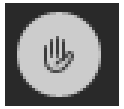
High DER: Integrated Capacity Analysis (ICA) Q1'25 Workshop

Joint Presentation by PG&E, SCE, and SDG&E

March 7, 2025

Welcome

Logistics

- All attendees have been muted.
- To ask questions, please ‘raise your hand’  and a host will unmute you so you can ask your question.
- If you would rather type, use the “Chat” function. Questions will be read aloud or responded to in the chat; attendees may be unmuted to respond to the answer verbally.

  *Reminder: Please press mute when done speaking 

Chat Participant List Raise Hand Settings Turn Camera on / off Mute / Unmute

Introduction by the Commissioner's Office

Opening Remarks

Commissioner Darcie Houck

Workshop Agenda

Agenda

Topic	Presenter	Time
Welcome and Opening Remarks	ED/Commissioner/IOUs	9:00 – 9:30
SCE's ICA Presentation and Q&A	SCE	9:30 – 10:45
Break (10 min.)	All	10:45 – 10:55
PG&E's ICA Presentation and Q&A	PG&E	10:55 – 11:55
Lunch	All	11:55 – 12:30
SDG&E's ICA Presentation and Q&A	SDG&E	12:30 – 1:30
Break (5 min.)	All	1:30 – 1:35
Stakeholder Discussion	All	1:35 – 2:25
Next Steps	IOUs	2:25 – 2:30

Regulatory Background

Regulatory Reporting Requirements

- On September 9, 2021, the ALJ issued a Ruling ordering the IOUs to:
  - begin making specific changes to their load integration capacity analysis (ICA) inputs, assumptions and methodology;
  - file ICA Refinements Annual Reports starting in the Fourth Quarter of 2022.
- On October 23, 2024, the CPUC issued Decision 24-10-030, which among other things, modified reporting ICA requirements as follows:
  - IOUs were to create a biannual ICA and Data Portal report, consolidating all previous ICA and Data Portal reports;
  - The first standalone biannual ICA report, in addition to consolidating all previously mandated reports, would describes all known issues related to ICA accuracy and missing or erroneous ICA values, for both Generation and Load ICA;
  - The report would also provide specific remediation plans and timelines for these known issues.
  - Each IOU served its first biannual ICA report on Jan. 31, 2025.

Regulatory Requirements Regarding Workshops

- The October 2024 Decision, Ordering Paragraph (OP) 35, required the IOUs to:
  - hold a quarterly Integration Capacity Analysis (ICA) public workshop by the end of each calendar quarter, including the following agenda items:
    - all known and identified issues with Load and Generation ICA, including but not limited to eliminating false zeroes, resolving inactive circuits and demonstrable substation reverse flow, and determining how to assess ICA accuracy and data validation in a fair manner;
    - proposed and adopted ICA remediation plans, timelines, and progress of plans;
    - Stakeholders feedback on ICA.
  - OP35 also noted: "Workshops without an associated biannual report release will serve as a discussion forum to address updates between the biannual reports, newly identified issues, and other stakeholder concerns and comments."

SCE's ICA Presentation

Agenda

Topic	Presenter	Duration
SCE ICA Methodology	Antonio Nunez	5 Minutes
Load ICA Update	Kate Torres & Cory Kienzle	10 Minutes
ICA Inactive Criteria Update	Armando Chacon	10 Minutes
ICA Accuracy and Missing Results Update	Carley Gomez	15 Minutes
DRPEP Update	Lawrence Yonathan	15 Minutes

SCE ICA Methodology

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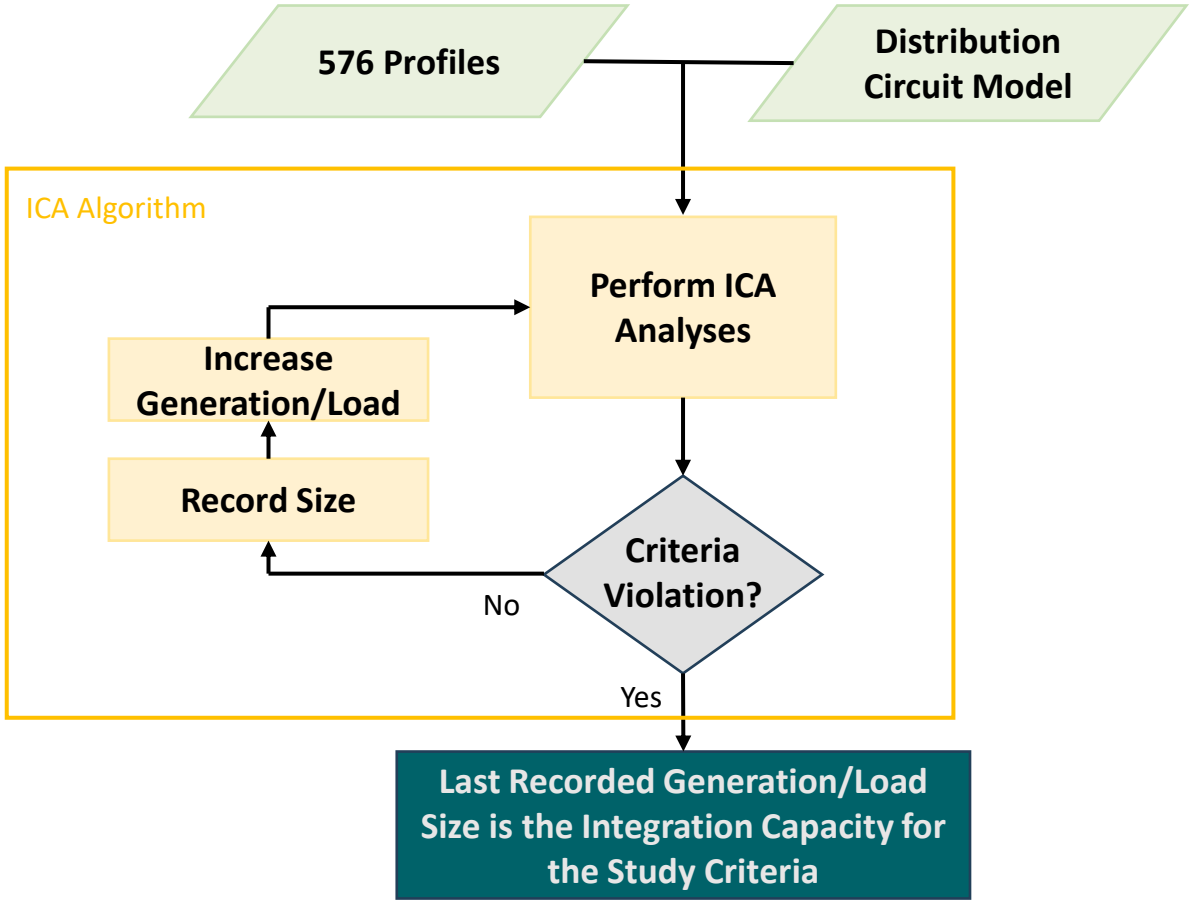
SCE - ICA Methodology

ICA Study Criteria	Generation ICA	Load ICA
Steady State Voltage (SSV) Identifies the maximum amount of load or generation that can be connected without violating adopted ICA voltage criteria (Customer service voltage exceeding ± 5% for generation ICA and +5% - 1.6%[1] for load ICA on a 120V base)	✓	✓
Voltage Fluctuation Identifies the maximum amount of load or generation that can be connected without causing a voltage variation of 3% or more	✓	✓
Thermal Limit Identifies the maximum amount of load or generation that can be connected without causing thermal overloads on equipment	✓	✓
Protection Identifies the maximum amount of generation that can be connected without causing loss of end of line (EOL) visibility on our protection devices	✓	
Operational Flexibility Identifies the maximum amount of generation that can be connected without causing reverse power flow at SCADA devices	✓	

[1] **Sept. 9, 2021 ALJ Ruling increased the lower bound of SSV from 114 V to 118 V for Load ICA**

SCE - ICA Iterative Methodology



Load ICA Update

Load ICA Updates – Long-Term Planning Tool and System Modelling Tool (LTPT-SMT)

The ALJ's Ruling Ordering Refinements to Load Integration Capacity Analysis, issued on September 9, 2021, in (R.)14-08-013 (the Sept 2021 Ruling), mandated several refinements. SCE refers to the enhanced load ICA as Forecast Load Integration Capacity Analysis (FLICA). SCE continues to implement tools, improve internal processes, and enhance methodologies to meet these requirements.

Target Year Delivery	Milestone Description	Status
2023 Q4	LTPT-SMT Vendor Selection & Business requirement Document	Completed
2024 Q4	Implementation of a single, integrated environment for data storage	Completed
2024 Q4	Implementation of Structure Level Forecast (SLF)	Completed
2024 Q4	Load Flow Engine Phase 1 – Balanced Load Flow	Completed
2025 Q4	Load Flow Engine Phase 2 – Unbalanced Load Flow	In Progress
2026 Q1	LTPT-SMT User Interface Implementation	In Progress
2026 Q1	Protection Capability	Not Started
2026 Q2	Load & Gen ICA Studies	Not Started
2026 Q3	FLICA starts publishing in DRPEP	Not Started

Load ICA Updates - Aggregated Load ICA Metrics

- Pursuant to Ordering Paragraph (OP) 2 of the Sept 2021 Ruling, SCE provides an updated account of aggregated Uniform Load Metrics.

- SCE identified two methodologies to evaluate the distribution of load ICA results:
  - **Most Limiting Hour Methodology –** The row of zeroes using this methodology represents the count and percentage of nodes with at least one (out of the 576 hours simulated for that node) uniform load ICA result equal to zero, and accounts for only the most limiting hour. This can create a false perception of sustained low capacity for additional load, therefore the node-hour methodology was also included in this report.
  - **Node-Hour Methodology -** This methodology considers the total number of node-hours (total number of nodes * 576) instead of just the most limiting hour, which addresses the shortcomings of the Most Limiting Hour Methodology by considering all uniform load ICA results for each node.

Distribution of Load ICA Results as of January 2025

	Most Limiting Hour Methodology		Node-hour Methodology	
Uniform Load ICA Range	Count	Percent	Count	Percent
Zeroes	602,469	42.81%	77,135,513	9.52%
>0-100 kW	31,268	2.22%	8,026,046	0.99%
>100-500 kW	63,839	4.54%	24,757,219	3.05%
>500-1,000 kW	75,432	5.36%	31,689,469	3.91%
>1,000-2,000 kW	172,794	12.28%	85,215,940	10.51%
>2,000-3,000 kW	182,285	12.95%	153,684,229	18.96%
>3,000-4,000 kW	123,579	8.78%	131,486,009	16.22%
>4,000-5,000 kW	72,401	5.14%	65,725,468	8.11%
>5,000 kW	83,285	5.92%	232,401,774	28.67%
Null	N/A	N/A	512,509	0.06%
Total	**1,407,352**	**100%**	**810,634,176**	**100%**

Progress Report: Distribution of Load ICA Results as of January 2025 compared with Distribution of Load ICA Results as of November 2023:

- Most Limiting Hour Methodology: *~24% decrease* in nodes with zero Uniform Load ICA Capacity
- Node-Hour Methodology: *~14% decrease* in nodes with zero Uniform Load ICA Capacity

ICA Inactive Criteria Update

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ICA Inactive Criteria

In 2023, SCE identified data quality gaps, modeling, and tool limitations, which were communicated to the CPUC in reports shared with applicable service lists. Since then, SCE has been able to mitigate issue on a number of circuits, resulting in a reduction from 30% to 27% of distribution circuits falling into inactive status.

- It should be noted that progress on reducing the number of impacted circuits may not be linear; therefore, reactivation of circuits will take place as incremental mitigation steps are completed, previously inactive circuits are queued, and the restudy is completed.

- SCE's inactive criteria consists of both short and long-term criteria. These criteria are not mutually exclusive, as circuits can meet multiple criteria causing them to be inactive.
  - Short-term inactive criteria include circuits that cannot be processed through ICA without further mitigation via deployed solutions for data quality and tool challenges.
  - Long-term inactive criteria include circuits that cannot be processed through ICA until mitigation solutions are developed for data quality and modeling challenges.

ICA Inactive Circuit Metrics

	Number of Circuits	Number of 3 Phase Nodes
Active	3,027	980,359
Short-term Inactive	706	286,700
Long-term Inactive	384	135257
Total Inactive Circuits	1,090	

Short-Term ICA Inactive Criteria

Criteria	Challenge	Mitigation/Timeline
Primary Meter Connectivity and Profiles	• 692 circuits impacted • Circuits missing connectivity and associated profiles needed data for large, impactful customers	• Solution: Improved mapping of primary metered customers as well as improved capture of primary metered customers' load contribution (load profile enhancements) - currently slated for Q4 2025
Reverse Flow: Negative Gross Profiles	• 16 circuits impacted • Negative values in circuit gross load profiles	• Manual correction • Slated for completion by Q4 2025
Technical Profile Limitation	• 0 circuits impacted • Circuits must have 12 months of usable profiles	• Not ICA Eligible • SCE anticipates regularly having some circuits without twelve months of profiles ○ E.g., new distribution circuits, non-customer serving circuits that have not been fully built out
Technical Simulation Limitations	• 0 circuits impacted • Complex circuits cannot complete a full run of ICA, resulting in missing or incomplete values due to simulation tool timeout errors	• Short-Term Remediation Plan: Modifications were made to allow processing circuits with a run-time of >25hrs • Long-Term Remediation Plan: implementation of the new LTPT-SMT in Q3 2026
Technical Model Limitation	• 2 circuits impacted • Circuit models are unable to load when two or more circuits are associated with identical equipment	• Current Solution: ICA updates the cleansed models manually • Long-Term Solution: SCE is creating scripts to address this issue systematically and is presently undergoing proof of concept testing

Long-Term ICA Inactive Criteria

Criteria	Challenge	Mitigation/Timeline
Power Flow Tool Limitations	• 286 impacted circuits • Existing power flow tools cannot appropriately model all equipment types with applicable settings/unique network configurations to be usable by the ICA algorithm and suitable for ICA study cases	• SCE is developing a new tool, LTPT-SMT, discussed earlier • FLICA capabilities by Q3 2026 • Comprehensive planning abilities 2028+
Child Substations	• 297 circuits impacted • Distribution-to-distribution level substations. Operational across various distribution voltage levels in both looped and non-looped (radial) system configurations with high and low-side voltages of less than 66 kV. Any alterations to the child circuits have a direct impact on the capacity of the parent circuit, which in turn imposes a limitation on the child circuits	• SCE is undergoing a manual data collection and validation effort with an estimated completion of Q2 2025 • Radially-fed child substations are projected to be incorporated into ICA in Q3 2026 with development of new LTPT-SMT • Loop-fed child substations require development of a long-term mitigation tool to ensure the parent system and child substation loadings are accurately represented (incorporated into LTPT-SMT 2028+)

ICA Accuracy and Missing Results Update

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Challenges to Accuracy and Missing Results

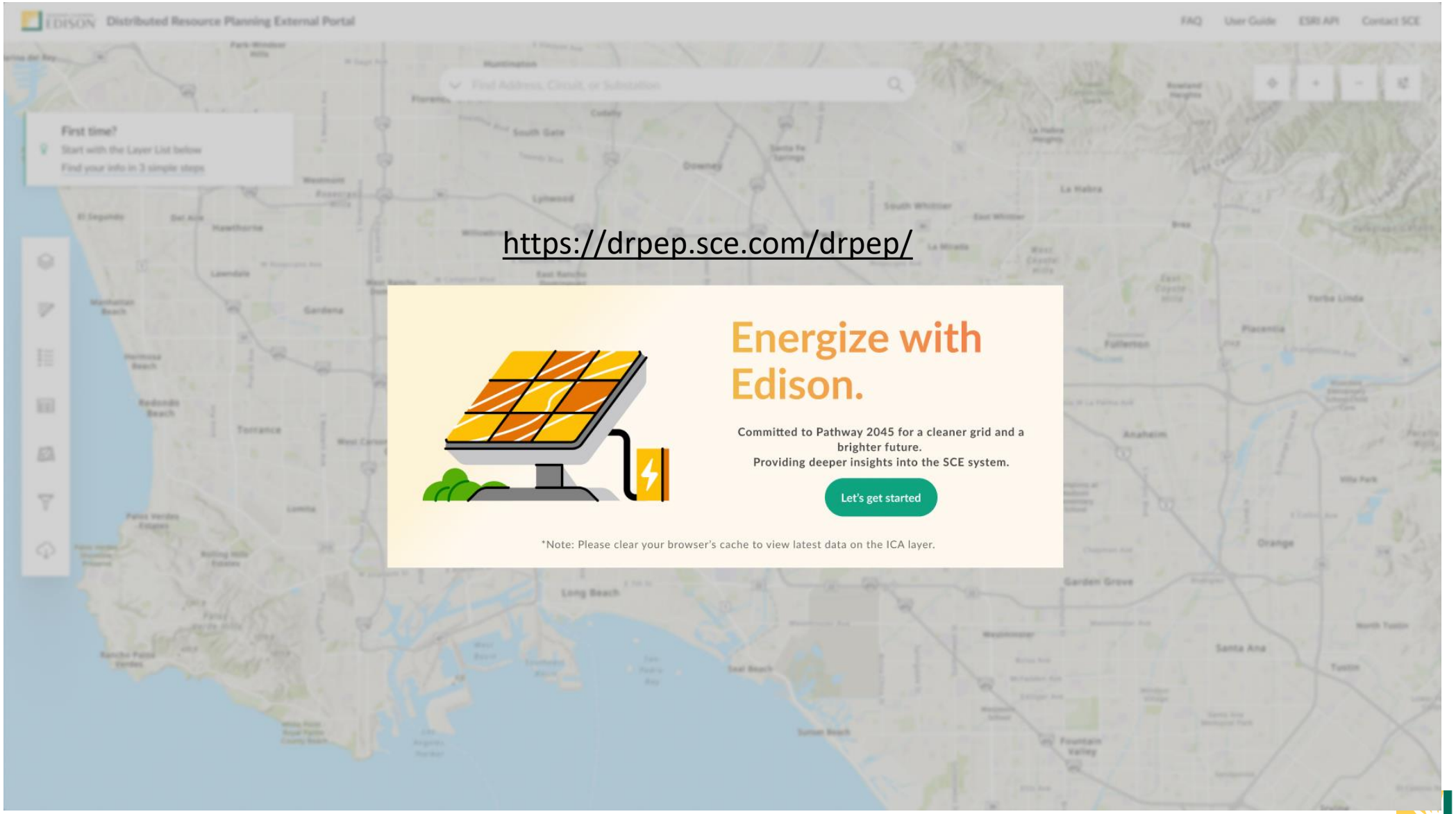
Criteria	Challenge	Mitigation/Timeline
Connected kVA vs. Actual kVA	SCE's ICA uses actual available kVA information, in some instances this information is inaccessible for ICA study application	• ICA currently backfills missing loading information with connected kVA rating • Actual loading information is prioritized • May introduce some inconsistencies amongst various engineering studies
Comprehensive Data Analysis	SCE's ICA examines all three-phase nodes for all 576 hours vs. single-hour peak or off-peak analysis (as conducted by various engineering groups)	• Currently no plans to alter this process. Engineering groups conduct various studies for different purposes, and multiple studies from different groups may be necessary to obtain a comprehensive understanding of capacity availability and potential customer connection solutions
Engineering Assumptions in Cases of Inaccessible Data	When actual field data is unavailable in a digital format (appropriate for model ingestion), engineers must rely on informed connectivity context to estimate the inaccessible information	• ICA has collected, verified, and corrected data where possible. • 2024: Partnered with various engineering groups within SCE to mitigate and/or correct connectivity data specific to substation bank information/modelling, circuit and substation association, and child substation capture/modelling • Data collection to continue through 2026
As-Is Model Study	ICA study simulations are run using a circuit model without forecasted load growth projects as well as any planned mitigations to accommodate new load or generation projects	• To address this in the interim, SCE has published the Available Load Capacity layers in DRPEP to provide more comprehensive insight to the system's capacity for additional load. • Long term, this limitation will be addressed with the implementation of FLICA in Q3 2026.
Generation Queue Integrity	ICA is mandated to include all queued generation projects in Generation ICA studies regardless of queue order	• ICA has proposed requirements for LTPT-SMT to create separate ICA values for each generation interconnection request, this capability is anticipated to be integrated post 2026.

DRPEP Update

DRPEP New Features

Capabilities	Feature Benefits
DRPEP New UI *Completed 12/31/24*	Complete redesign of the DRPEP UI, guiding new users to their information of interest faster
Introduction of A-Bank Available Load Capacity Values *Completed 12/31/24*	Providing users with new insights into the capacity of a portion of the subtransmission system, extending beyond the distribution system
ALC / Heatmap Toggle Options *Completed 12/31/24*	Provides more flexibility for users to easily customize Available Load Capacity (ALC) information by type of load growth project, specific year or by Main Level Available Capacity levels
ICA Inactive Circuit Layer *Completed 8/29/24*	Users are now able to find ICA circuits that are missing from the ICA layer and their specific status
Load Growth Penetration Layer *Completed 2/27/25*	Quickly identify areas that are affected by forecasted customer demand within the next 5 years

DRPEP Live Demo



DRPEP Upcoming Features

Capabilities	Upcoming Feature Benefits
Limited Generation Profiles *Target Date: 6/27/25*	Customers will be able to download templates with pre-populated maximum Limited Generation Profile (LGP) values directly from DRPEP before starting the LGP application process
Introduction of Subtransmission Line Capacity *Target Date: 8/28/25*	Providing additional insights into subtransmission system capacity by incorporating subtransmission line limitations
Subtransmission Hosting Capacity Heatmap *Target Date: 11/20/25*	Mandated by FERC Order 2023, users will now be able to quickly understand generation hosting capacity at each substation within the SCE territory
Improvements to ICA layers *Target Date: 12/31/25*	Providing more insights into the ICA results and more flexibility within the load profile graphs and Application Programming Interface (API)

DRPEP Bugs/Fixes

Bugs	Description
Uniform Gen values swapped with Opflex values	With the new redesign, there was a small bug where the column names for uniform gen values were swapped with Opflex values. The data was correct but displayed in the wrong sections within the widget. This was resolved swiftly once reported back in the start of 2025

Q & A

Q&A for SCE

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PG&E's ICA Presentation

Load ICA Methodology (Current and After Refinements)

Current Load ICA Inputs

Historical Load: 576 Hourly Profile

Network Topology (Distribution Circuit Model): "As Is“

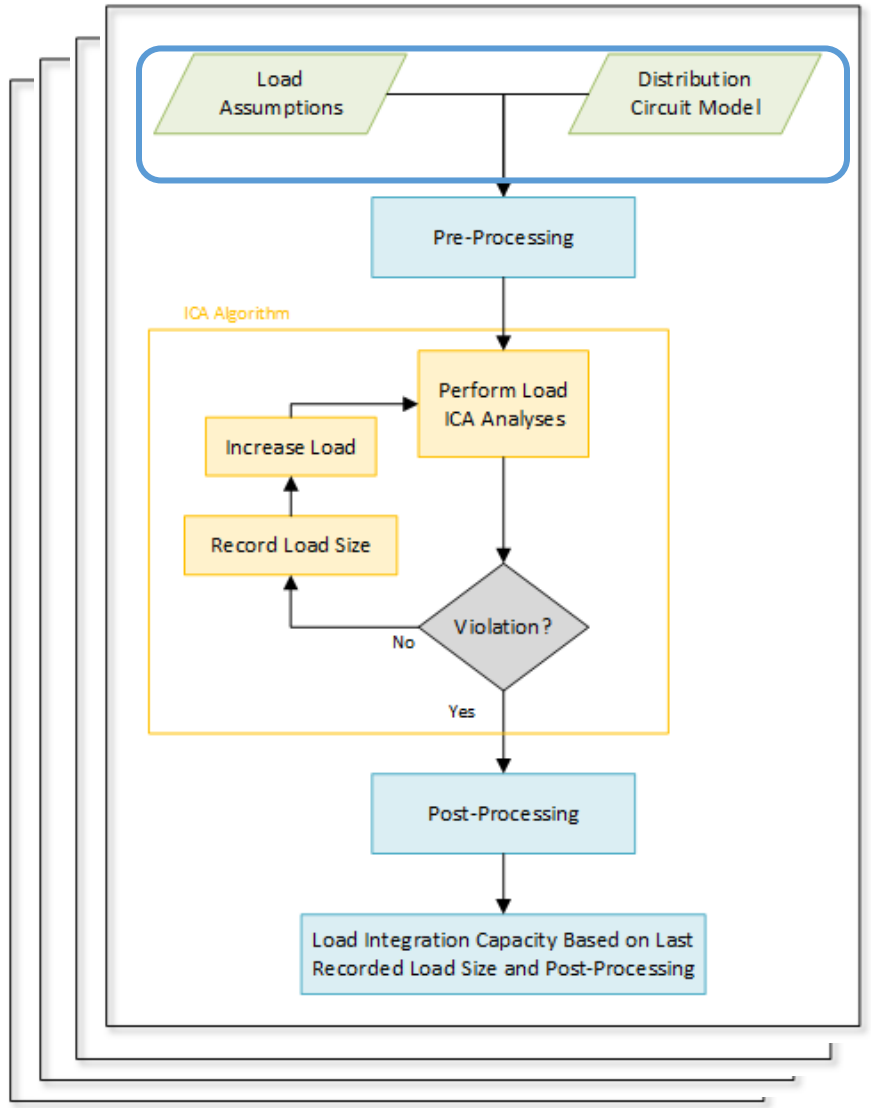
Load ICA Inputs After Refinements

Future Load: 576 Hourly Next Year Load Forecast

- Next Year DER Growth
- Next Year Load Forecast
- Future Approved Load Projects

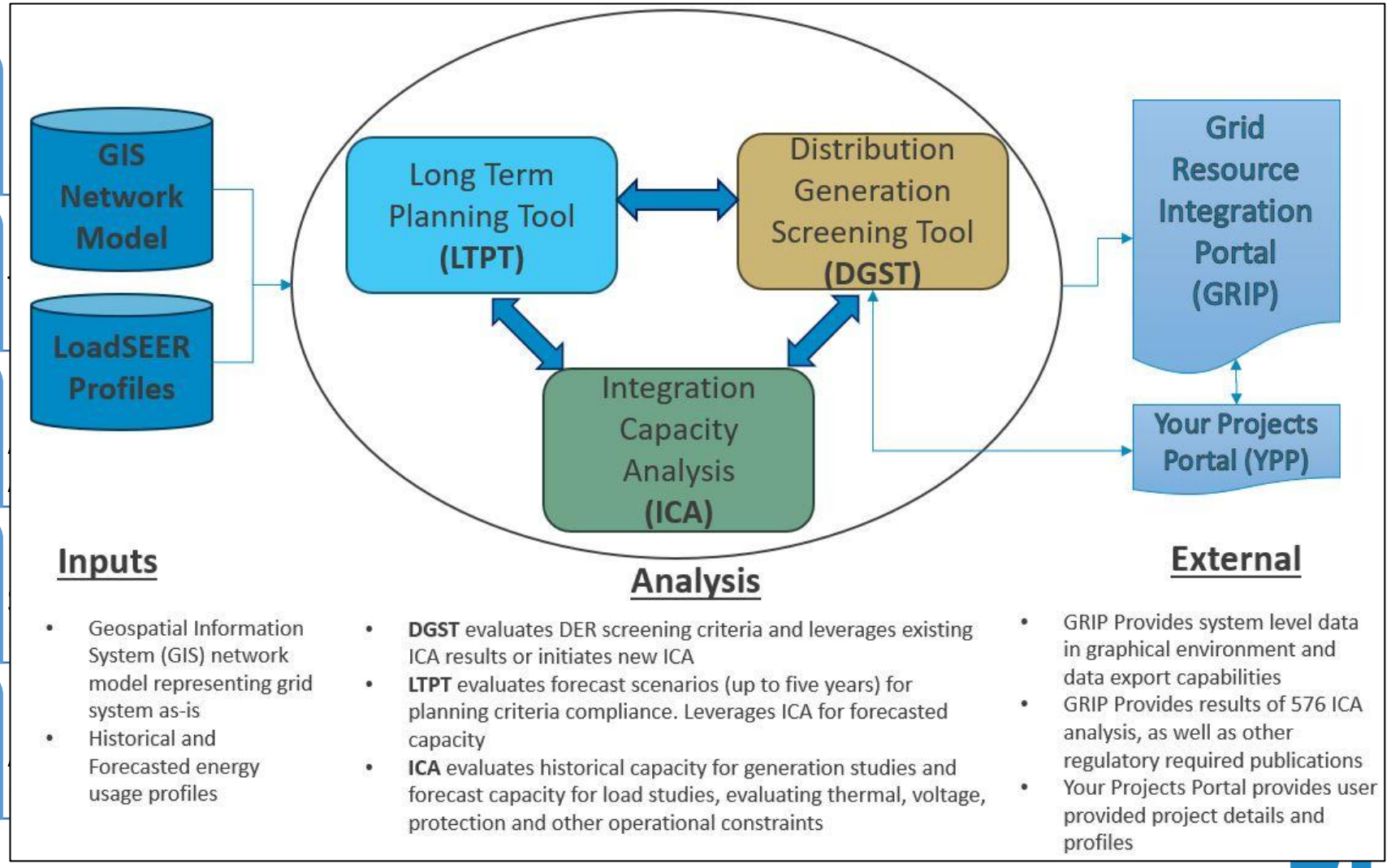
Network Topology: "As Designed"

- Planned Capacity Projects
- Planned Network Reconfiguration

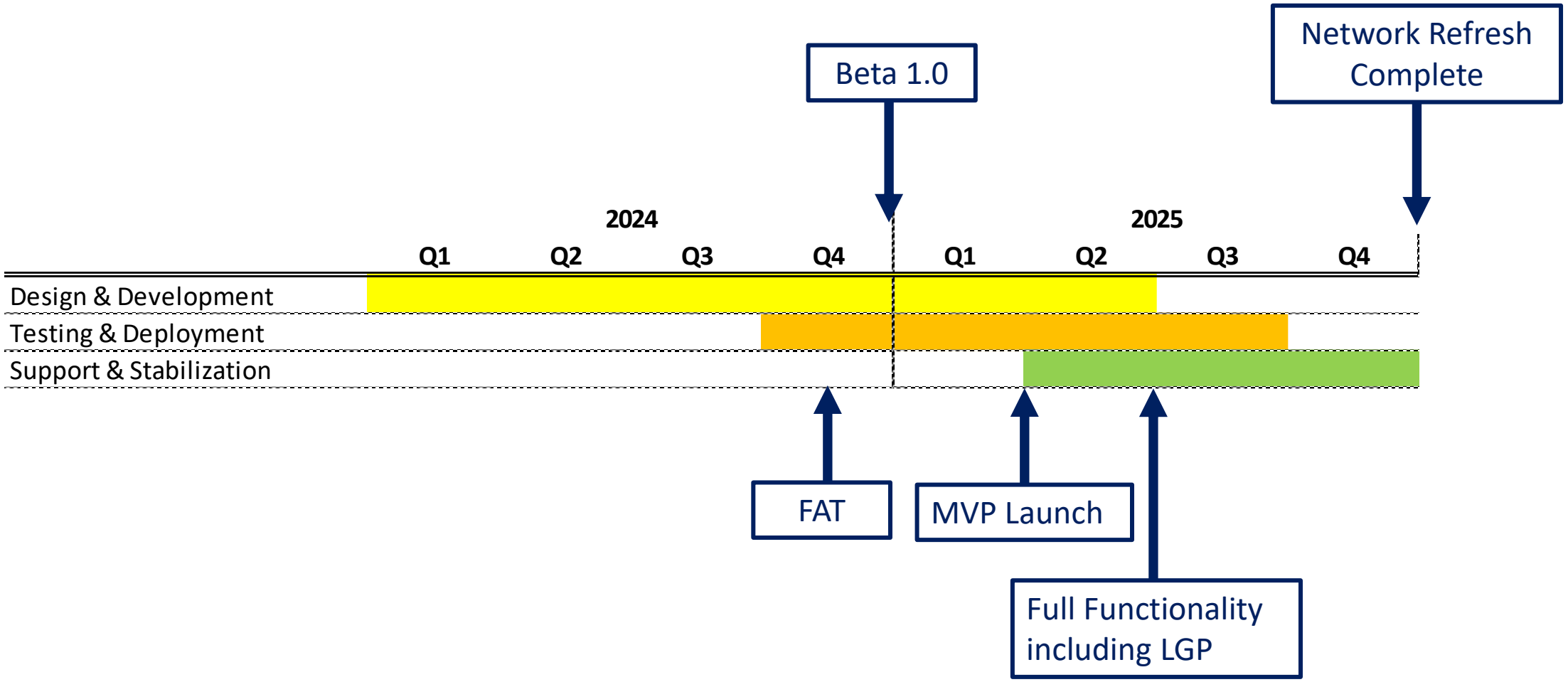


Challenges

- Maintenance
- Data Migration
- Software Dependencies
- HW/SW Resources
- Dynamic System Data



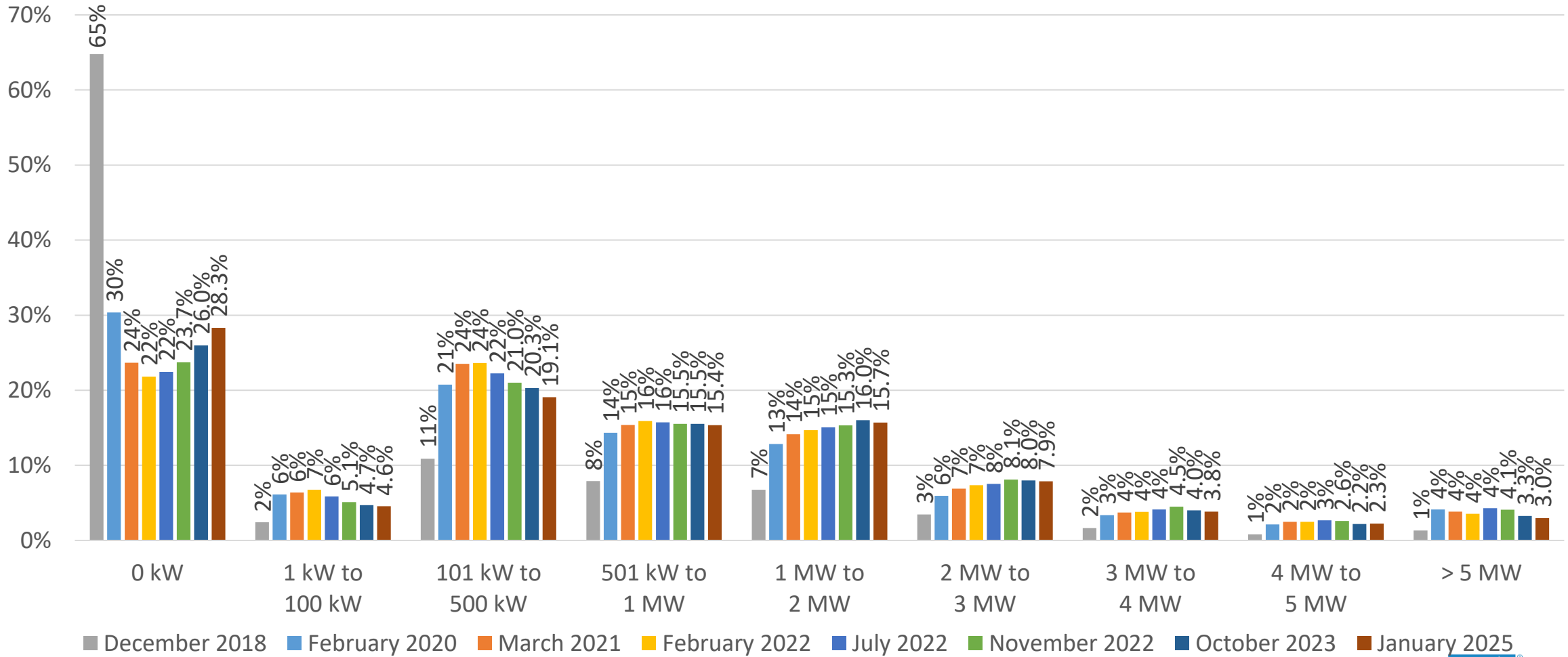
Progress


Network Refresh Complete
Beta 1.0
2024
2025
Q1
Q2
Q3
Q4
Q1
Q2
Q3
Q4
Design & Development
Testing & Deployment
Support & Stabilization
FAT
MVP Launch
Full Functionality including LGP

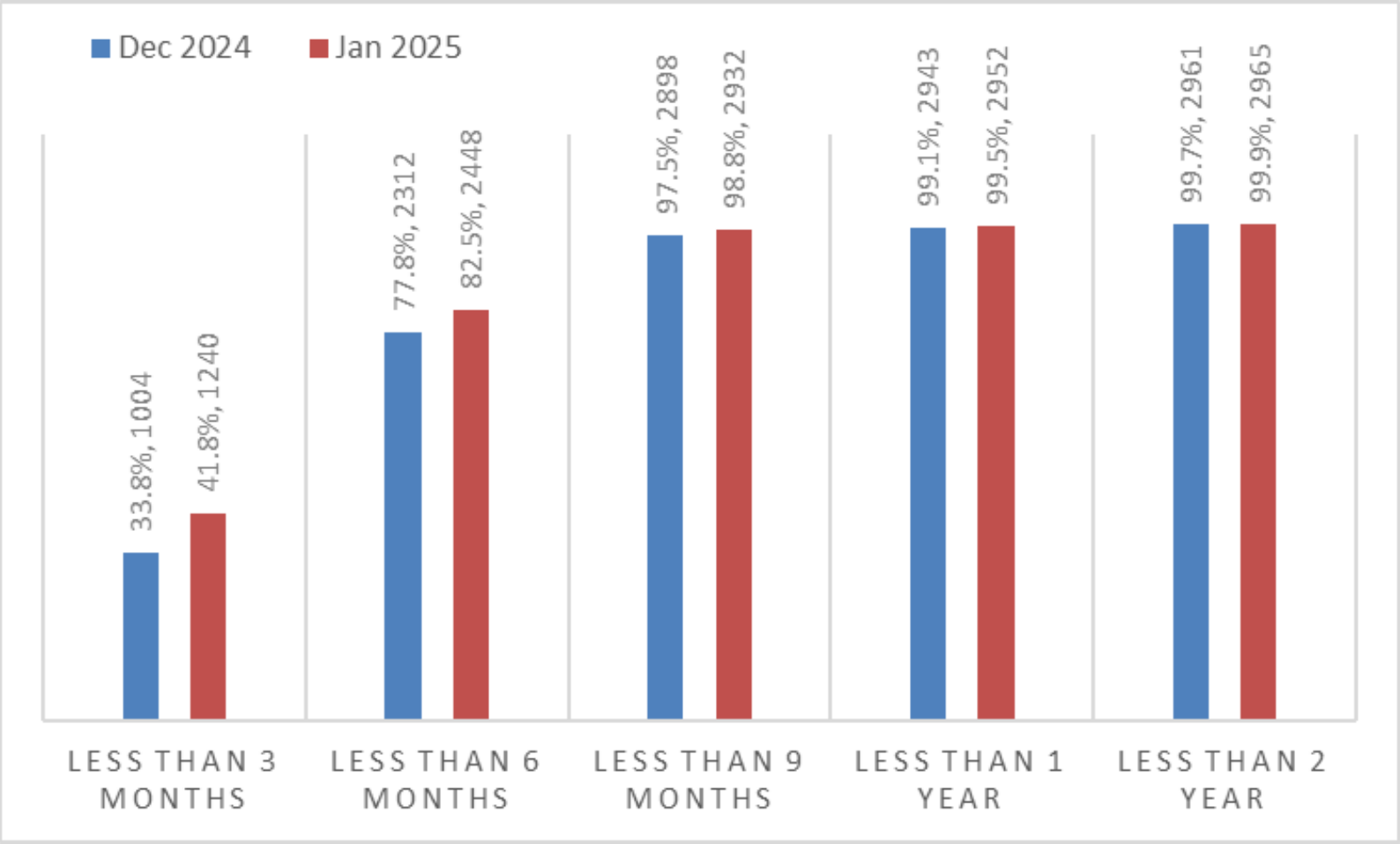
Known Issues Related to ICA

Issue	Description	Remediation Plan
Default Equipment Settings	Circuit device settings (e.g. reclosers, breakers, capacitor banks) may be incorrect or missing in Powerbase	Create automatic logic to detect inconsistencies and assign appropriate default values in line with Distribution Planning Engineering. (Ongoing)
Mapping of Queued Generation	Queued generation data containing inaccuracies such as incorrect, missing, or inconsistent project information (e.g., node IDs). Some projects that are already operational or have been decommissioned remain erroneously listed in the queue.	Implement automatic synchronization of data across SAP and other platforms (Q4 2025). In the interim, the data is being cleaned on a monthly cadence.
Missing Hours out of 576	A small number of circuits are reporting less than the required 576 hours of results due to various errors	Resolve when the issue appears. Note that the published results in the csv files and on the map are accurate. The issue is causing solely missing data for certain hours. (Ongoing)
Load Data Zeroes	Load profiles having zero value load for certain hours (PSPS was one cause)	Data cleanup. Resolve when the issue appears. (Ongoing)
Load Tap Changer (LTC) Cannot Be Set	LTC slider cannot be set due to feeders having previous dependencies that no longer exist due to network reconfigurations and thereby no loading information is available for these unwanted feeders	Model preservation under study. Resolve when the issue appears. (Ongoing)

Aggregated Uniform Load Results



Age of ICA Results



PG&E's goal is to make sure every circuit has been updated within the last year.

Recently:

- ~99% of results were updated in the last 9 months
- ~40% of results were updated in the last 3 months

Factors affecting lead time of ICA runs:

- Computational Resources
  - With 20 servers PG&E can only refresh around 10-15% of all circuits (~3000) monthly
- Ill Condition/High Complexity Circuit Models
  - Each node is modeled through non-linear optimization for 576 hours, generation and load
  - Circuits with high number of nodes can occupy one entire server's computational power
- Human Resource Constraints
  - Each ICA results review takes anywhere between 1-3 hours of engineering resources depending on the severity of issue, the expertise of the engineer, or the root cause of the issue

- **Network Refresh:** Monthly process of importing new load data, queued generation, network models, device settings, etc. from different databases to ICA platform for the new study cycle.
- **Study Trigger:** Process that identifies which circuits need to be rerun based on the set thresholds on network topology changes, generation changes, load changes, device setting changes, etc.

Grid Resource Integration Portal (GRIP)

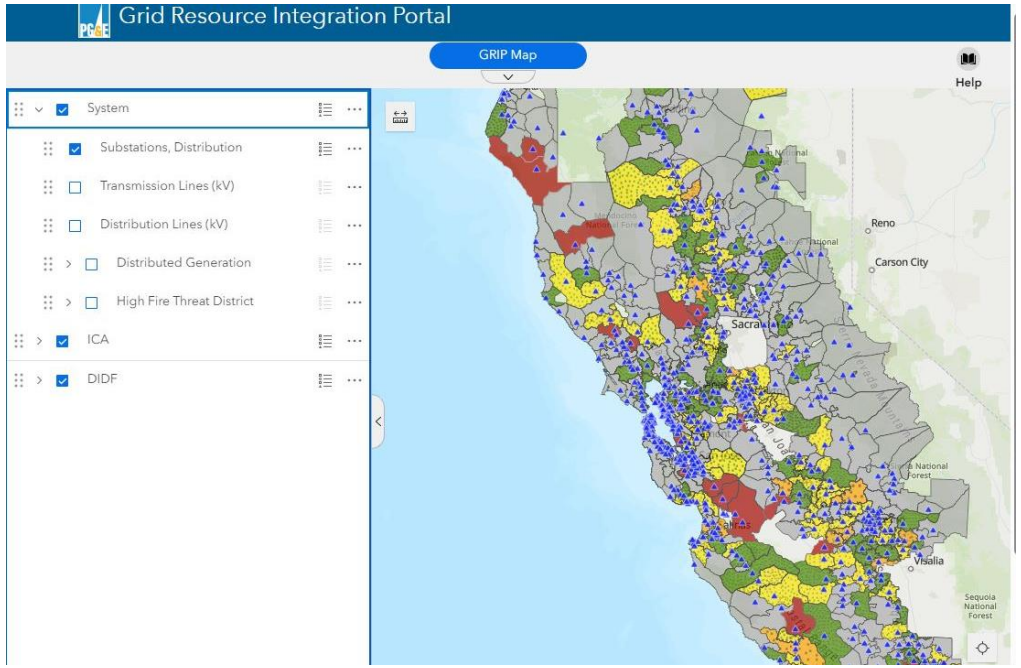
Launched the GRIP portal October 2024

Capacity and Forecast data

- ICA (hosting capacity)
- Forecast DERs
- Forecast Load
- Planned Projects

New Features

- Standardized interface functions
- Enhanced filtering functionality
- New analysis functionality
- Enhanced user control of data and visibility

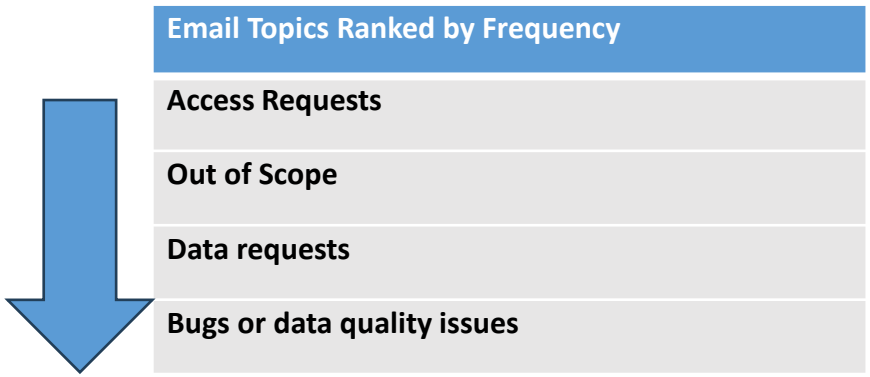


Link: GRIP.pge.com

Data Portal Emailed Issues

From 2018 to 2024, there were 309 emails sent to the portal inbox…

- The highest number of emails were received in 2018 and were regarding **access** to the first version of the portal, which required approval from PG&E at that time.
- Approximately 50 emails were **out of scope,** and 40 were **requesting data** that was not available at that time.
- There were 25 emails received that were reporting **bugs or data quality** issues.
  - Data quality issues were addressed by bringing the issue to the ICA team and the engineers, identifying the issue then addressing the root cause at the source.
  - Bugs with the portal or maps were addressed by diagnosing and fixing the source of the issue with the support of the IT and web development teams.



Q&A for PG&E

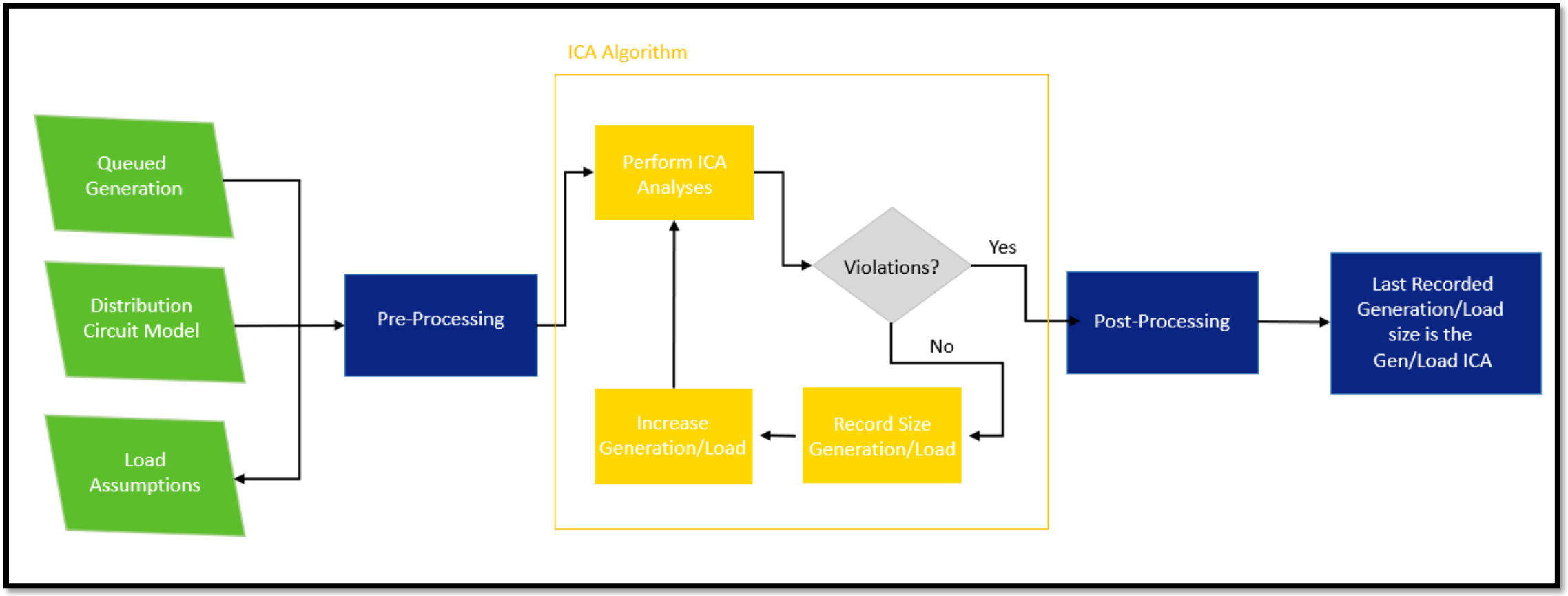
SDG&E's ICA Presentation

Agenda

- ICA Overview
- Updates on Refinements and Changes
- Updates on Data Validation Efforts
- Q&A

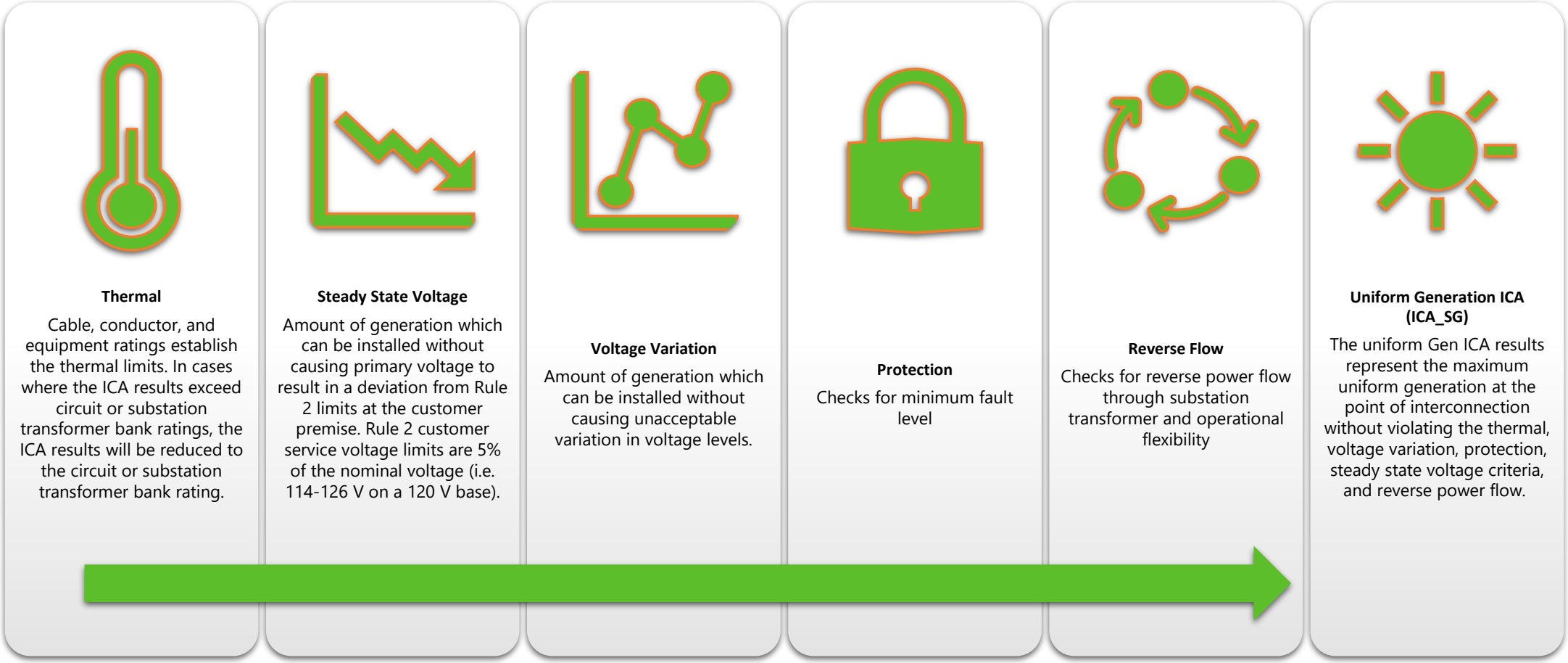
ICA Overview

Iterative Methodology to Develop Load and Gen ICA Results



ICA Overview

Summary of Limiting Criteria for ICA



Thermal

Cable, conductor, and equipment ratings establish the thermal limits. In cases where the ICA results exceed circuit or substation transformer bank ratings, the ICA results will be reduced to the circuit or substation transformer bank rating.

Steady State Voltage

Amount of generation which can be installed without causing primary voltage to result in a deviation from Rule 2 limits at the customer premise. Rule 2 customer service voltage limits are 5% of the nominal voltage (i.e. 114-126 V on a 120 V base).

Voltage Variation

Amount of generation which can be installed without causing unacceptable variation in voltage levels.

Protection

Checks for minimum fault level

Reverse Flow

Checks for reverse power flow through substation transformer and operational flexibility

Uniform Generation ICA (ICA_SG)

The uniform Gen ICA results represent the maximum uniform generation at the point of interconnection without violating the thermal, voltage variation, protection, steady state voltage criteria, and reverse power flow.

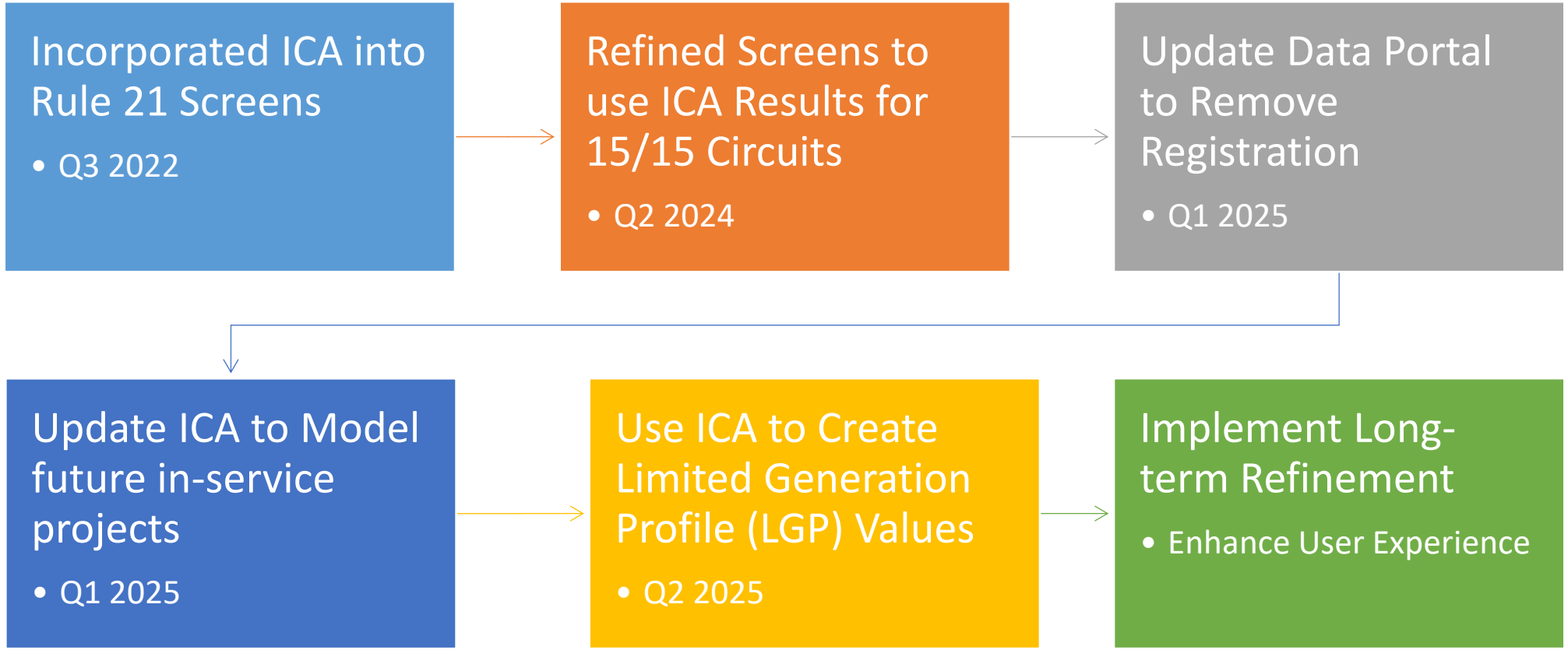
ICA Update Frequency

Monthly Update

- Queued Generation
- Load Additions
- Reconfiguration to distribution circuit model

Portal update

Refinements and Changes



Data Validation Efforts

Implemented a QA/QC review process - Load ICA

- Review all models with zero Load ICA
- Look for patterns
- Identify anomalies

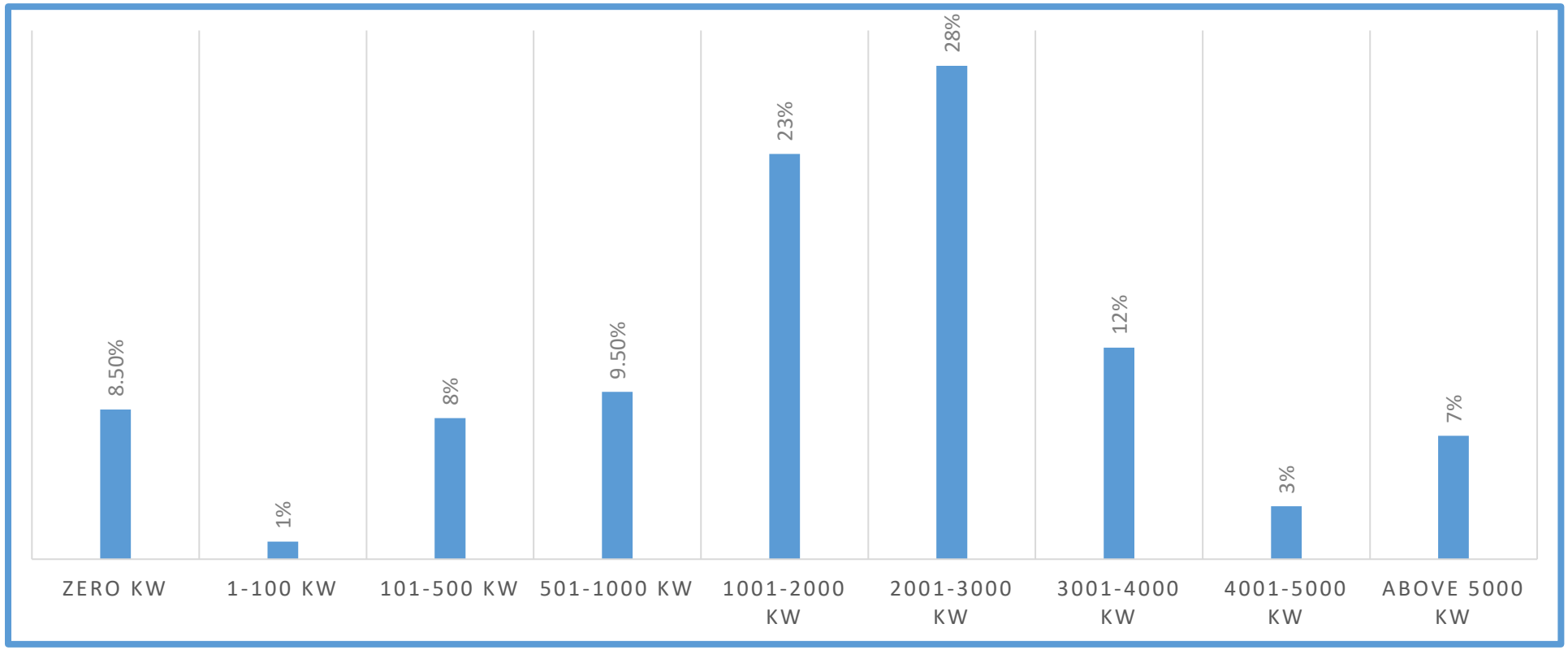
Model sources improvements

- Clean up some source databases

Reduction of Zeros for Load ICA

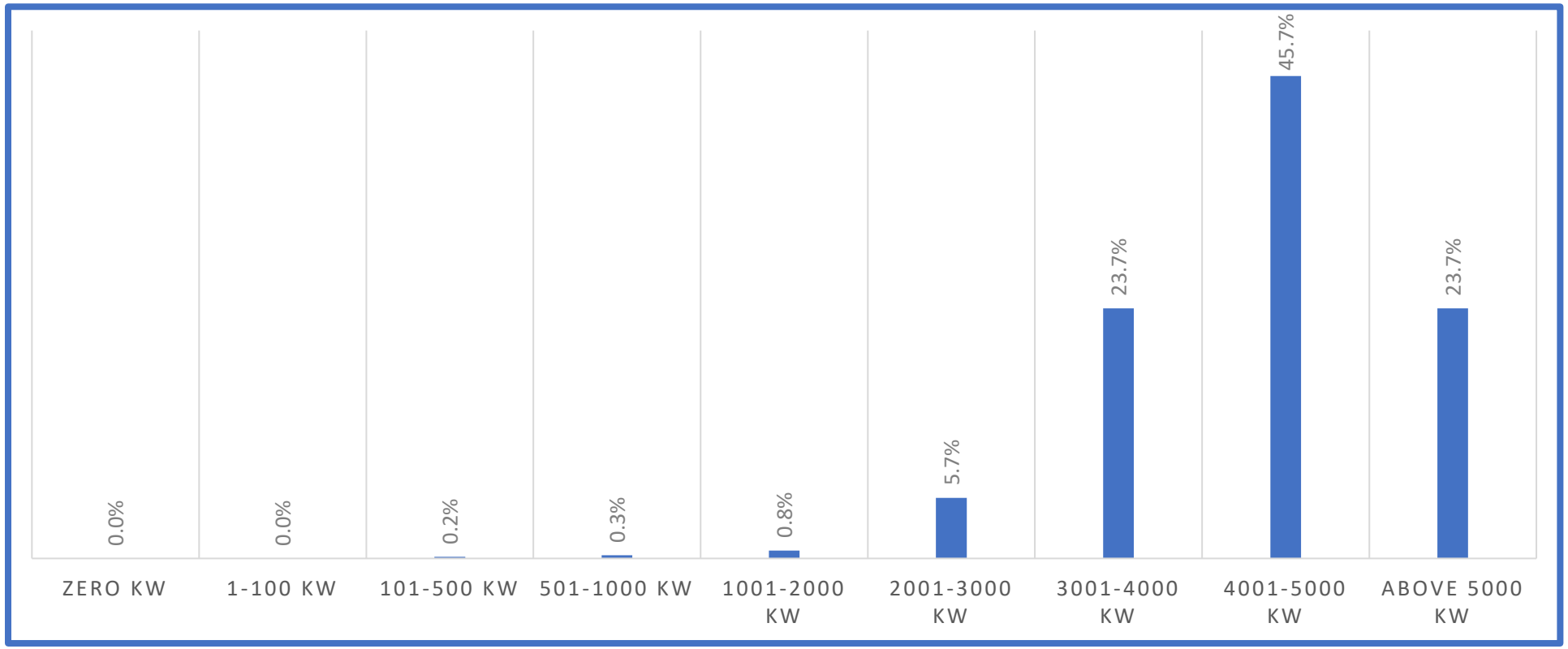
Data Validation Efforts

Figure 1 - Load ICA Segment Level Results Distribution as of 12/31/2024



Data Validation Efforts

Figure 2 - Circuit average distribution results for Load ICA as of 12/31/2024



Data Validation Efforts

Implement a QA/QC review process - Gen ICA

- Review all models with zero generation ICA
- Look for patterns
- Identify anomalies

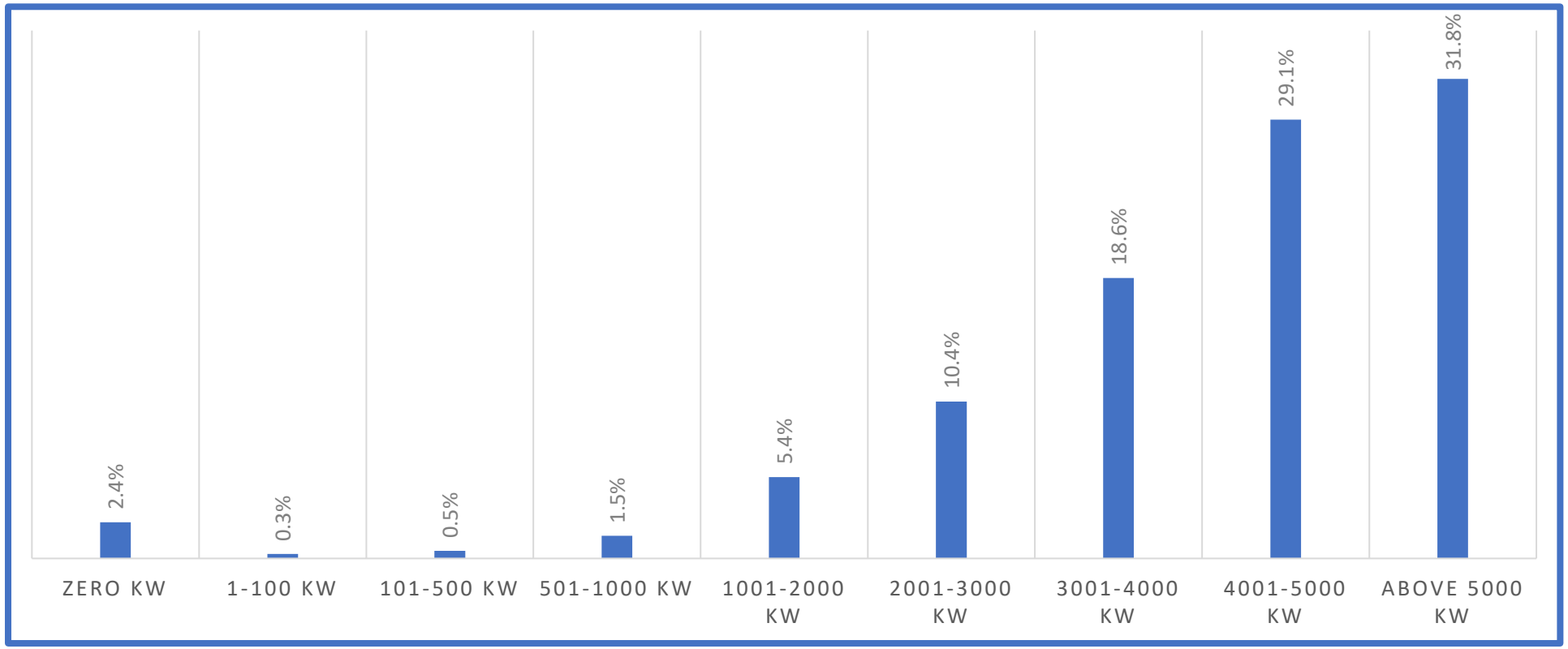
Model sources improvements

- Review Data sources

Goal to reduce false zeros for generation ICA

Data Validation Efforts

Figure 3 - Circuit average distribution results for Gen ICA_SG as of 12/31/2024

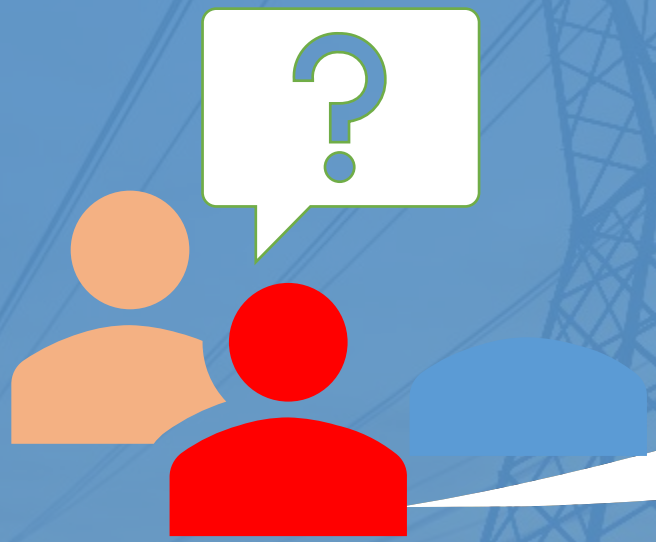


Resources

SDG&E ICA Portal

SDG&E ICA User Guide

sdgeinterconnectionmap@sdge.com



Q&A

Stakeholder Discussion

Wrap-up

Next Steps

- Next Workshop – by end of Q2’25
- Next Set of ICA Biannual Reports – by end of July 2025, followed by Q3’25 Workshop in September
- Tier 3 Advice Letter on ICA Remediation Plans – by end of August 2025