernization Investment Phased Roadmap

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Market Support

Support advanced market and settlement

DER at Scale

Investments to support expansion of DER grid services
DERMS Capabilities, DRMS, Data Analytics, IEEE 2030.5 Integration

Foundational Technology Investment

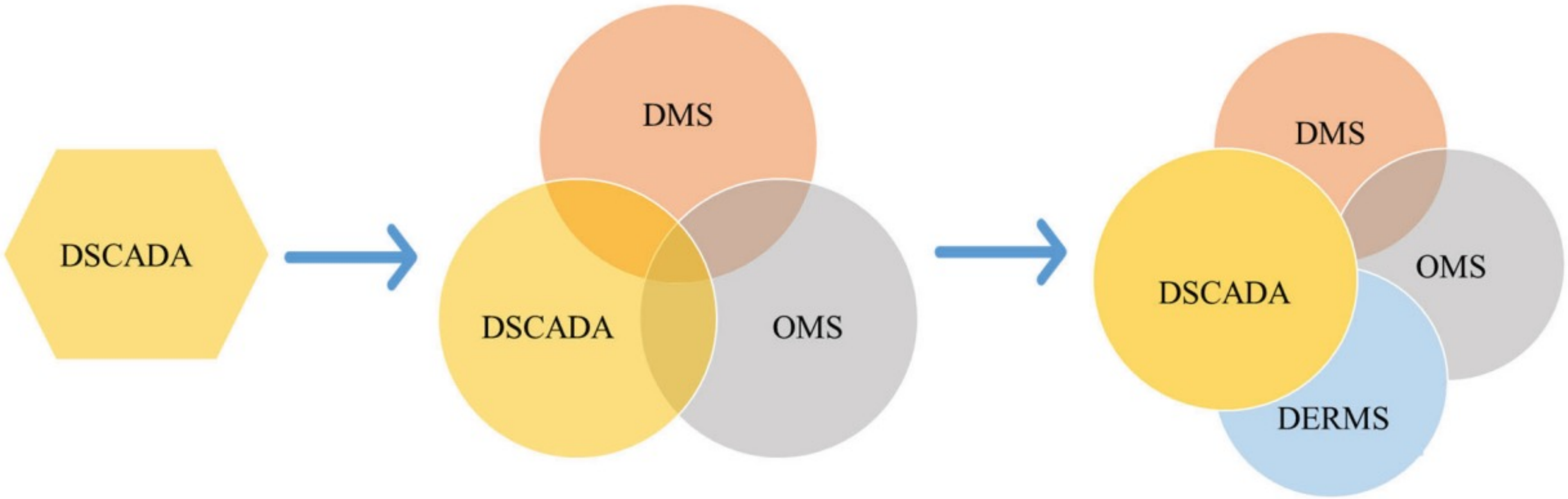
Foundational technology investments supporting enhanced system safety and reliability
AMI, SCADA, GIS, ADMS, DER interconnection portals, local controller, Communication Improvements, Fiber Build, Intelligent Sensors, Energy Storage Systems, Microgrids

Traditional Investments

Traditional investments maintaining safe and reliable operations of the electric system
New circuits, reconductoring, aging infrastructure replacement

TIME 2010 2016 2022 2028 2030 +

Control System Evolution at SDG&E



SCADA
(Prior to 2012)

DER Aware ADMS
(2012-Present)

Integrated ADMS and DERMS
(Company Vision)

SDG&E Current Capabilities for DER Orchestration (2024)

Capability	Description
DER Visibility	• Telemetry requirement for DERs >1MW, allowing for control center visibility. Situational awareness includes topographical visibility in Network Management System (NMS). Ability to isolate CAISO DER via SCADA switch if operational emergency calls for it. • In-flight project, PIVA: Photovoltaic Integration over Virtual Airgap, to quantify "True Load"
Short-term Forecasting	• Short-term forecasting is available and being evaluated with distribution system model. Additional efforts to integrate with other functional modules and operational processes.
Advanced Grid Analytics	• Building out ADMS capabilities to prepare for DERMS, including power flow and day-ahead forecasting. Additional future capabilities included in the roadmap are fault location, VVO, and FLISR.
Grid / DER Optimization	• DER-Aware NMS today and future plans for DER-Aware ADMS. • Local Area Distribution Controllers (LADC) deployed at our internally owned DER locations to optimize DER assets within an electric microgrid environment.
DER Scheduling and Dispatching Tools	• For DERs >1MW there is control center visibility of static charge limits.
Advanced CAISO Coordination / Communication	• Requests to attach and permission to operate per an interconnection agreement which includes safety and reliability requirements (SCADA Isolation Switch, Telemetry, Anti-Islanding, Charging/Discharging Parameters, Ramp Rates)
Grid Infrastructure Orchestration	• In-flight projects and demonstrations: ○ Vehicle2Grid Partnerships ○ EPIC projects focused on evaluating communications ○ Two Virtual Power Plant (VPP) Projects • Need to integrate with future grid management tools (DERMS)

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PG&E's Technology Progress

PG&E Advanced Distribution Management System (ADMS)

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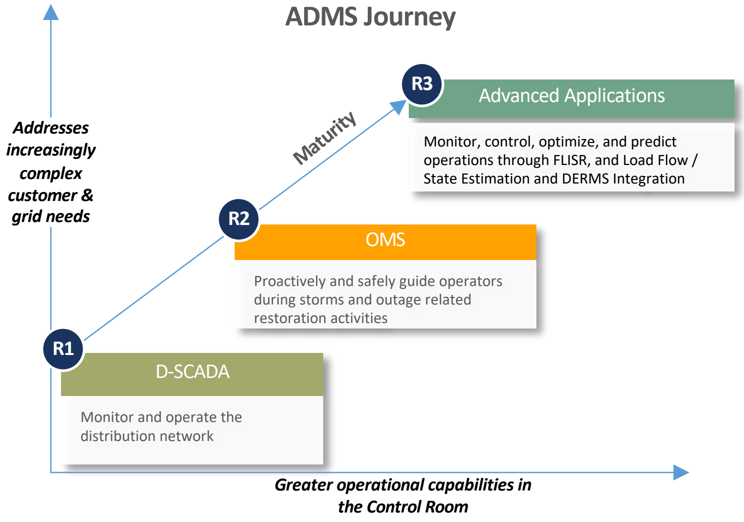
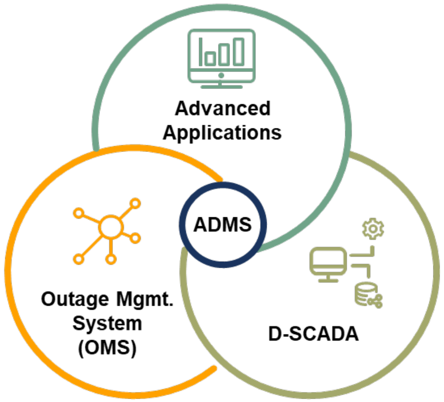
ADMS replaces legacy control center software used to operate the electric distribution system with an integrated technology platform, **enabling step-level improvements** in PG&E's ability to monitor, manage, and control our distribution network.





ADMS consolidates the Distribution Supervisory Control and Data Acquisition (D-SCADA), Outage Management System (OMS), and other Advanced Applications into an integrated, modern platform

***D-SCADA**: Distribution Supervisory Control & Data Acquisition*
***OMS**: Outage Management System*
***FLISR**: Fault Location, Isolation, and Service*
***DERMS**: Distributed Energy Resources Management System*

PG&E's ADMS Progress

We will finish upgrading Distribution SCADA and in a good path to deploy ADMS. DERMS platform setup to enable EV goals

2023	2024	2025	2026 - 2030	Future State

ADMS as a foundation for grid management

DERMS platform to support future grid orchestration

What we Achieved

ADMS Release 1 (SCADA)
- Pilot Go-Live for 5 divisions
- End-state Go-Live for 1 of 14 remaining divisions (Humboldt)

ADMS Release 2 (Outage Mgmt Consolidation)
- Design & Build kickoff

ADMS Release 3 (Adv. Apps)
- Design & Build kickoff
- Supported Microgrid enablement in SCADA

What's in Progress

ADMS Release 1 (SCADA)
- End-state Go-Live for remaining 13 divisions; close out the Release

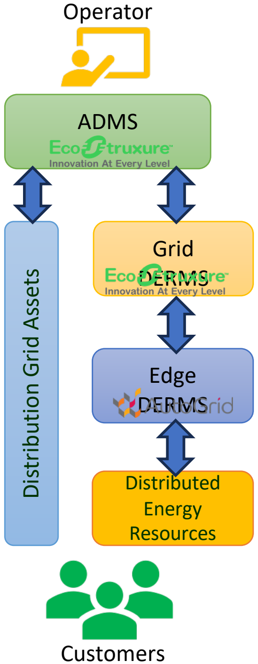
ADMS Release 2 (Outage Mgmt)
- Complete the Design Phase

ADMS Release 3 (Adv. Apps)
- Deploy Enhanced Powerline Safety Settings (EPSS) functionality in ADMS

What's Planned

ADMS Release 2 (Outage Mgmt)
- 2025 – Complete Build & Test activities
- 2026 – Deploy Outage Management System, including PSPS module

ADMS Release 3 (Adv. Apps)
- 2025 – Complete foundational Line Sensor and Load Flow/State Estimation functionality deployment on limited feeders; Deploy EPSS additional enhancements and functions
- 2026+ - Complete enablement of additional advanced ADMS features such as power flow and state estimation



Key Outcomes

PG&E DER Orchestration Roadmap and Evolution

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DERMS aims to create near-term value while building toward DER Orchestration Vision while leveraging ADMS capabilities as they become available

Present focus is on uses cases and capabilities to enhance situational awareness and manage distribution grid capacity constraints. Over time focus will expand to orchestrating DERs across multiple value streams.

Now (2023/2024)

- **Deployed foundational DERMS platform including 2030.5 DER headend for low-cost telemetry**
- **Implement initial use cases to enable Flexible Service Connections for bridge capacity on constrained circuits**
- **Dispatch contracted DERs as "non-wires alternatives" to capacity projects (DIDF)**

Mid-Term (2024-2027)

- **Scale DERMS capabilities to the entire system rather than spot locations**
- **Transition demand response and load management programs to Enterprise DERMS**
- **Orchestrate DERs and LM across multiple value streams**
- **Enable electric vehicles as flexible loads via managed charging and V2X**
- **Integrate real-time pricing pilots and initiatives to utilize DERs as a system resource**

Longer-Term (2028-2030)

- **Simplify customer experience via a single interface and engagement platform**
- **Optimize customer value of DERs for participation in distribution and transmission grid services and energy markets**
- **Evolve DERMS into a grid edge computing platform to automatically optimize at the hyper local level**

PG&E Current Capabilities for DER Orchestration (2024)

Capability	Description/Current Status
DER Visibility	Real-time Awareness of DERs for 1MW+ and DERs participating in capacity use cases via IEEE 2030.5, Visibility and control of initial Microgrid Locations via SCADA.
Short-term Forecasting	Short-Term Forecasting at targeted constrained grid locations where SCADA is available (~100 circuits of 3200 modeled)
Advanced Grid Analytics	Measurement-based FLISR deployed, EPSS functionality targeted for 2024 ADMS Advanced Applications such load flow state estimation in the design phase for initial pilot deployment in 2025
Grid / DER Orchestration	Ability to mitigate distribution capacity constraints by managing a single participating DER or aggregation (H2 2024)
DER Scheduling and Dispatching Tools	DER Dispatch and communications of limits to participating DERs (~10 sites in 2024)
Advanced CAISO Coordination / Communication	Market participants notify CAISO in the event of local dispatch via modification of bids

Policy Gaps

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Policy Gaps for DER Orchestration: What needs to be true to unlock the local DER orchestration opportunity?

In order for DERs to effectively contribute to future grid operations, DERs will need to reliably and cost effectively perform key functions at targeted locations over time. Policy to play a key role in ensuring that certainty via the rules, compensation mechanisms, performance requirements etc.

- **Establishment of standard rules of engagement for participation in orchestration schemes or programs *that can evolve over time***
  - Valuation of distribution services and determination of cost effectiveness. (noting that the value is location and time specific)
  - Rules for how to allocate scarce capacity to electrification loads (Who gets dispatched? Who gets curtailed?)
  - Mechanisms to engage with multiple flexible service providers (multi-vendor, multi-technology)
    - Participation models for heterogenous (mixed) aggregations of distributed generation, storage, and demand response to participate in grid services and wholesale markets
    - Mode of engagement: bilateral agreements, price signals, retail rate design, flexibility markets, dispatchable programs, allocation rules (e.g. FIFO)
  - Compelling value proposition for customers to participate
  - Determination roles, responsibilities and allocation of risks in the more dynamic and decentralized ecosystem codified in rules, tariffs and/or agreements
    - Performance requirements, monitoring, cybersecurity, fail-safes, measurement and verification
    - Contingencies in the event of business failure (e.g. provider of last resort or other provisions)
  - Establishment of customer programs targeted toward distribution grid needs

Policy Gaps for DER Orchestration (continued)

- **Ability to connect and coordinate localized transmission grid needs w/ DER participation and engagement**
  - Cross jurisdictional challenge across FERC and CPUC to align planning processes and participation models for DER
  - Alignment across transmission and distribution planning on forecasting assumptions and requirements for infrastructure planning

- **Resolution of key equity and fairness issues raised by local capacity markets or local pricing**
  - Example: Higher capacity prices at capacity constrained locations
  - Consideration of impacts of DER policies on customers without DERs or load flexibility
  - Potential market power for single DERs on radial circuits

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Policy Gaps for coordination and orchestration between grid needs and energy system

Coordination and communication between market participants is required to scale DER participation while maintaining safety and reliability.

Orchestration across value streams has the potential to unlock value by optimally deploying and operating DERs across multiple value streams (customer, grid, system)

- **Common framework(s) for wholesale market participation:** today's patchwork includes direct participation of DERs, Participation via LSE, Participation via DSO, price signals via real-time pricing other retail rates
- **Information sharing across market actors (T&D Grid Operators, ISO, Market Participants)**
  - Grid impact of DER market participation and other dynamic participation methods (e.g. real time prices, load modifying programs) are unknown to grid operators today
  - Planned and emergent local grid conditions are unknown to market actors (e.g. outages, abnormal configurations)
- **Prioritization between the needs of Distribution Grid and the Energy System** and the mechanisms to coordinate participation across different impacted entities.
  - E.g. What is the sequence of committing resources across various services? What are the procedures for out of sequence dispatch to address emergent conditions?

Proposed Next Steps

Recommendations

- **Resolving Policy Gaps and Developing a Framework**
  - Working group/task force(s) to map out jurisdictional responsibilities, needs, and opportunities to collaborate on a framework for cooperation that enables advanced orchestration.
  - Leverage this work to develop a regulatory framework that is adaptable to future technological advancements in orchestration of DERs. This framework should support scalability, interoperability, and seamless integration of new DERs.
  - Clearly delineate the roles of various parties in removing barriers for the deployment of a pilot.

- **Develop Intersecting Pilots to Determine What a Framework Will Look Like**
  - Focus on targeted pilot programs which will allow us to identify successful paths towards a more robust solution(s).

Recommendations (continued)

- **Iterative Approach for Future Solutions**
  - Initially focus on creating a stable and reliable operational framework. Advanced orchestration can be gradually introduced based on learned experiences and technological maturity.

- **Coordination with CAISO**
  - Strengthen coordination mechanisms between IOUs and with the California Independent System Operator (CAISO) to ensure that the operational needs of both the distribution and transmission levels are met.

- **Equity**
  - Defining and assigning responsibility to ensure equity in customer market participation

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Q&A

15 Minute Break

Please be back at 2:40pm

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Panel 2: Advocates

Amin Younes

Public Advocates Office

Samuel Golding

Utility Consumers' Action Network (UCAN)

Lorenzo Kristov

The Climate Center

Sahm White

350 Bay Area

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High DER Future Grid Study Workshop #2
Gaps in Operations Needed

Amin Younes

Distribution Planning and Policy

March 12, 2023

Operations Needed : Gaps

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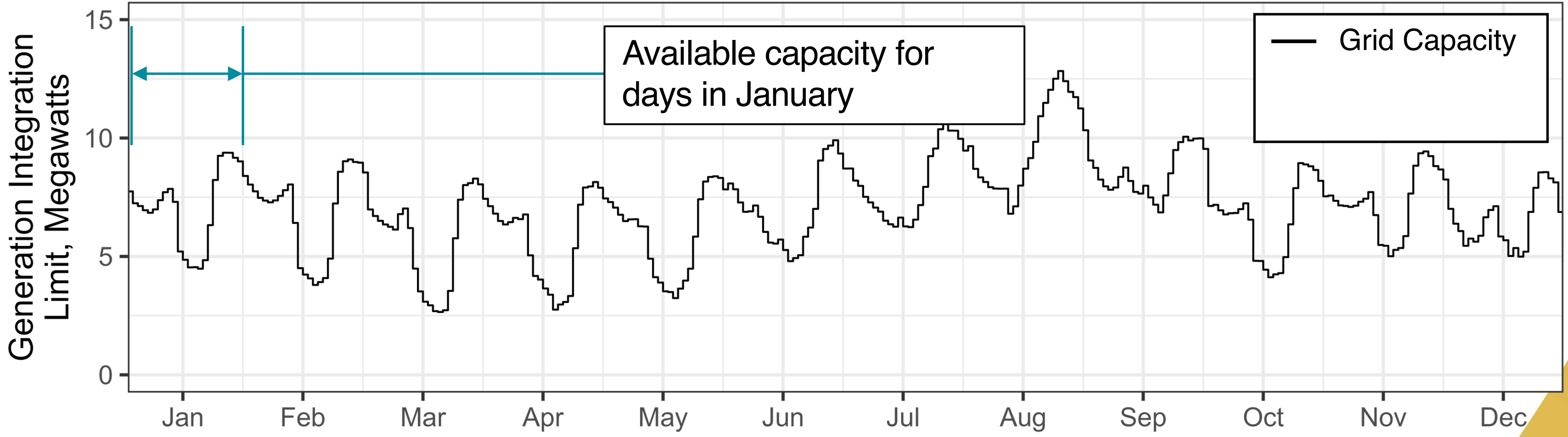
- Operation Needed: Set policy on, authorize, and implement interconnection; **establish DER operating limits** and (smart) inverter requirements.
- Gap: DERs are not always allowed to operate when and as would be most societally optimal.
  - This could be due to inaccurate (or overly conservative) integration capacity analysis (ICA), or other limits, both for imports and exports.
- At present, import and export limits use separate single values of grid capacity: the annual minimum capacity for imports and exports, respectively; this is highly conservative and limits grid utilization.

Status and recommendation:

- The Commission is in the process of applying more than one value per year for export limits, using Limited Generation Profiles (LGP), in the interconnection proceeding.
- The Commission could take a similar approach with respect to load.
  - The Utilities have begun to propose such programs, for example, through Advice Letter 5138-E: *Establishment of Southern California Edison Company's Customer-Side, Third Party Owned, Automated Load Control Management Systems Pilot.*

Flexible import limits

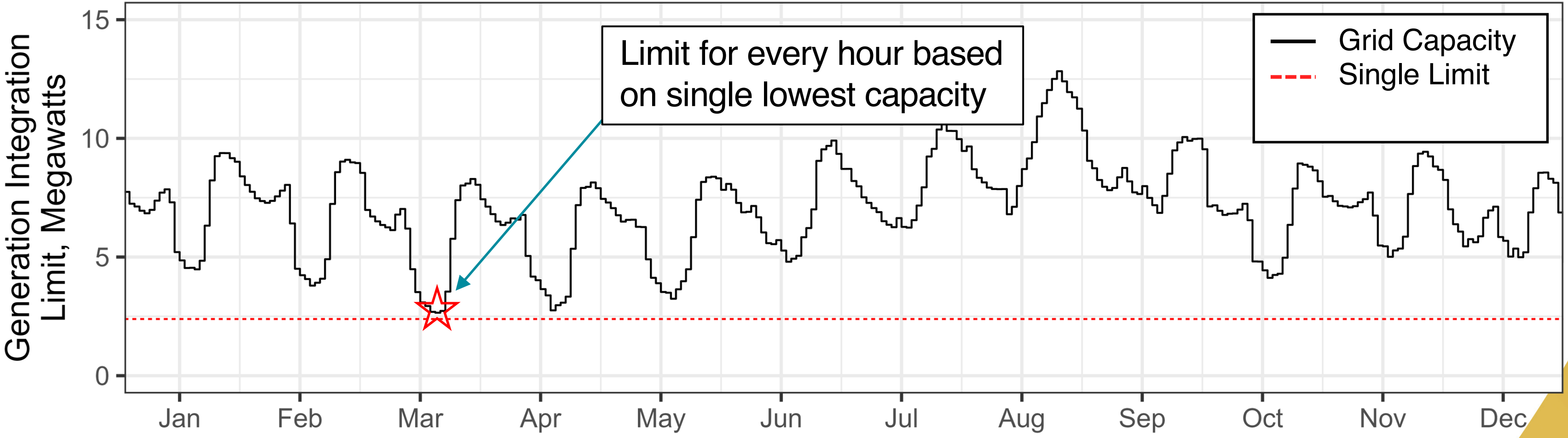
- ICA profiles, as below, provide 288 values per year (12 months X 24 hours = 288).



Data from ICA Release 4, Mulholland 16-kilovolt feeder in the Santa Monica Maintains

Flexible import limits

- At present, the capacity allowed for interconnection is the single lowest value among the 288.
- The same type of limit is applied to load (though not through the ICA).



Data from ICA Release 4, Mulholland 16-kilovolt feeder in the Santa Monica Maintains

Flexible import limits

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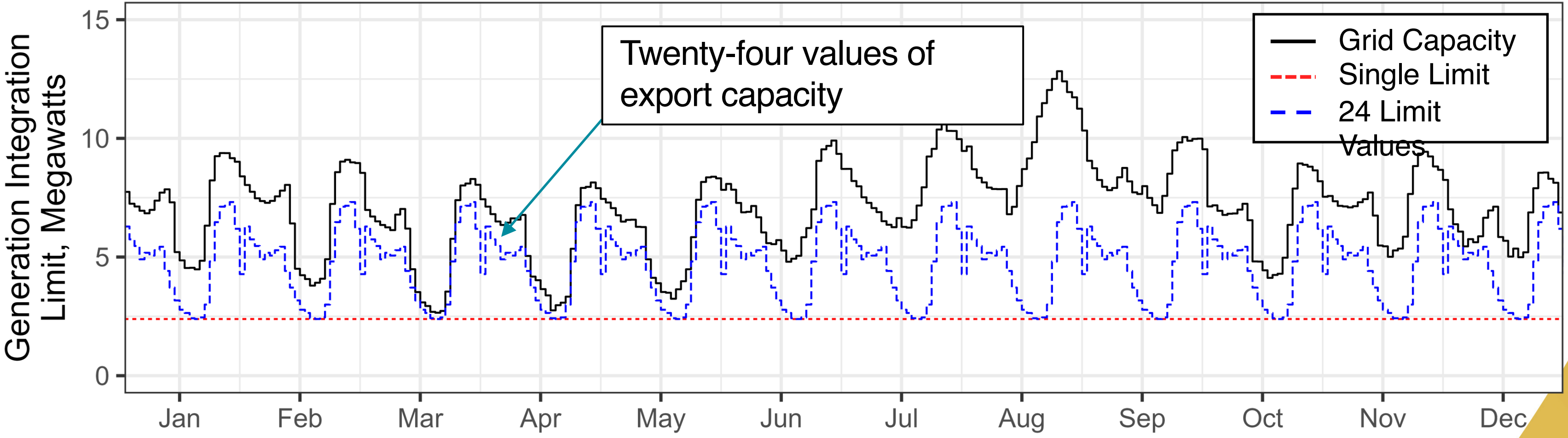
- Moving from a single value to multiple values (for exports **and** imports) can unlock grid capacity.
  - Draft Resolution E-5296 envisages LGPs that use 24 values per year for export limits.
  - Limits can, in principle, be preset, real-time, or a combination (e.g., preset limits with real-time curtailments under grid emergency conditions).



Data from ICA Release 4, Mulholland 16-kilovolt feeder in the Santa Monica Maintains

Flexible import limits

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- A Commission decision that leads to use of flexible import limits could create a standard for Utilities' automated load control systems (otherwise known as flexible interconnections, or flexible import limits).
  - Flexible import limits could provide the short-term benefit to all ratepayers of increased energy sales, which tend to lower rates.
  - Customers in capacity-constrained areas could be energized earlier than they would be if additional capacity had to be built first ("bridge-to-wires").
  - In the long term, the downward pressure on rates* could increase as more customers benefit from flexible import limits.
- Flexible import limits should be standardized. Are standards needed beyond Underwriter Laboratories' UL 3141 (for Power Control Systems)?

*Downward pressure on rates means that rates with flexible import limits could be lower than counterfactual rates, all other things being equal. Rates may still increase overall due to other factors such as wildfire mitigation or clean energy procurement.

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Appendix

Operations needed - reduced

1. Operate distribution grids: Maintain operational flexibility, voltage stability, safety, etc.
2. Maintain grid frequency: Ensure sufficient (local and bulk) inertia, generation capacity, and frequency response.
3. Set policy on, authorize, and implement interconnection; **establish DER operating limits** and (smart) inverter requirements.
4. Choose when to operate (*i.e.*, schedule) DERs.
5. Operate (*i.e.*, dispatch) DERs.
7. **Model and monitor DER and non-DER data and convey to transmission operator.**
8. *e.g.*, develop the function $Net\ Demand = f(Price)$.
   Manage data access for all data relevant to distribution grid operation: Track DER performance and interconnection characteristics, DER state-of-charge, cost of operation, historical performance, aggregator data, real-time prices. Manage confidentiality and data access.
9. **Set appropriate rates for consumption and generation based upon cost causation.**
   - Prevent market manipulation.
10. System defense and restoration (*e.g.,* cybersecurity, emergency load reduction, resiliency, black start).

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R. 21-06-017, Track 2: Future Grid Workshop #2

Gaps & Barriers for California's High DER Future

March 12, 2024

Future Grid Workshop #2: Gaps & Barriers

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Workshop #1

"What are the operational needs necessary to efficiently operate a high DER grid, unlock economic opportunities for DERs to provide grid services, limit market power, reduce ratepayer costs, increase equity, support grid resiliency, and meet State policy objectives?"

Workshop #2

"What are the existing gaps and barriers in achieving the needs identified above within our current Distribution System Operator (Utilities)?"

Workshop #3

"What are the potential solutions in overcoming these barriers?"

Summary of UCAN's Recommendations

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Statewide Platforms to enable operational requirements

- Data Hub: "API of APIs" ensures data access for all parties
- DER Register: database tracks location / capabilities of DER
- DER Market: facilitate trading & scheduling DERs, microgrid & CAISO coordination.

Market Reforms to enhance operational efficiency

- Shift to 5-/15- minute smart meter and CAISO scheduling intervals
- Leverage AMI capabilities
- Implement LMS dynamic rates (Load Management Standards)
- Expand DER submetering
- Enable Supplier Consolidated Billing for CCAs + fix for ESPs
- Allocate transmission costs to LSEs
- Count Community-Scale DER as wholesale load reducers

Statewide Platforms

Functions to enable new operations:

1. Reliable data access & communications across market entities
2. Enhanced tracking & monitoring of DER assets
3. Distribution-level market to orchestrate DER dispatch & coordinate with CAISO

Underlying Data Exchange Requirements

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- Substantial cost, friction, and lack of interoperability associated w/ accessing multiple data types siloed within each utility:
  - Advanced Metering Infrastructure (AMI) Network
  - Customer Information System (CIS) & billing
  - Meter Data Management System (MDMS)
  - Advanced Distribution Management System (ADMS)
  - Distributed Energy Resource Management System (DERMS)
- Similar challenges re: accessing useful data from aggregators / DERs.
- **Operations require standardized and extensible approach to ensure accurate data, efficient data access — at appropriate latencies — and data interchange across entities (utilities, LSEs, DER providers, CAISO, regulatory agencies).**

Smart Grid: Legislative Intent

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- **Community Choice**: AB 117 (Migden, 2002) directed IOUs to provide "*metering, billing, collection, and customer service*" for CCAs, predicated on the assumption that IOUs "*cooperate fully*" with CCAs (and that the CPUC "*enforce the requirements*").
- **Smart Grid**: SB 17 (Padilla, 2009) charged the CPUC with adopting "*standards and protocols to ensure functionality and interoperability developed by public and private entities*", recognizing that "*products, technologies, and services*" could be provided "*by entities other than electrical corporations*".
- **Customer Authorization:** SB 1476 (Padilla, 2010) established privacy requirements for sharing customer data with 3rd parties (DER aggregators), requiring IOUs to exercise "*reasonable*" processes for customers to authorize 3rd parties.
- **CCA Bill of Rights**: SB 790 (Leno, 2012) recognized that "*The exercise of market power by electrical corporations is a deterrent to [CCAs]... It is therefore necessary to establish a code of conduct, associated rules, and enforcement procedures, applicable to electrical corporations in order to facilitate the consideration, development, and implementation of [CCAs], to foster fair competition, and to protect against cross-subsidization by ratepayers.*"
- **PUC § 366.2(c)(9) and PUC § 8380 require the IOUs to provide CCAs with *"incremental... meter-specific electricity data to the extent produced by [advanced metering] infrastructure".***

Customer Data Access Barriers (CCAs)

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R.20-11-003 (Extreme Weather OIR):

- January 2021 – CAISO Final Root Cause Analysis confirmed UCAN's testimony that IOU non-provision of daily interval data to CCAs contributed to August 2020 rolling blackouts; CalCCA clarifies that PG&E ShareMyData Platform is unreliable and that SCE & SDG&E have ignored CCA requests.
- February 2021 - UCAN demonstrates that the IOUs: (1) collect/validate Smart Meter data daily, finishing 2+ hours prior to CAISO's 10AM demand-bid window, and (2) technically able to provide 3rd parties daily Smart Meter data updates — which they transmit to IOU contractors — but have "*chosen to disregard their statutory obligation, Commission orders and requests by CCAs to do so*."

R.22-07-005 (Demand Flexibility OIR):

- October 2023: Working Group report clarifies that SCE and SDG&E are implementing platforms to provide Smart Meter interval data to CCAs.
- December 2023: CalCCA agrees w/ PG&E's recommendation to hire "*neutral independent consultant*" to resolve PG&E ShareMyData platform data access problems (proposed decision pending).

Customer Data Access Barriers (DER Aggregators)

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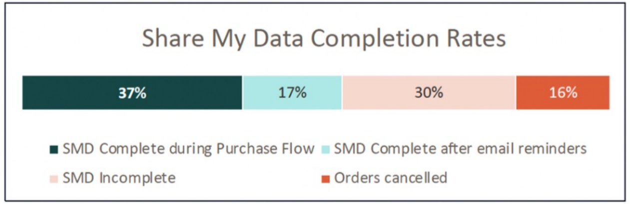
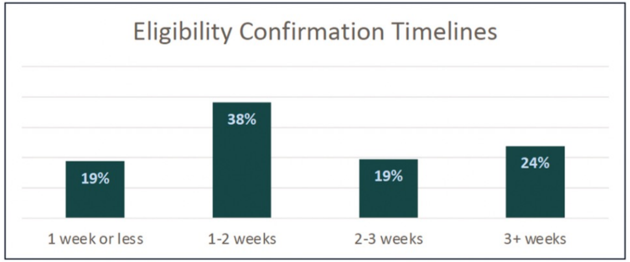
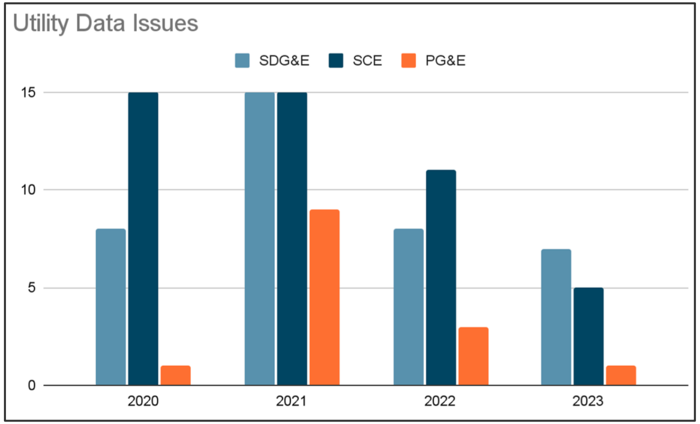
- Broken data authorization process: ~50% customers drop out & fail to authorize sharing.
- Broken IOU Green Button Connect platforms: inconsistent, often unreliable, burdensome.
- Poor, delayed customer service by IOUs.
- No service-level performance requirements.
- Data shown is tracked by ecobee, Ohmconnect, self-reported by customers.

Utility Outage Hours by Year

	YEAR	PGE	SCE	SDGE
1	2018	30.25	68	93.5
2	2019	166.1667	489.7833	1741.85
3	2020	136	194.3	83.7833
4	2021	248.0833	435.55	703.9167
5	2022	60.4167	133.1667	164.2333







Source: 23-LMS-01, 1/17/24 workshop, UtilityAPI slides and recording (at 59:00) & CEDMC comments

Customer Data Gaps (Phase 1 Kevala Study)

- AMI measurement anomalies and collection gaps examples provided:
  - General need to ID invalid reads & clean up "outliers and missing data" in IOU datasets.
  - Physically impossible level of load recorded across most PG&E meters on April 7, 2018.
  - 1 million SCE meters missing observations in March 2020.
  - Similar gap in SDG&E meter reads in April 2020.
- Noted inaccuracies in customer information (e.g., misaligned NAICS codes, residential coded as nonres)

Distribution System Data Gaps (Phase 1 Kevala Study)

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Accurate mapping between feeders and transformer banks is critical information to enable identification of points of potential distribution grid overload & opportunities to manage via DER services and load transfers.

- Feeders missing a join to a substation bank:
  - PG&E = 13% missing
  - SCE = 14% missing
  - SDG&E = 17% missing
- Transformer bank ratings incomplete for SCE.

Table 11: Summary of number of substations, transformers, feeders, and related data, missing data highlighted orange *(Source: Kevala)*

	PG&E	SCE	SDG&E
Unique Service Transformers	838,170	562,534	159,686
Service Transformers Missing a Rating	38,506	168	1,594
Service Transformers Missing a Parent Feeder	0	0	0
Service Transformers Missing a Parent Substation	0	3,274	0
Unique Feeders	3,131	4,140	995
Feeders Missing a Rating	**460**	**104**	**216**
Feeders Missing a Parent Substation Transformer	**402**	**580**	**169**
Feeders Missing a Parent Substation	0	72	0
Unique Substation Transformers	1,035	843	176
Substation Transformers Missing a Rating	6	**208**	0
Substation Transformers Missing a Parent Substation	0	15	0
Unique Substations	747	714	282

Note: notable data issues related to grid connectivity and ratings are denoted with **bold** text.

DER Data & Integration Gaps (Phase 1 Kevala Study)

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- Poor battery storage interconnection records:
  - Energy rating (KWh) — 80% of records missing.
  - Capacity rating (KW) — instances of “clearly erroneous” ratings (e.g., zeros or MW-scale capacities on residential homes).
- Electric Vehicle records sourced from DMV.
- Challenges in linking DER interconnection data, service points, premises, and meters — examples provided:
  - Single meters mapped to multiple end points.
  - Bad dates for meter IDs (read dates were flipped or mismatched).
  - DER interconnection data that could not be matched to premises.
  - Meters or service points that lacked corresponding distribution data (downstream feeders or substations).

Market Reforms

Actions to promote efficient operations

Leveraging AMI Networks + Wholesale Alignments

- CAISO previously proposed — and then withdrew — shifting the day-ahead market from hourly to 15-min intervals (see 2nd Revised Straw Proposal for Day-Ahead Market Enhancements Phase 1: Fifteen-Minute Granularity, August 2018)
- Current market rules permit LSEs to settle load in 15-minute **or** hourly intervals, based upon underlying meter interval granularity.
  - Mass market (residential, most commercial) records hourly intervals.
  - Prior IOU reports show AMI communications networks have excess capacity & that backhaul reporting frequency / meter sampling rates could be shortened at low-cost — with shorter intervals supporting advanced services for DER customers.
- CPUC oversight required to ensure that AMI deployments & GridMod plans support enabling CCA / ESP / DER aggregator innovation.

Supplier Consolidated Billing

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- Consolidated ESP Billing requirements impose barriers to adoption. Example from PG&E Rule 25: Direct Access*
  - Consolidated PG&E Billing: "*PG&E will not forward any amounts owed to the ESP that have not been received from the customer.*"
  - Consolidated ESP Billing: "*Under this option the ESP must pay all undisputed PG&E charges to PG&E regardless of whether the customer has paid the ESP.*"

*Similar language in SCE Rule 22 and SDG&E Rule 25

Billing Method for Direct Access Customers

	PG&E	SCE	SDG&E
Consolidated IOU Billing	16.80%	15.14%	19.60%
Consolidated ESP Billing	0%	0.26%	<1%
Dual Billing	83.20%	84.60%	80.30%

Source: R.20-11-003, IOU responses to UCAN data requests (Feb 2021)

- CPUC authorization need to enable Consolidated CCA Billing — also dual billing — while addressing Consolidated ESP Billing barriers.

LMS Implementation & Retail Transmission Rates

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- SCE proposed delaying LMS implementation by 5 years.
  - UCAN protested and prevailed in D.24-01-032.
- PG&E + SDG&E attempted to avoid CPUC oversight of how transmission costs are recovered via dynamic retail rates:
  - UCAN recommended CPUC first approve PG&E and SDG&E dynamic transmission rates prior to submission to FERC — as SCE has proposed — plus updates to Resolution E-3930 to clarify and standardize the process for all IOUs.
  - FERC Order 888 indicated that FERC would defer to state regulators to "*accommodate the design and special needs*" of retail transmission rates in states that allowed customer choice.
  - UCAN cited to legal precedent & examples where other state regulators implemented dynamic transmission pricing and/or had shifted transmission cost recovery to LSEs (permitting retail rate innovation so long as total transmission costs were recovered).
  - Issue is pending a decision in R. 22-07-005 (OIR to Advance Demand Flexibility Through Electric Rates).
- CPUC action required to exercise oversight over dynamic transmission retail rate design and/or allocating transmission costs to LSEs for recovery in rates.

Accounting for Community-Scale DER as Load Reducers

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- DER connected to distribution grid can operate under PUC jurisdiction (instead of registering as a supply resource w/ CAISO).
- SCE recently proposed* utility-owned storage projects that would:
    1. *"be interconnected to non-CAISO-controlled portions of the electric system under the jurisdiction of the Commission and the operational control of SCE and operate outside of the CAISO wholesale market."*
    2. *"be located at or near substations with the purpose of providing benefits to the overall system, such as within load pockets, local capacity requirement areas, or substations in areas with significant solar generation, and would provide reliability by discharging to the grid during the peak and net peak periods and charging during high solar or low load periods."*

    **See R. 20-11-003, SCE Reply Brief, 27 September 2021*
- CPUC action required to "level the playing field" via new mechanism allowing CCAs / ESPs to fully count community-scale DER as wholesale load reducers (to lower wholesale energy + RA obligations + transmission costs).

Questions?

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San Diego's Utility Watchdog

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SECURING YOUR COMMUNITY'S ENERGY FUTURE

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References and Citations

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15 Minute Break

Please be back at 4:05pm

Discussion

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1. Are there elements of the IOUs' proposed upgrades to distribution IT systems that would support the operational needs identified by advocates? (e.g. flexible interconnection, data sharing, open access, bottom-up system architecture)
2. Are there any specific functional requirements that need to be included in the IOUs' proposed upgrades to distribution IT systems?
3. What else is needed?

Discussion

IOU presentations have articulated the need for grid orchestration. Workshop presentations appear to differ on the conductor. IOU presentations indicate a central role for utilities as conductor. Advocates have proposed market mechanisms as conductor.

1. What is your perspectives on grid orchestration in a High DER future?
2. What are the gaps in future operations to support this vision?

NEXT STEPS

Workshop #2 Summary posted on the Gridworks California Future Grid Study page and distributed via email prior to Workshop #3

Join us for Workshop #3 in **April**

Please take a moment to fill out a slido feedback survey

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