Load ICA Refinements

Joint IOU/Energy Division Workshop

March 8, 2023

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Workshop Background – Why Are We Here?

- 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; and,
  - host an annual workshop to review topics identified in the annual reports and provide stakeholders with the opportunity to discuss with the IOUs and Energy Division the progress made.

Agenda for IOU Presentations

1. Energization Overview (Joint IOUs)
    - The Load Interconnection Process
    - Applicable Tariffs
2. History and Use of Load ICA (Joint IOUs)
    - History of Load ICA
    - Current Use of Load ICA
3. 10-Minute Break
4. Individual IOU Presentations on Annual Refinements
    - SDG&E
    - SCE
    - PG&E

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Energization Overview and Use of Load ICA

Presented Jointly by PG&E, SCE, and SDG&E

Energization/Tariff Overview

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IOU Load Interconnection/New Business Process

Application

- Customer submits application

Project Intake

- Gather detailed project scope information
- Identify customer needs
- Engineering Advance

Planning & Engineering

- Design service route and meter location
- Planning review

Dependencies

- Permits, Joint Pole, Easements, Environment Review
- City/County Inspections
- Sign & pay contract

Construction

- Coordinate site logistics and validate site readiness
- Service installation
- Meter set

Close Out

- Commence customer energy billing

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Applicable Tariffs

Many existing California tariffs govern the process to connect load. Customers looking to establish new or expanded service are governed by the following:

Tariff	Description
Rule 2	Description of Service –Establishes the rules of electric service for customers. These rules specify the service criteria based on # of phase(s), allowable customer voltage levels, motor loads, special facilities, etc.
Rule 15	Rule 15 is the tariff that governs the investor-owned electric utilities distribution line extensions, which are extensions of the existing distribution lines from the nearest permanent and available distribution facilities to commercial areas/neighborhoods. Rule 15 specifically requires new distribution line extensions to be built underground.
Rule 16	Rule 16 is the electric utility tariff that outlines the rules and requirements for service line extensions, which are lines that connects the distribution lines to the customers' electric meters. Service line extensions are necessary to provide utility service when new residential/commercial/industrial facilities are constructed. Like Rule 15, Rule 16 also has an underground requirement for new customer facilities.
Rule 29/45*	This rule is applicable to all Electrical Distribution Infrastructure or Electric Vehicle (EV) Service Extensions on the utility side of the meter for all Customers or Applicants, excluding single-family residences, installing separately metered infrastructure to exclusively support Charging Stations for EV. For purposes of this Rule, Electrical Distribution Infrastructure includes EV Service Extensions

* SCE and PG&E's EV Infrastructure Rule is Rule 29, SDG&E's EV Infrastructure Rule is Rule 45.

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Q&A (5 min)

History and Use of Load ICA

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Load ICA: History/Regulatory Background

- ICA was developed in the DRP Proceeding, R. 14-08-013.
  - CPUC issued D. 17-09-026 to adopt the ICA methodology, including load ICA.
- ALJ Ruling in January 2021 began a stakeholder process for Load ICA refinements.
  - The ruling directed IOUs to "develop a description of the Uniform Load methodology, inputs, and assumptions" and host a workshop.
  - The Ruling invited IOUs and parties to submit proposals for Load ICA Refinements
  - IOUs and parties filed proposals in May 2021, followed by comments.
  - The collaboration between all parties resulted in an ALJ Ruling Ordering Refinements to Load ICA on September 9, 2021.
- IOUs began implementation following the September ALJ Ruling
  - February 2022: IOUs filed initial report on Load ICA refinements
  - Q4 2022: IOUs filed first annual Load ICA Refinements report
- CPUC's December 2022 EV Infrastructure Rule (E-5247) added additional reporting on load ICA.

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Load ICA Definition & Methodology

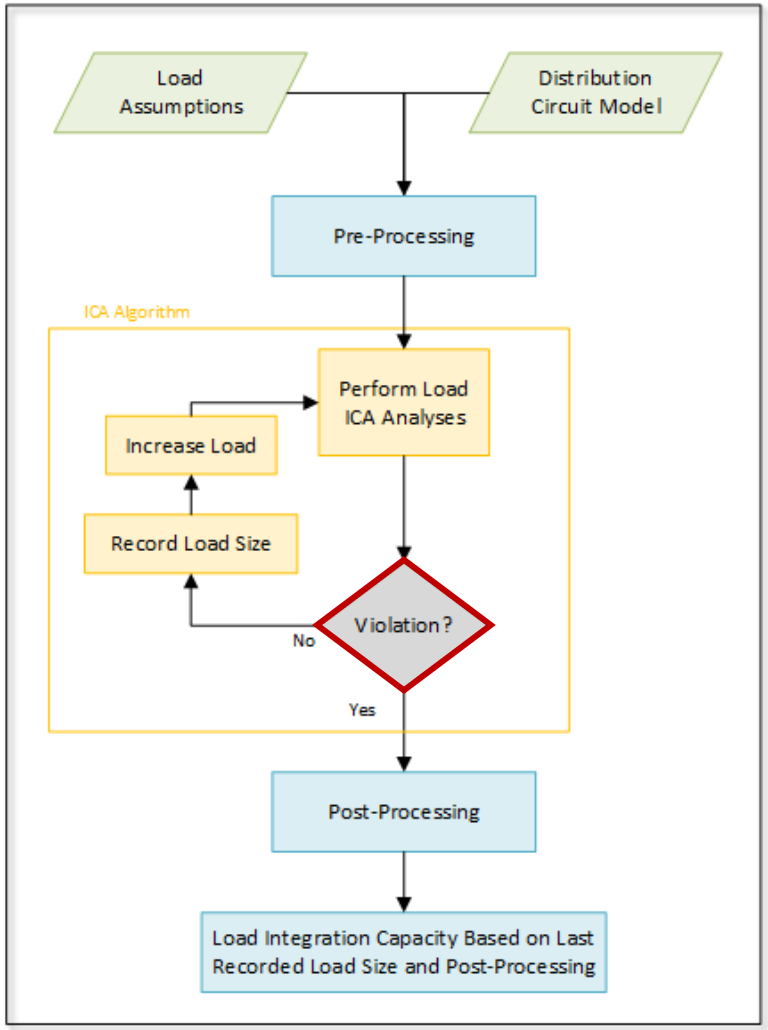
Uniform Load

The uniform load ICA results represent the maximum uniform load at the point of interconnection without violating the thermal, voltage variation, and steady state voltage criteria.

Current Iterative Methodology*

INPUTS

ALGORITHM



* The load assumptions and base line distribution circuit model are being revised as part of the Load Refinement Plan for each IOU.

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Load ICA Inputs (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

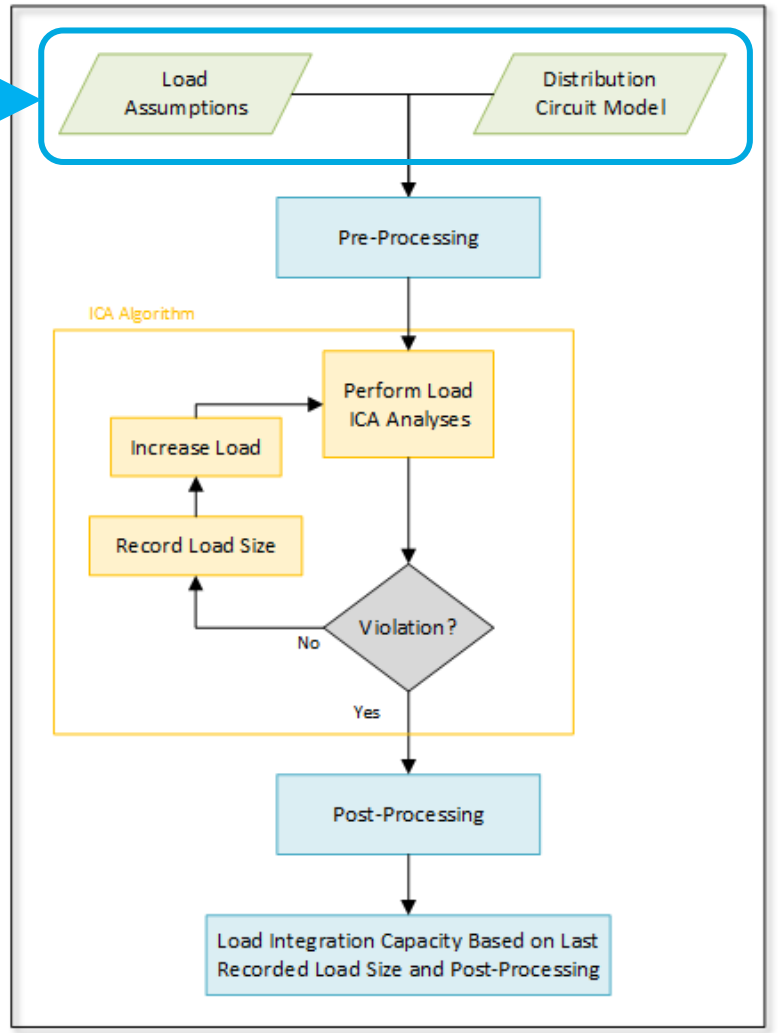
Future Load: 576 Hourly Next Year Load Forecast

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

Network Topology: "As Designed"

- Planned Capacity Projects
- Planned Network Reconfiguration

Current Iterative Methodology



* SDG&E's Load ICA currently takes forecast loads and known loads for the first year of the DPP planning horizon as an input.
** SDG&E's Load ICA currently models queued generation.

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What is the Value of Load ICA Today?

- Based on the current “Load Assumptions” and “Distribution Circuit Model” used in the Iterative Methodology on the previous slides, Load ICA results provide users with a directional understanding of where capacity for additional load may exist.

Q&A (5 min)

10-Minute Break

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Individual IOU Annual Reports

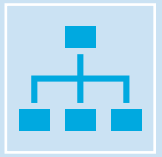
ALJ Ruling on Load ICA Refinements

Q4-2022 Annual Report / Annual Workshop are to cover the following 7 points:

1. Description of issues and challenges
2. Proposed solutions
3. Progress made toward addressing challenges
4. Timeline for implementing solutions
5. Progress to date implementing said solutions
6. Updated table of aggregated Uniform Load results
7. Summary of IOUs coordination efforts with the CEC on ICA tool updates

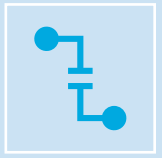
San Diego Gas & Electric
2022 Load ICA Refinements Annual Report

1. Description of issues and challenges



The current distribution system topology model used for ICA only reflects the projects that have been placed in service and doesn't reflect future distribution upgrades or configuration changes.

The base load profiles for ICA are built mostly based on historical load data. No historical load data exist for the new circuits.



ICA User interface currently uses the GIS shapes files reflecting existing distribution topology, changes to process and workflow are needed to reflect the future distribution system upgrades.

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2. Proposed solutions

1. Model load ICA with all queued load projects and planned, known, near-term distribution system projects	In the Load ICA model, SDG&E currently models known load projects with in-service date within the first year of the DPP planning horizon.
	Regarding the requirement to model "planned, known and near-term distribution system projects," SDG&E considers it covered under the modeling requirement #2, as discussed below.
2. Model load ICA to include distribution system upgrades with an approved construction schedule and an in-service date within one year	SDG&E interprets this requirement as the need to include distribution system upgrades identified with approved construction schedules specifying in-service dates that are within the first year of the DPP planning horizon. As noted previously, the model and process to accurately reflect the projects will need to be developed and maintained.
3. Include the impact of forecast DER growth in the loads modeled in load ICA	In the Load ICA model, SDG&E currently includes forecast loads for the first year of the DPP planning horizon as an input.
	These forecast loads therefore already include the system-level DER growth forecasts provided in the CEC's Integrated Energy Policy Report (IEPR) (and approved by the CPUC for use the DPP), disaggregated down to the circuit level.

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2. Proposed solutions – Contd.

4. Model load ICA to consider planned network reconfiguration	SDG&E interprets this requirement as the need to include planned permanent network reconfigurations identified within the DPP with in-service dates that are within the first year of the DPP planning horizon.
	Temporary network reconfigurations necessary and/or required by the Distribution Operations Department, are excluded from the Load ICA models.
	SDG&E considers planned network reconfigurations to be a subset of distribution system upgrades which are addressed above under modeling requirement #2
5. Model Load ICA with load forecast for the next year	SDG&E interprets this requirement as the need to include in the Load ICA forecast loads for the first year of the DPP planning horizon.
	As discussed above for modeling requirement #3, Load ICA already includes forecast loads for the first year of the DPP planning horizon.

3. Progress made toward addressing challenges
5. Progress to date implementing said solutions

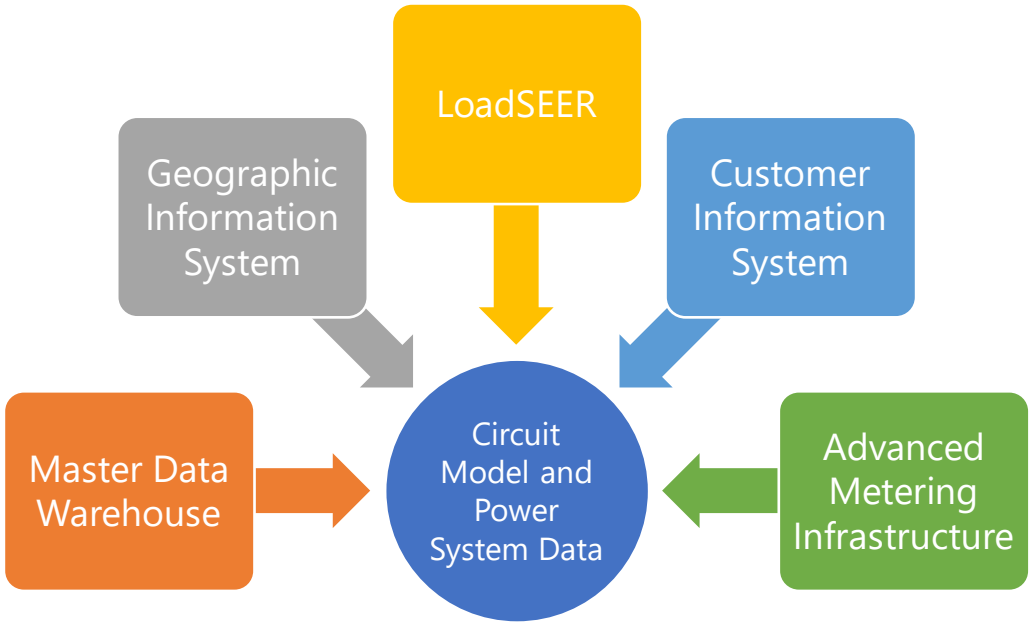

Figure 1 – Load ICA Data Input Framework

Already Implemented:

- Next Year[1] DER Growth
- Next Year[1] Load Forecast
- Next Year[1] Known Load Projects

Under Development:

- Planned Distribution System Upgrades
- Planned Network Reconfiguration

1. "Next Year" is referring to the first year of the Distribution Planning Process's planning horizon

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4. Timeline for implementing solution

SDG&E is currently in the process of working with internal and external groups on designing the updated process and data flows to implement the remaining changes.

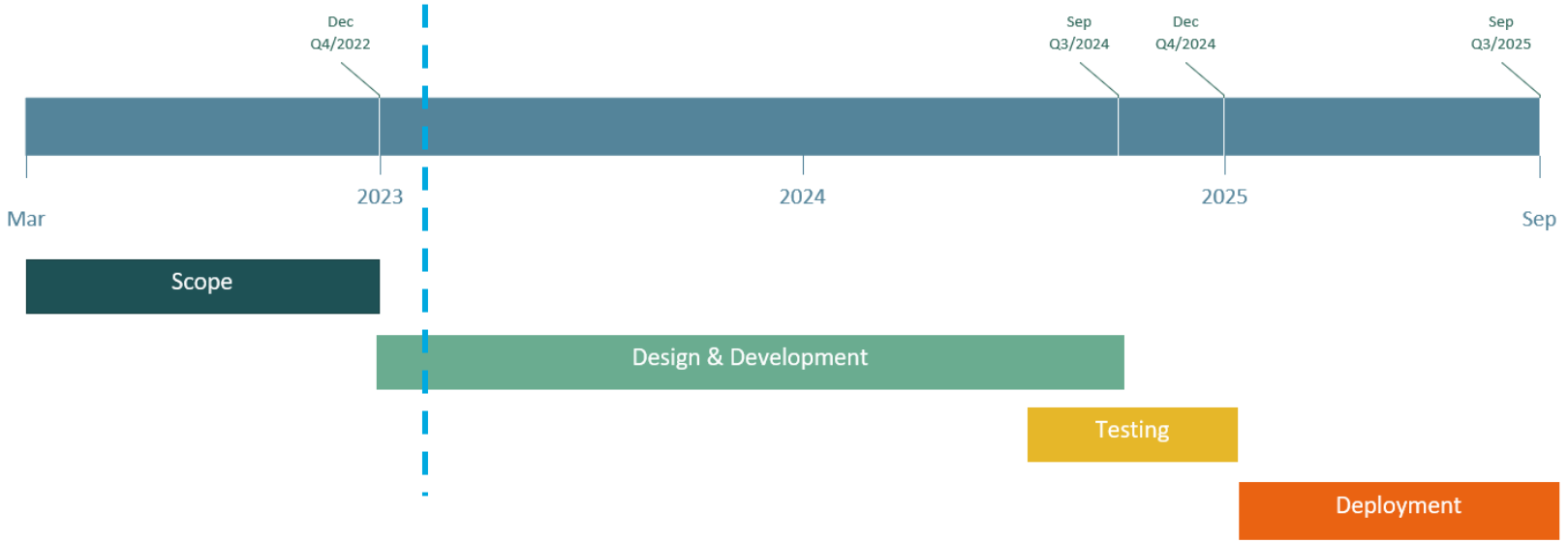


Figure 2 - Load ICA Refinements Timeline

6. Updated table of aggregated Uniform Load results

Table 1:Breakdown of Load ICA data based on the amount of indicated load hosting capacity[1]

Line Segments	Percentage using "Most Limiting Methodology"	Percentage using "Node hour Methodology"
Zero kW	69.7%	8.64%
1-100 kW	0.76%	0.40%
101-500 kW	3.4%	4.21%
501-1000 kW	3.0%	5.91%
1001-2000 kW	7.9%	15.02%
2001-3000 kW	9.0%	32.20%
3001-4000 kW	2.3%	10.00%
4001-5000 kW	1.2%	2.61%
Above 5000 kW	2.6%	21.02%

Most Limiting Hour Methodology:
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 methodology can create a false perception of low capacity for additional load.

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.

1. Load ICA data as of Dec 15, 2022, was used for this analysis.

6. Updated table of aggregated Uniform Load results Contd.

In an effort to increase confidence in results that indicate no load hosting capacity is available on a particular line segment or substation transformer ("zeros" in the Load ICA), SDG&E upgraded its modeling and analysis tool (Synergi) and made certain data corrections. The corrections made to date have resulted in fewer line segments and substation transformers showing zero hosting capacity. This effort is continuing, and we expect further reductions in the number of line segments and substation transformers showing zero hosting capacity.

7. Summary of IOUs coordination efforts with the CEC on ICA tool updates

Although SDG&E has participated in previous discussions with CEC regarding its EVSE Deployment and Grid Evaluation (EDGE) tool, there have not been any formal discussions addressing ICA data between the CEC and SDG&E in 2022.

In February 2023, SDG&E, along with other IOUs, met with CEC for a status update of CEC's EDGE tool development.

Q&A (5 min)

Pacific Gas & Electric Load ICA Refinements Report

Overview

1. ICA Annual Report
2. Introduction of PG&E's Load ICA Use Case
3. PG&E's Data Portal Interim Plan

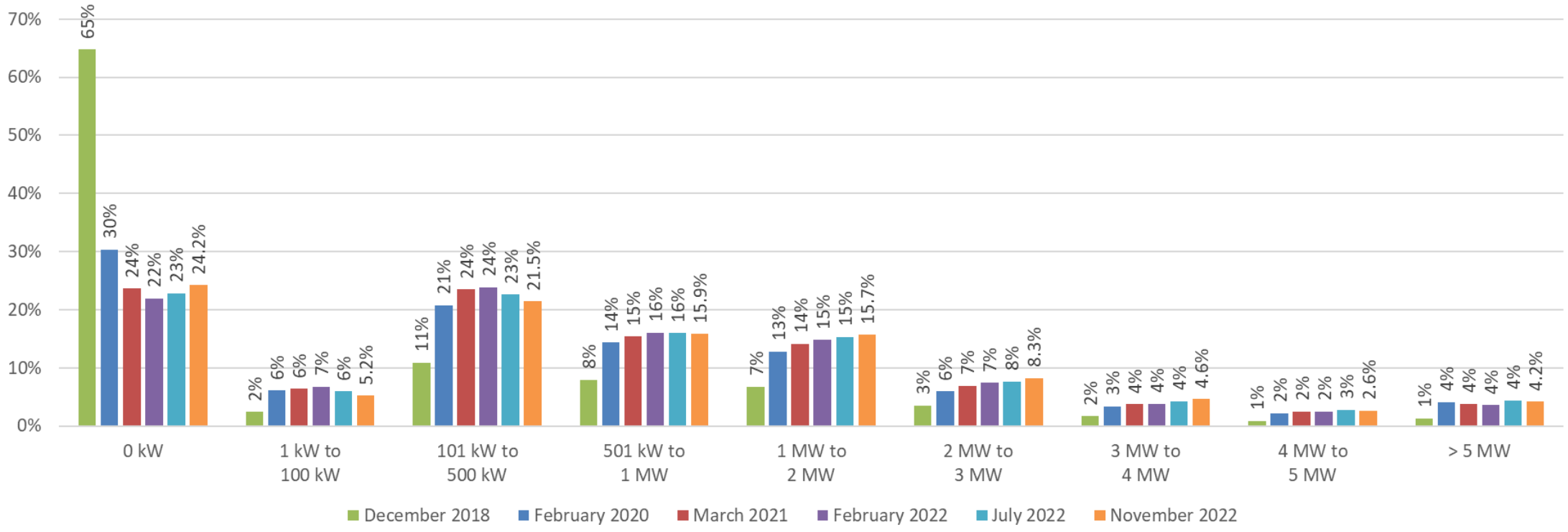
ICA Annual Report

- Dependency to other tools and databases:
  - CYME Upgrade:
    - Version 9.2: Completed December 2022
      - Results between CYME 8, 9 (server) and local machines have been tested to match. PG&E found some issues that was results of inverter modelling differences and initial status of the cap banks, which are corrected at the source.
    - Version 9.3: Q2 2023
  - PG&E's long term planning tool
  - PG&E's load forecasting tool (LoadSEER)
  - Known load and known capacity project databases: Process changes
- IT and publication process adjustments
- Project scoping, budgeting, and vendor engagement

ICA Annual Report

- Key Data Validation Activities
  - Frequency of queued generation and model imports are improved.
  - Improved modeling for temperature-controlled capacitor banks.
  - PG&E modified the process to automatically assign feeders with issues to responsible engineers of the corresponding planning area.
  - System-wide statistical analysis is performed.
- Key Future Improvements
  - Improved power-flow engine to enhance convergence: Q2 2023
  - Post an indication of potential Screen L results on Integration Capacity Analysis maps: Q2 2023.
- CEC Coordination Efforts
  - Comments and meetings supporting the EDGE tool

Annual ICA Report – Data Quality



Distribution of uniform Load ICA results, demonstrating continuous improvement of the PG&E ICA data quality (Most Limiting Hour Methodology)

Introduction of Load ICA Use Case

Current use of Load ICA

- Load ICA's current use is to provide directional information for siting new load
  - PG&E's believes Load ICA is a valuable resource to start the load interconnection journey. However, in its current form it misses some critical information (ex: forecast load growth)

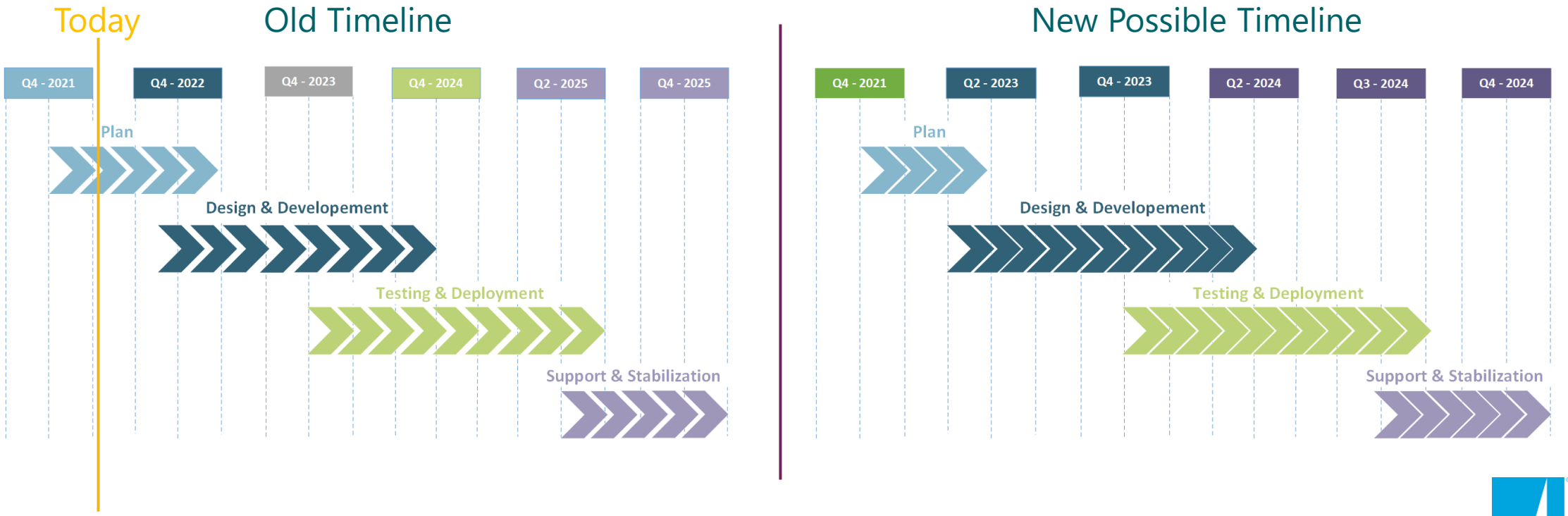
- PG&E believes that Load ICA can be used to improve internal processes in the early stages of load interconnection process

- PG&E believes that this will drive significant improvements in customer experience

Load ICA Refinements Progress and Timeline

PG&E is investigating the possibility to fast track and expedite the project to Q4 2024.

- Finalized product/project requirements
- Started design sessions with vendors
- Vendor selection and contracting in progress



Possible Load ICA Use Case

Plan: Load ICA data will be used by service planning and distribution planning in PG&E's new business interconnection process. This will only be feasible after Load ICA refinements are complete*.

Goal: PG&E to streamline the early stages of the interconnection process by using load ICA data to assess EV and New business loads.

Benefits: PG&E has a large territory, had 600+ EV applications last year, and anticipate to have 1000+ this year. Initial application review needs to become more efficient to keep up with increase in number of applications.

- Process efficiency: limited human resources
- Timely response in the early stages of interconnection
- Increases transparency and streamlines process
- Reduce wasted resources: ~1/3 of applications are withdrawing before moving forward into the utility design phase

*Load ICA published on the map is still for directional use and is not a replacement for the load interconnection process.

Data Portal Interim Plan

Interim ICA Map Refinements

Long Term Plan: PG&E is investigating the possibility to fast track and expedite the Load ICA improvements to Q4 2024.

Interim Goals:

1. Improve the directional data for siting new loads on the ICA map
2. Better inform customers of how to use the combined data

Interim Plan: Provide high level direction using ICA, forecast, and projects at each location to improve guidance to customers siting new load*.

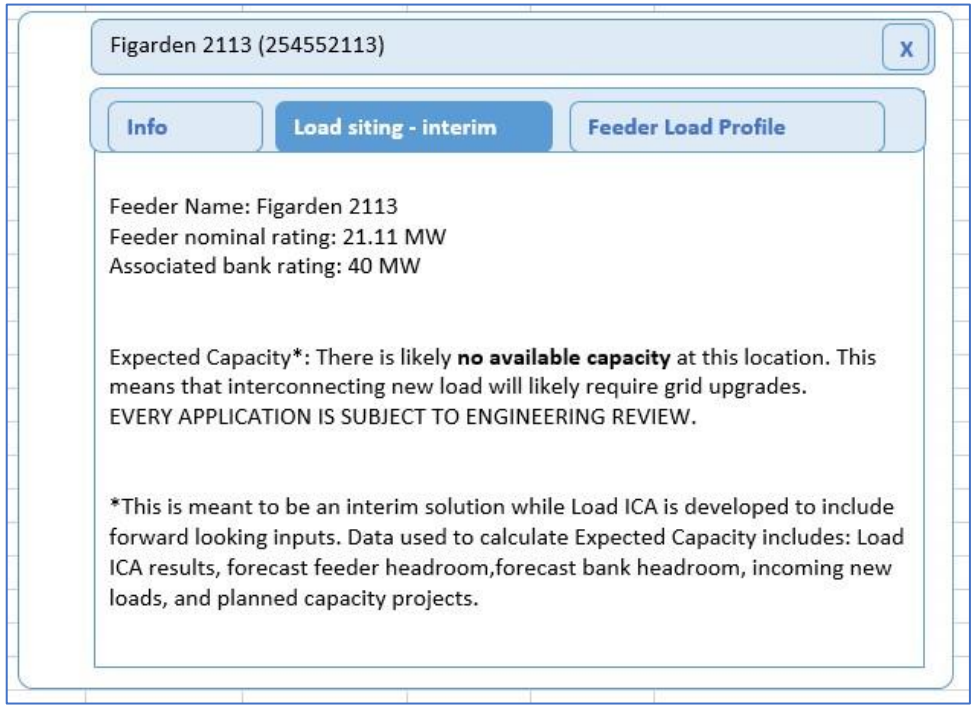
- Provide more accurate directional guidance that benefits interconnection customers

Proposal: Add 'easy to interpret' data via a pop-up on the ICA map

Timeline: Approximately 3 months

* All interconnection applications are still subject to engineering review.

Interim ICA Map Refinements



Potential Scenarios:

- There is likely **no available load capacity** at this location. This means that interconnecting new load will likely require grid upgrades and longer interconnection timelines.
- There is likely **available load capacity** at this location. However, every interconnection application is subject to an engineer's review.
- **An engineering review is necessary** to assess the interconnection capacity at this location, due to a planned project or a future load that may change the state of the feeder.

Examples:

Forecast feeder capacity	Forecast bank capacity	Load applications	Planned projects	Load ICA	Expected Capacity
Yes	Yes	Yes	Yes	Yes	Engineering Assessment Required
Yes	Yes	Yes	No	No	No Expected Capacity
Yes	Yes	No	Yes	Yes	Likely to Have Available Capacity

Q&A (5 min)

Southern California Edison Load ICA Refinements Report

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Overview

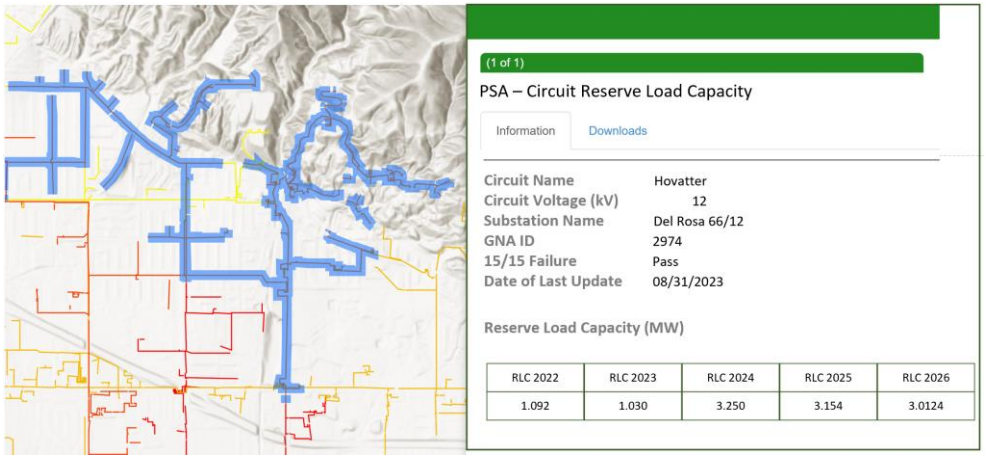
1. SCE's Data Portal Interim Plan
2. SCE's Long-Term Vision for Load ICA
3. SCE's Annual Report Overview

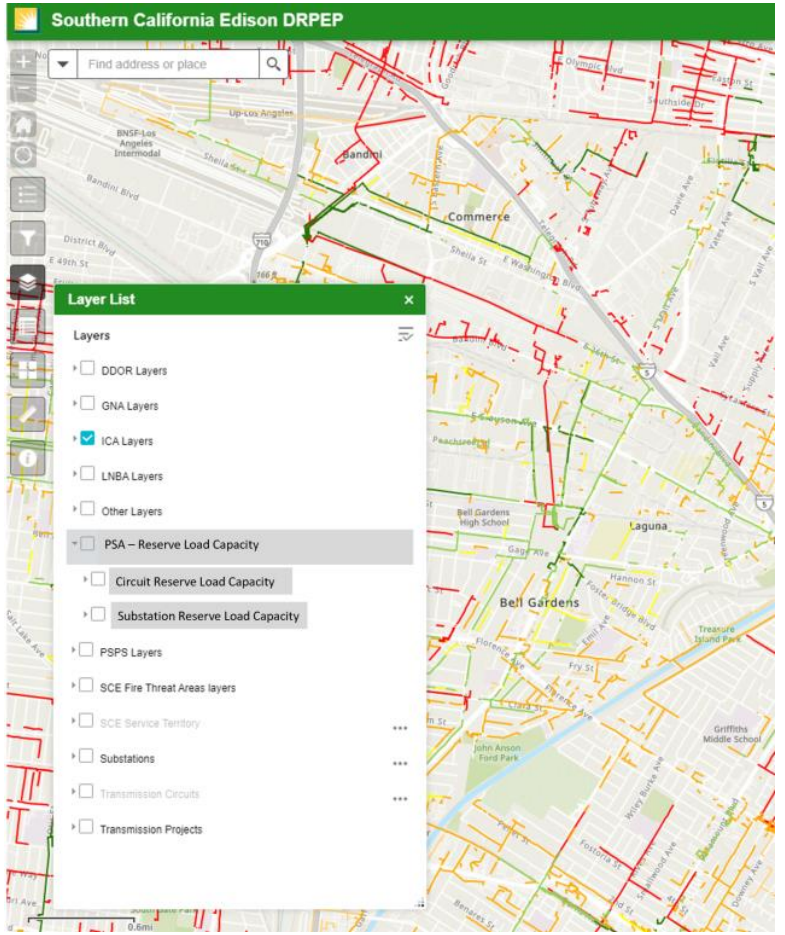
1. SCE's Data Portal Interim Plan

- **Enhance DRPEP** with new layer as steppingstone to Forecast Load ICA=> Power Service Availability (PSA) Reserve Load Capacity layer (updated on monthly cadence) uses GNA layer as basis and will subtract "High Confidence" Load Growth project nameplate size from Circuit and Substation Reserve Load Capacity to address stakeholder requests for more frequent GNA updates

- **Implement internal Load Growth Process** and database enhancements to aggregate/centralize load growth project data

- **Perform Customer/Interested Party Outreach** and education on Load ICA: where we are at, where are we going





*Preliminary design mockup

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2. SCE's Long-Term Vision for Load ICA

- **2026**: Transition from Load ICA for Forecast Load ICA by implementing the 5 pillars of the refinements to improve accuracy of load capacity information
  - This will help with accelerating the Load Interconnection Process
  - This will help with internal SCE processes to become more streamlined and efficient (i.e. Engineering Review process improvements)

- **2027+:** Explore internal process improvements in System Planning to leverage Load ICA data as additional data points in planning decision making

3. SCE's Annual Report Overview: Challenges & Solutions

5 Pillars of Load ICA Refinements	SCE Implementation	Description of issue/challenge(s)	Potential Solutions
1. Model load ICA with all queued load projects and planned, known, near-term distribution system project	Models and profiles used for load ICA must include all incremental load and distribution projects for the first year of the forecast horizon	• Ultimate Solution is one repository for the different data sources to be consolidated. • Each data source provides different pieces of information, e.g. project size, profile, structure, and supporting structure are key data points necessary for accurate modeling. • The one-year forecast should reflect the load growth projects published in the Grid Needs Assessment (published annually). • Include >250kW high confidence Load Growth projects • Layer to be updated monthly	• Currently have 2 distinct Load Growth Databases • Developing business process to streamline Load Growth Interconnections • Consolidating all Load Growth Projects into one database
2. Model load ICA to include distribution system upgrades with an approved construction schedule and an in-service date within one year	Models and profiles used for load ICA must include all planned system upgrades for the first year of the forecast horizon.	• Primary challenge is the process of including system upgrades to circuits. • For example, design of the planned upgrade is subject to modifications after final engineering and design, based on field conditions, compliance with applicable environmental and permitting requirements; and actual construction. • Such design modifications may change capacity levels as compared to those initially assumed in the planning environment. • Layer to be updated Yearly and should align with GNA layer	• Enhance Grid Connectivity Model to build upon the as-is System Topology and include planned system upgrades

3. SCE's Annual Report Overview: Challenges & Solutions

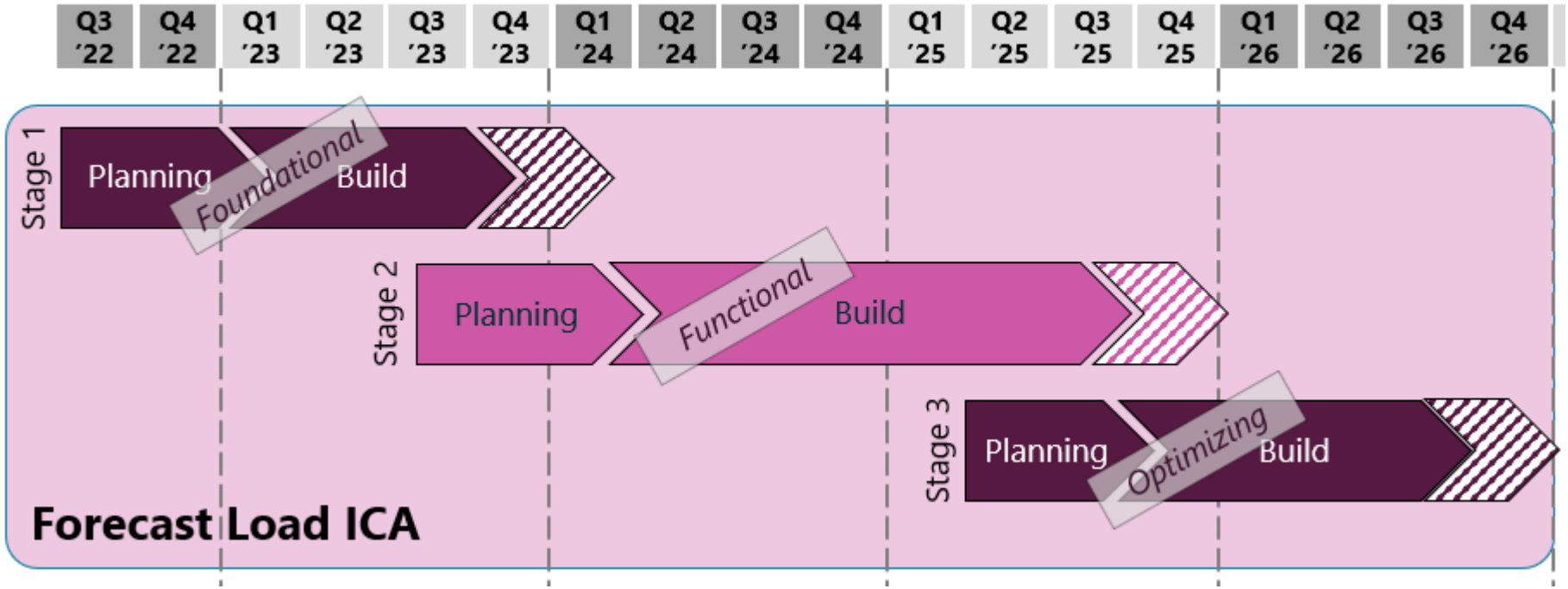
5 Pillars of Load ICA Refinements	SCE Implementation	Description of issue/challenge(s)	Potential Solutions

3. Model load ICA to consider forecasted DER growth	Models and profiles used for load ICA must include forecasted DER growth for the first year of the forecast horizon	• A major challenge presented is how to include the Integrated Energy Policy Report (IEPR) forecast and disaggregate the information at a nodal level.
		• This involves two disparate DER planning processes related to DER growth.
		  • Well-established interconnection of new generation resources under the CPUC jurisdictional Rule 21 and FERC jurisdictional Wholesale Distribution Access Tariff (WDAT),
		  • forecast DER defined in IEPR.
		• Exact locations of forecast DERs are not well established.
		• DER disaggregation assumptions implemented for the IEPR DER forecast will have to be developed to ensure Load ICA values are not overstated.
		• Will Affect Yearly Layer containing System Upgrades
			Refine methodology for integrating the DER Forecasting into Load ICA Calculations

3. SCE's Annual Report Overview: Challenges & Solutions

5 Pillars of Load ICA Refinements	SCE Implementation	Description of issue/challenge(s)	Potential Solutions
4. Model load ICA to consider planned network reconfiguration	Models and profiles used for load ICA must reflect all planned system reconfiguration (i.e., permanent transfers) for the first year of the forecast horizon.	• Need to determine a better methodology for including monthly changes to circuit topology. • SCE must develop cutting-edge and cross-functional processes for validating transfers as they occur. • Will Affect Yearly Layer containing System Upgrades	Enhance Grid Connectivity Model to encompass As-Planned System Topology
5. Model load ICA with load forecast for the next year	Profiles (circuit load, structure load, etc.) used in load ICA must reflect the first year of the most recent, approved planning cycle, converted to 576 format	• Dynamic nature of changes on the distribution circuits • Circuits may look very different at the end of the year as compared to the beginning of the year. • Planned Upgrades may be constructed differently than planned; these changes may impact load forecast allocation • Will Affect Yearly Layer containing System Upgrades	Enhance Profile Creation to encompass As-Planned High Confidence Load Growth Projects

3. SCE's Annual Report Overview: Timeline



Foundational capabilities:

- As-Planned Meter to Grid model and distribution Connectivity
- Profile enhancements for Planned DERs
- Integration/updates with Load Flow Analysis

Functional capabilities:

- Load Flow Analysis engine enhancements for mitigation modeling

Optimizing:

- Optimized integration with System Of Records and Systems of Truth

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3. SCE's Annual Report Overview: Uniform Load results table

	Most Limiting Hour Methodology		Node-hour Methodology	
Uniform Load ICA Range	Count	Percent	Count	Percent
Zeroes	1,065,364	82.92%	202,525,865	27.42%
>0-100 kW	35,345	2.75%	41,501,417	5.62%
>100-500 kW	28,666	2.23%	50,723,306	6.87%
>500-1000 kW	28,481	2.22%	43,970,569	5.95%
>1000-2000 kW	42,391	3.30%	83,801,497	11.35%
>2000-3000 kW	26,973	2.10%	77,391,409	10.48%
>3000-4000 kW	20,549	1.60%	67,564,212	9.15%
>4000-5000 kW	11,219	0.87%	29,078,759	3.94%
>5000 kW	24,324	1.89%	118,722,498	16.08%
Null	1,477	0.11%	23,214,100	3.14%
Total	1,284,789	100.00%	738,493,632	100.00%

3. SCE's Annual Report Overview: Coordination efforts with the CEC

- **In mid-September 2022**, SCE met with CEC staff to discuss and provide input on the CEC's EVSE Deployment and Grid Evaluation (EDGE) tool. During the meeting SCE discussed the grid information it makes available to customers through its distribution resources plan external portal (DRPEP). It also shared some considerations to help guide development of the EDGE tool. For example, SCE requested that the CEC consider the need to ensure that the tool encourages customers to engage with the utility.

- **On 2/28 2023**, SCE (along with other IOUs) met with CEC to discuss latest EDGE Tool developments, timelines and data inputs. Based on current intent of the tool, the recommendation to CEC was to leverage GNA Substation and Circuit data for forecasting purposes
- SCE will work with CEC to provide the GNA data to support the launch of EDGE tool this year
- Once SCE's DRPEP PSA layer is available, it can also be ingested/used by the EDGE tool
- **Future**: Once Forecast Load ICA is available and if EDGE tool requires more granularity of data (i.e. at node level as opposed to Circuit/Substation level) integration points can be established

Conclusion

- SCE believes that Forecast Load ICA can be a beneficial tool for external and internal usage in order to streamline processes and improve timelines in the interconnection process
- SCE believes that strong collaboration with all stakeholders will make the Forecast Load ICA tool better

Q&A (5 min)

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