

ET Summit 2024

Presented by



Smart Electric Panel Lab Test Project



Albert Chiu
Expert Product Manager
Pacific Gas & Electric[®]



Pacific Gas and Electric Company

About us

We are focused on providing safe, reliable, clean and affordable natural gas and electricity to our customers.

Service Area

70,000
SQUARE MILES



Service area population

16 million
CALIFORNIANS



(That's 1 in 20 Americans!)

25,000

EMPLOYEES WHO
LIVE AND WORK

in the communities we serve



MORE THAN

715,000

SOLAR CUSTOMERS

representing **>6,900 MW**
of solar energy generated



NEARLY

500,000

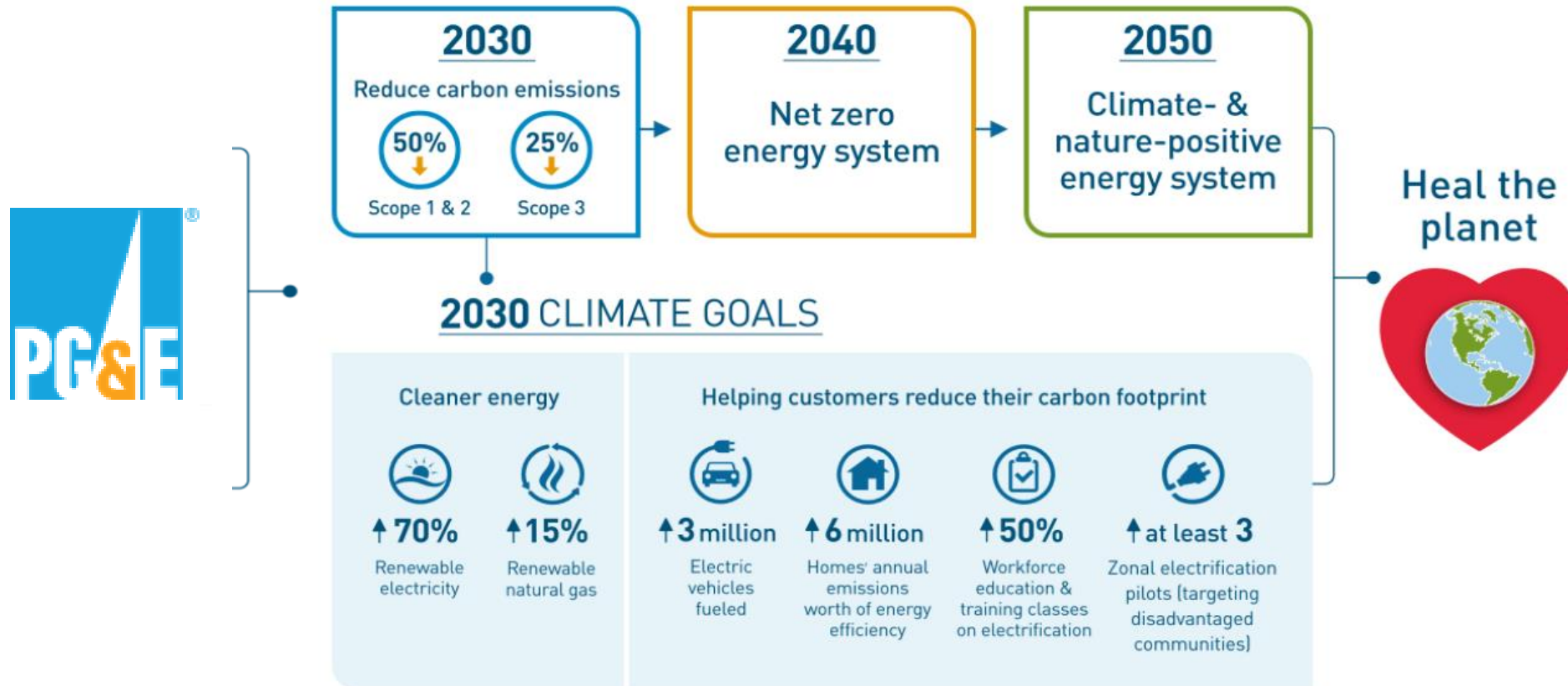
ELECTRIC VEHICLES

registered in our service area



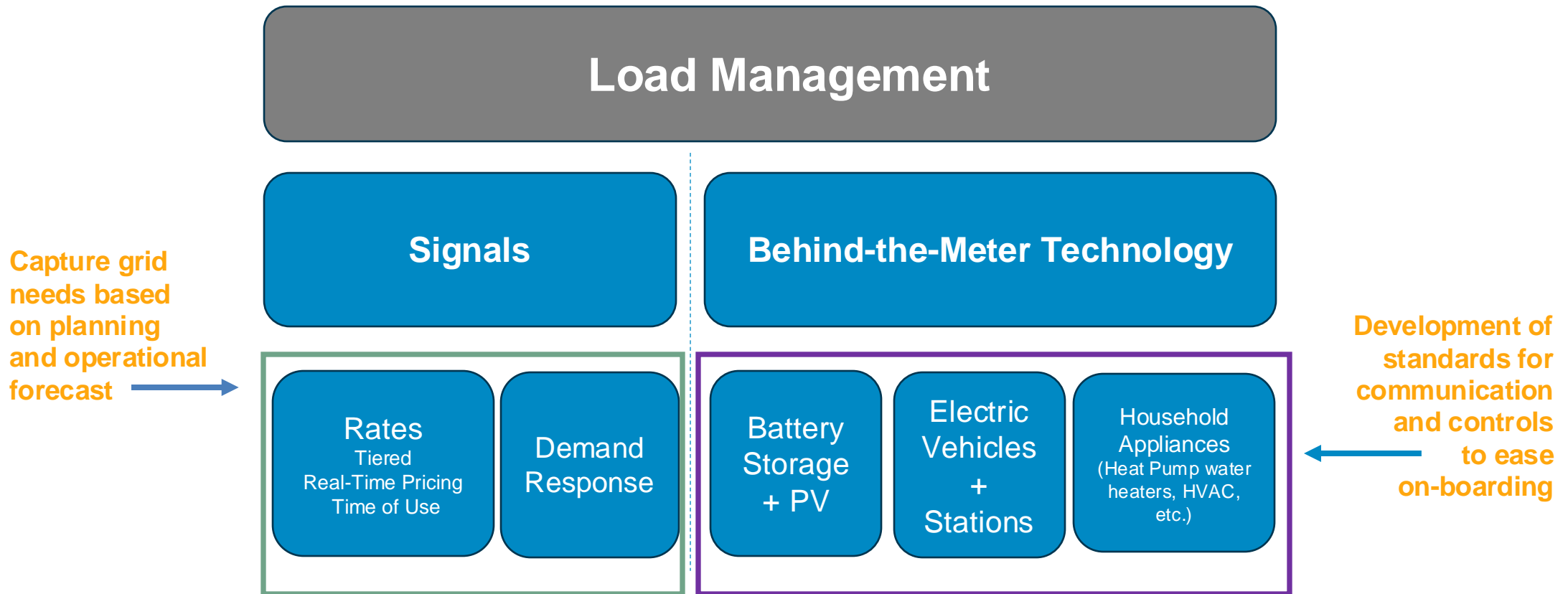
PG&E's Contribution to Healing the Planet

California's decarbonization plan requires us to achieve carbon emission reductions of 85% below 1990 levels, be carbon neutral, and achieve 100% renewable and GHG-free resource supply by 2045. PG&E plans to achieve this by 2040.



PG&E's Load Management Strategy

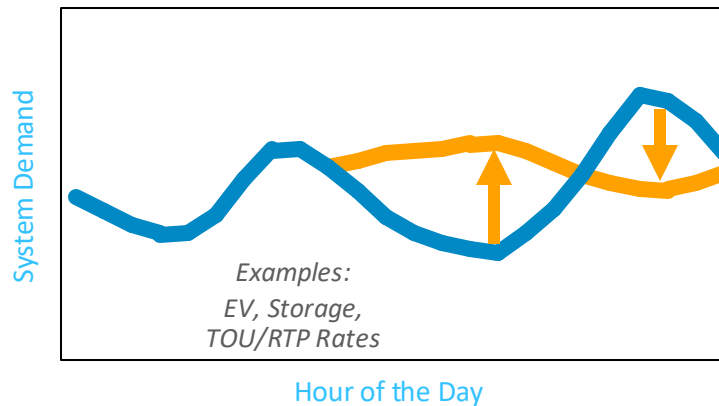
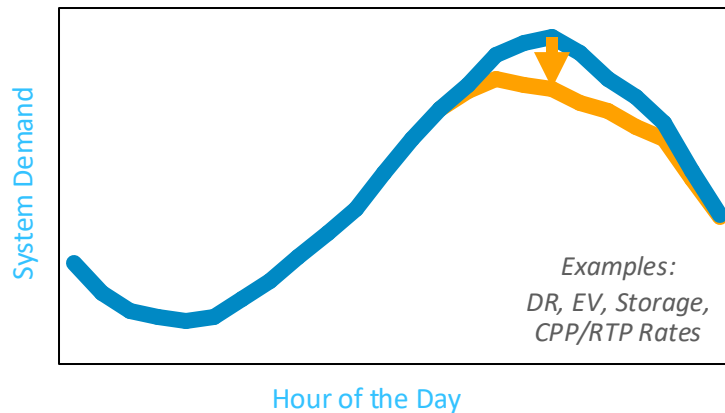
PG&E's load management strategy recognizes the many options for shaping customer load and help balance the grid while meeting the customer's energy agenda.



Different Types of Load Management

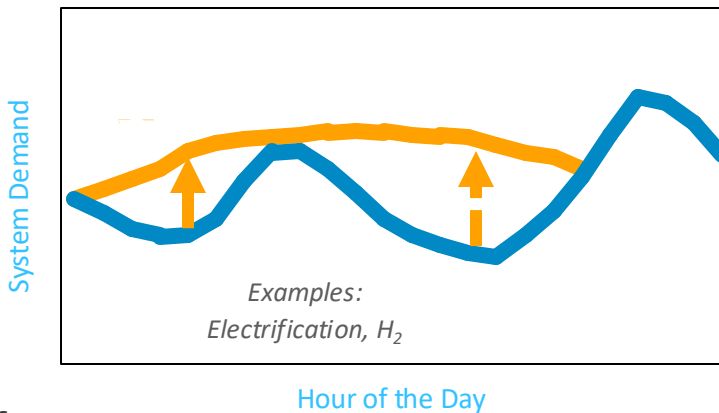
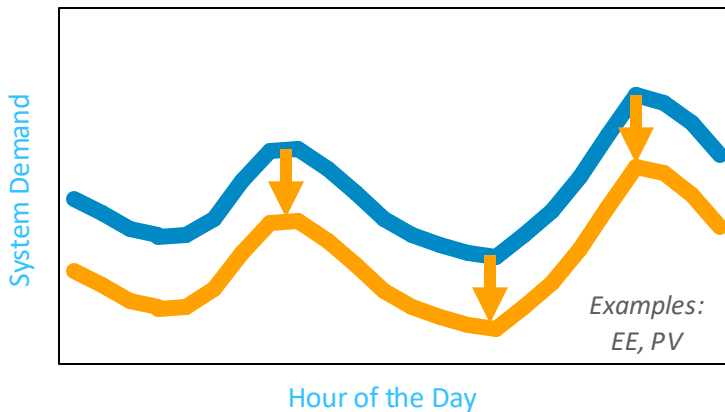
Traditional demand response (DR) provides load reduction during peak times and high price periods, and often helps to prevent power interruptions due to supply shortages. Today load management programs and rates have become important tools for flattening the load curve.

Peak Load Shed:
MW of load reduction during annual/monthly peak conditions



Daily Load Shift:
MWh shifted from peak hours to non-peak hours

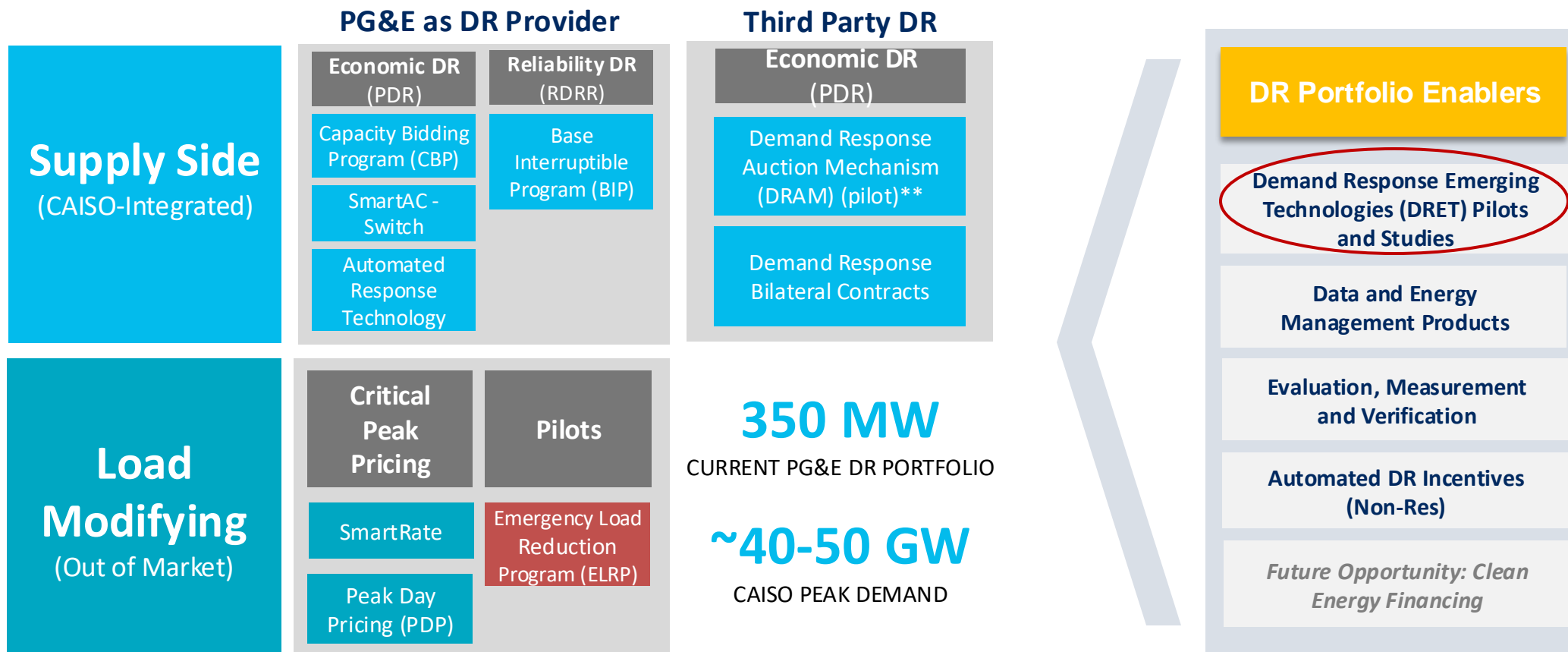
Permanent Load Reduction:
MWh reduced relative to a baseline



Strategic Load Growth:
MWh increased in non-peak hours

PG&E's Demand Response Portfolio

Today, our DR portfolio caters to generation capacity and energy shortfalls offered via a range of CAISO* market-integrated and load modifying programs. Portfolio “enablers” facilitate data and insights driving portfolio modernization and continuous improvement.



*California Independent System Operator [Today's Outlook | Demand | California ISO \(caiso.com\)](https://www.caiso.com)

**Ending 12/31/2024

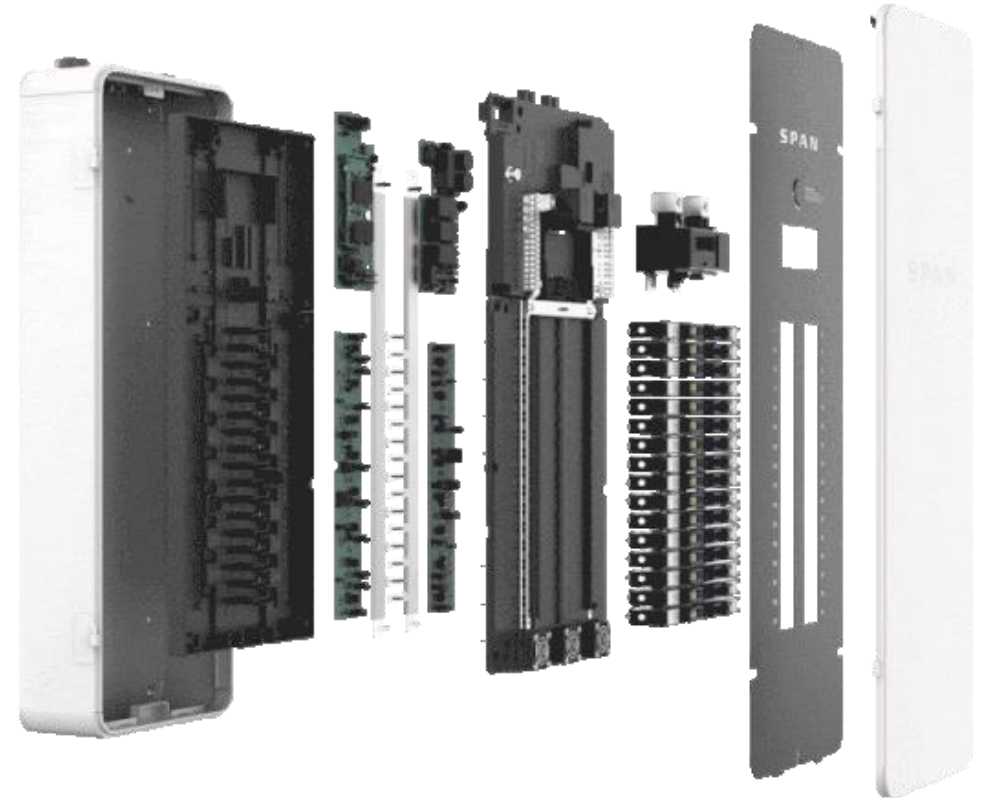
PG&E Smart Electric Panel Lab Testing Project

Summary

This research project evaluates electrical panel technologies integrated with add-on software controls that provide customers with additional information and capabilities beyond a traditional panel.

Testing Objectives

- Evaluates the difficulty of installation for smart panels
- Evaluates smart panel customer app functions
- Evaluates smart panel utility app functions
- Validates that the smart panel is safe to operate in field demonstrations



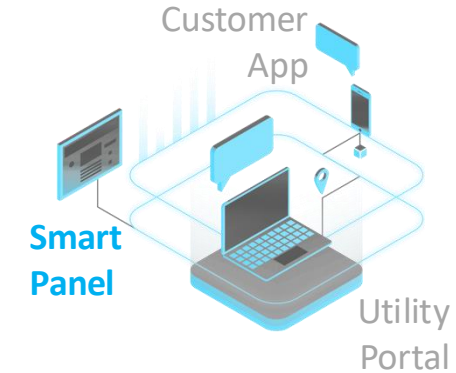
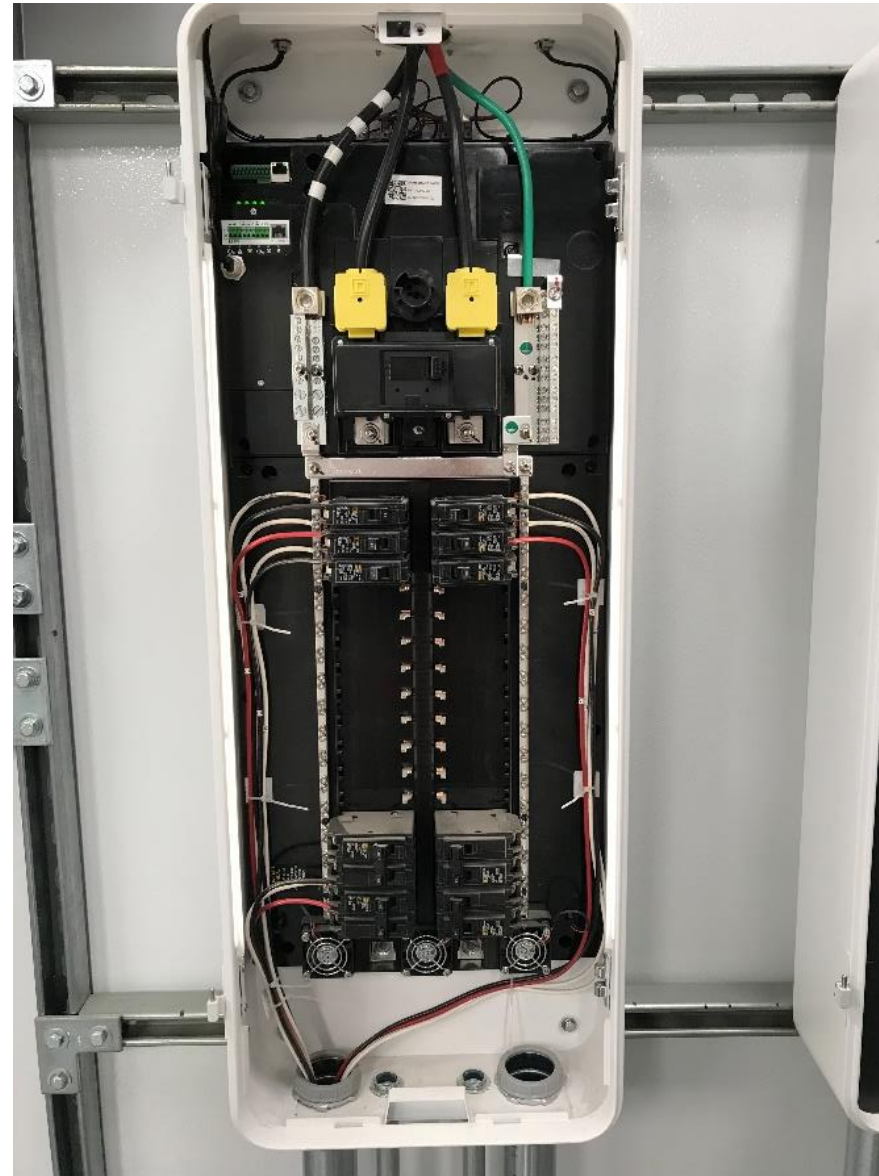
Installation / Test Setup

Laboratory Site:

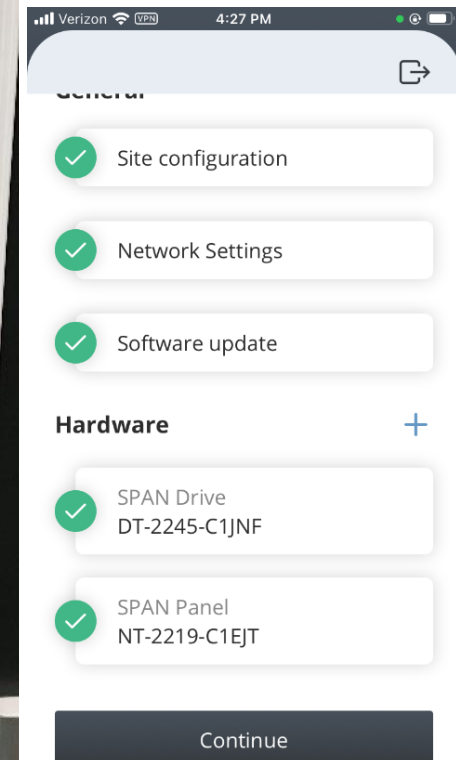
The device under test is a SPAN Panel Gen2 and Koben Systems Genius Panel. Behind each breaker position, there is a contactor that is software controlled. These contactors enable disconnecting load through SPAN's Customer App or PowerAssist platform.

Breaker positions 1-5 each have a single-pole breaker (120V) connected to a Chroma 63804 Electronic Load.

Breaker positions 29 and 31 have a 2-pole breaker (240V) connected to a Chroma 63804 Electronic Load.

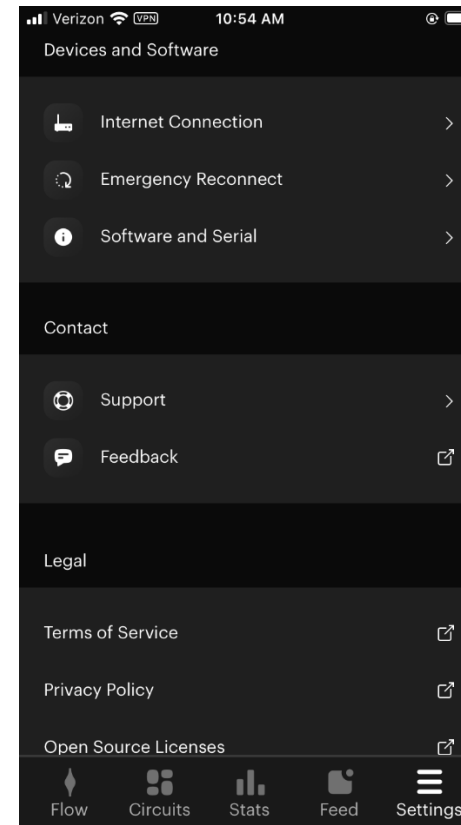
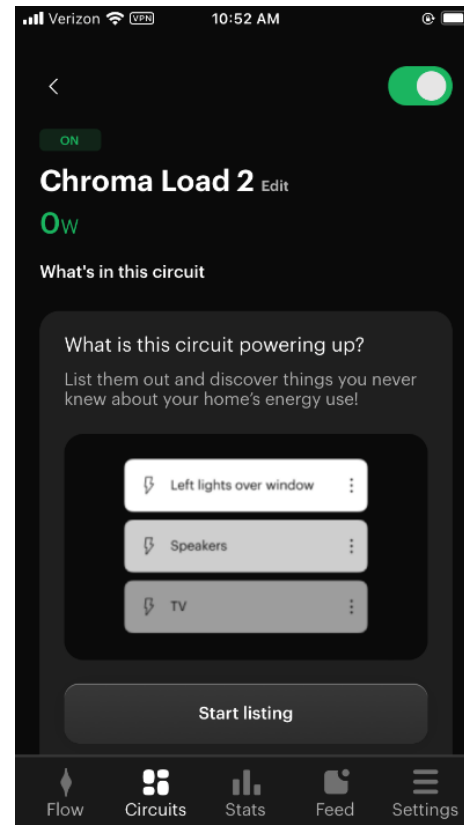
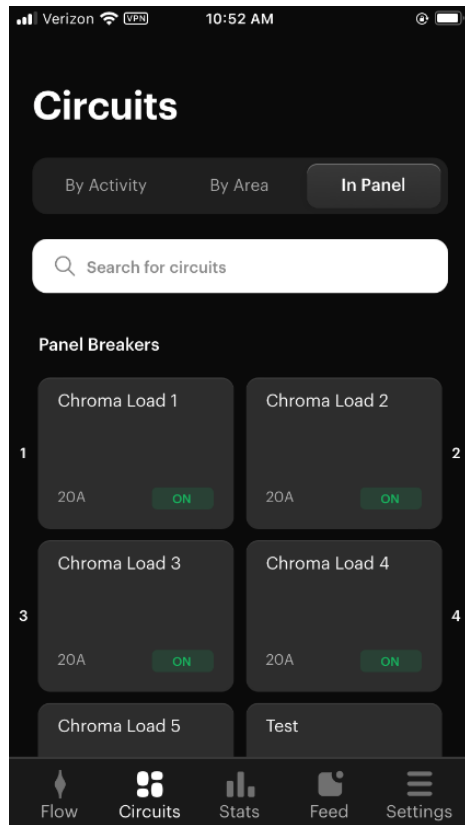
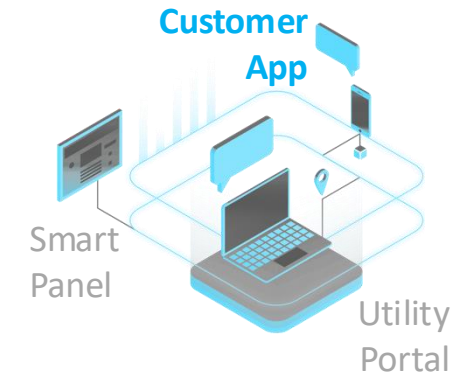


App Controls



User Interfaces (for Customers)

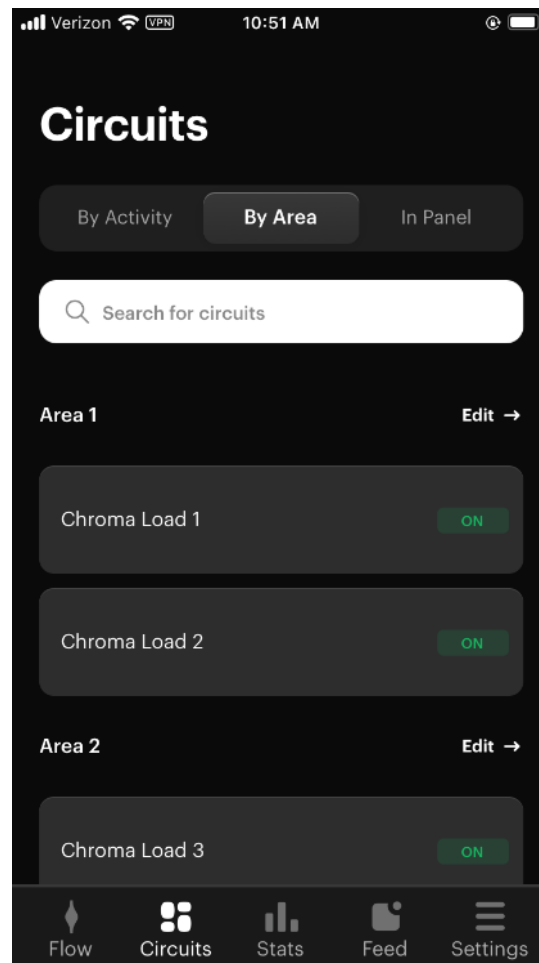
The homepage of the Customer App shows the total panel load. The Circuits page shows a view of the individual branch loads. If a tandem breaker is used, the load through both circuits will be reported for the panel position.



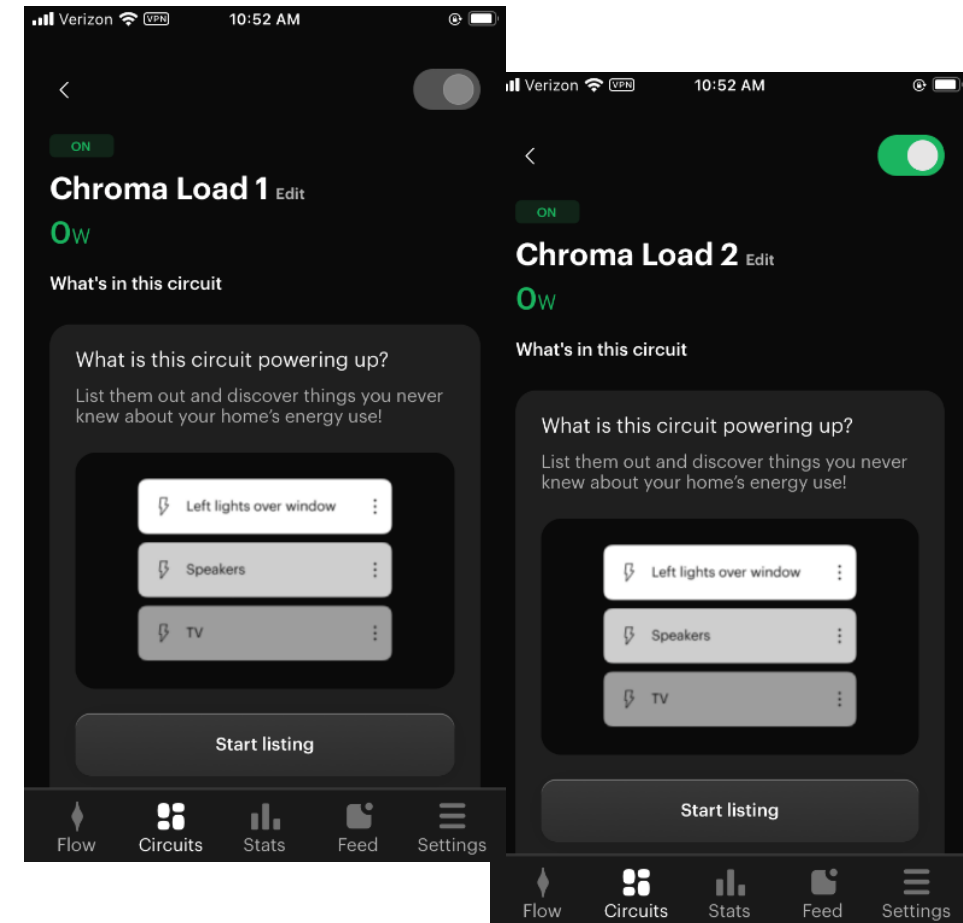
The monitor and control function in the Customer App are all done through the internet. There is no local LAN communication between the panel and the Customer App.

Customer App Control Functions

Circuits can be grouped by area of the house.

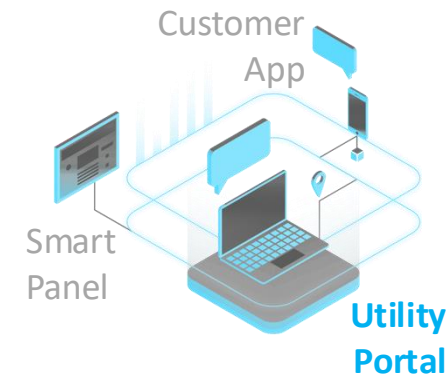


The contactor behind a breaker can be controlled by selecting the breaker and then toggling the selector in the upper right-hand corner. If the breaker was assigned as “Always on” during installation the selector will be grayed out.



Signaling Platform (for Utilities)

PowerAssist is a platform SPAN provides that will let Utilities control a fleet of SPAN Panels. When enrolling a site, the breakers are placed into groups. SPAN can create new group names as required. Any circuit that was designated as “Always on” during installation can not be put into a group.



Enroll site

Serial # nt-2219-c1ejt Address 3400 Crow Canyon Rd San Ramon, CA 94583 Commissioned 2022-06-27

Identifier:

Enrollment window: from until

1 - Chroma Load 1 - (20A)	Water Heater	Chroma Load 2 - (20A) - 2
3 - Chroma Load 3 - (20A)	Group B	Chroma Load 4 - (20A) - 4
5 - Chroma Load 5 - (20A)	Group C	Test - (20A) - 6
7 -	Pool Pump	- 8
9 -		- 10
11 -		- 12
13 -		- 14

If no loads are selected, the site is enrolled for reporting only

[Save](#)

SPAN PowerAssist

Events

[Enroll site](#) [Create Event](#)

Sites **Assisting Circuits**

1 EVSE 1 Group A 1 Group B 1 Group C 1 Group D 1 Group E 0 Pool Pump 0 Power Assist 0 Water Heater 0

Next Event

Type	Sites	Date
Reduction	1	May 05

Last updated 0 min ago. Please refresh page for latest info. All dates and times in America/Los_Angeles.

EVENT ID	TARGET	CIRCUIT(S)	LOADS	START DATE	START TIME	DURATION	OVERRIDES	STATUS
pge-00006	1 Zips	Group A	1	May 05, 2023	15:59	30 Minutes	0	Scheduled
pge-00005	1 Zips	Group B	1	May 05, 2023	14:58	30 Minutes	0	In Progress
pge-00004	1 Sites	EVSE	1	April 20, 2023	13:55	3 Minutes	0	Complete
pge-00003	1 Sites	EVSE	0	April 20, 2023	12:33	10 Minutes	0	Cancelled on April 20, 2023
pge-00002	1 Sites	Group A, Group D	2	February 16, 2023	14:25	30 Minutes	0	Complete
pge-00001	1 Sites	Group A	1	January 18, 2023	11:10	30 Minutes	0	Complete

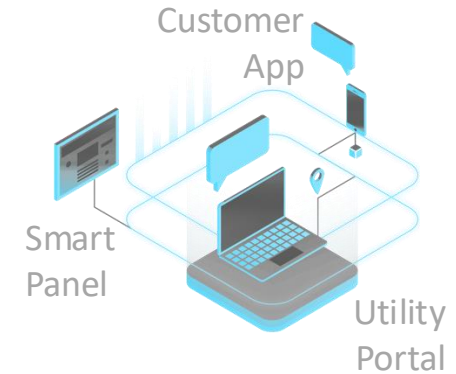
Laboratory Testing

Project Testing is built around three facets establishing the Smart Panel's safety, functionality, and communication.

Safety Testing:

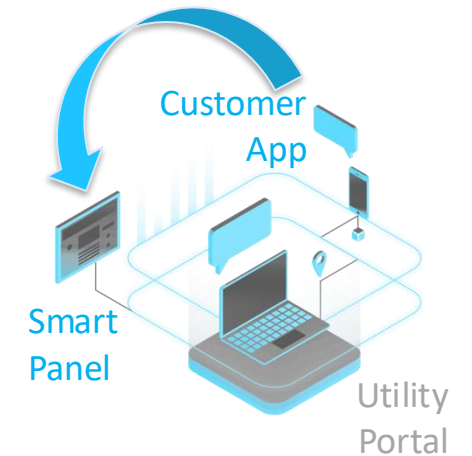
- Fit all compatible breakers, apply same load to all, and monitor with IR camera.
- Misalign breaker positions by 1 in the device set up and see if it is possible to disconnect a single pole of a 2-pole breaker.

Test No.	Test	Result
4.1.1	Fit all compatible breakers, apply same load to all, and monitor with IR camera.	The listed compatible breakers (Appendix A of the installation manual) are commonly found to be interchangeable with panels. The SPAN panel was tested to the UL 67 Standard with all compatible breakers. For this reason, the temperature test was not done.
4.1.2	While performing breaker assignment in the Installer App, offset the location of a 2-pole breaker by one position such that the installer app shows the breaker in positions 28/30 but the breaker is actually in positions 30/32. After breaker assignment is done see if contactors on positions 28/30 will open with the Customer App.	When the contactors behind a 2-pole breaker are opened in the Customer App the contactors on both poles open. In this test the contactors on positions 28/30 opened and contactor on position 32 remained closed. If this configuration mistake were to happen in a real installation it would be possible to single-phase the load on the 2-pole breaker in positions 30/32.



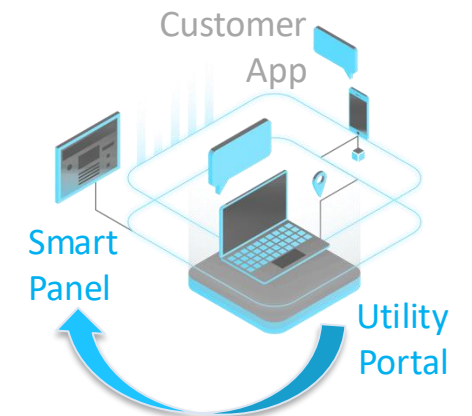
Functional Testing

Test No.	Test	Result
4.2.1	SPAN claims +/- 0.5% energy metering accuracy. Use a calibrated meter with sufficient accuracy to measure load and compare against SPAN reported metering.	Accuracy was spot checked and found to be within the stated accuracy of +/- 0.5% at 10 amps and within +/- 1 % at 1 amp. The reported load values are in the unit Watts.
4.2.2	Use the Customer App to check load readings. Change the amount of load and measure the time it takes for the Customer App to update the load reading after the change. Repeat the test 10 times.	Below are the results of the time interval between the load changing and the Customer App showing the new load level. Trial 1: 7 seconds Trial 6: 1 second Trial 2: 8 seconds Trail 7: 1 second Trial 3: 7 seconds Trail 8: 2 seconds Trail 4: 5 seconds Trail 9: 1 second Trail 5: 6 seconds Trail 10: 1 second
4.2.3	Use the Customer App to open and close a circuit. Measure the time it takes between the command being entered in the Customer App and the panel executing the action. Repeat the test 10 times.	Below are the results of the time interval between the open or close command being entered in the Customer App and the panel executing the action. Trial 1: 1 second Trial 6: 7 seconds Trial 2: 2 seconds Trail 7: 8 seconds Trial 3: 2 seconds Trail 8: 7 seconds Trail 4: 1 second Trail 9: 8 seconds Trail 5: 2 seconds Trail 10: 4 seconds



Further Tests done include:

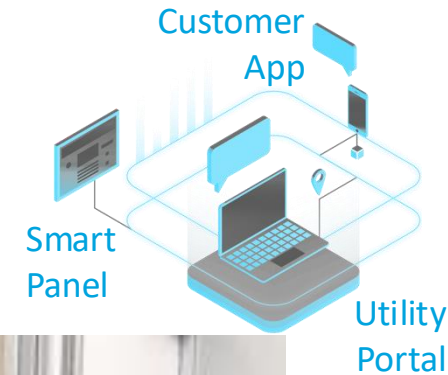
- Use the Utility Portal to check load readings. Measure time it takes to update after load level change.
- Use the Utility Portal to open and close circuits. Measure time it takes for control to execute.
- Use the app to shed load with the 3 tier assignments and use the Utility Portal to shed load with the 3 tier assignments.
- Use the app to close in a relay that was disconnected though the tiered load shed commanded by the app.
- Use the Utility Portal to close in a relay that was disconnected though the tiered load shed commanded by the Utility Portal.



Smart Panel Lab Communications

Communication Testing:

- Remove LAN interface and verify that monitor and control from app and Utility Portal work with the cell backup.
- Compromise the cell backup (remove antenna or disrupt the signal strength is some other way) and verify monitor and control from app and Utility Portal work over LAN connection.
- Disconnect LAN from internet and compromise cell backup. See if app on same LAN can still monitor and control.
- Perform a software update over the air if one is available.



Learnings & Experience So Far

- SPAN panel showed robust communication with good metering accuracy and response times.
- The ability to dynamically manage load by disconnecting branches to stay under a set load at the main break does not exist at the time the panel was tested.
- The utility portal named PowerAssist can execute scheduled demand response, but it is limited to opening and closing specified loads.
- There is no real-time view of loading in PowerAssist, but there is the ability to download reports with the load data.
- Lab will use preliminary learnings as it begins testing of another smart panel by Koben Systems





This project was funded by
PG&E's Demand Response - Emerging Technologies Program

For more information,
contact Albert Chiu

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The project report can be found at
[https://www.dret-ca.com/wp-content/
uploads/2024/04/Smart-Electric-Panel-Lab-Test.pdf](https://www.dret-ca.com/wp-content/uploads/2024/04/Smart-Electric-Panel-Lab-Test.pdf)