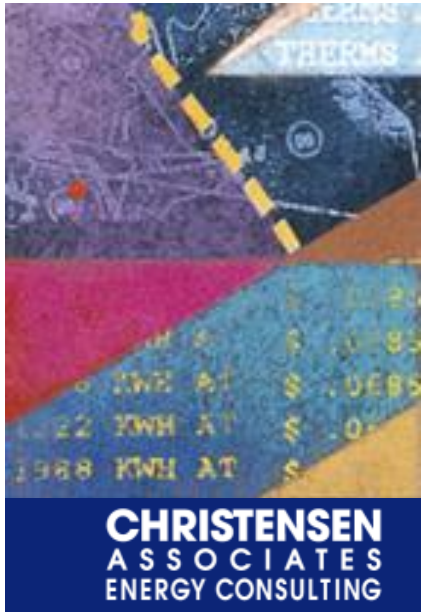

Load Impact Evaluation:
Base Interruptible Program

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Presentation Outline

1. Program Description
2. *Ex-post* Methodology
3. *Ex-post* Load Impacts
4. *Ex-ante* Methodology
5. Enrollment Forecast
6. *Ex-ante* Load Impacts

1. BIP Program Description

- Emergency DR program for non-residential customers, events triggered by CAISO or local system emergencies
- Customers receive a monthly capacity credit in exchange for a commitment to reduce energy consumption to their Firm Service Level (FSL)
- The FSL represents the customer's minimal operational requirements
- 15 or 30-minute notice of events
- Failure to reduce load to the FSL can result in excess energy charges, an increase in the FSL (and commensurate reduction in capacity credits), re-test events, or de-enrollment from the program
- Program specifics vary by utility

2. *Ex-post* Methodology

- Individual regressions were used to estimate BIP *ex-post* load impacts
- This method was chosen for two reasons:
  - Difficulty in finding adequate control-group customers
  - Some customers have volatile loads, so even customers that match reasonably well on average may not have a comparable load on a specific day
- Customer-specific specification search conducted to:
  - Determine whether each customer has a weather-sensitive load
  - Find the best fitting weather and shape variables by groups defined by weather sensitivity and industry group

2. *Ex-post* Methodology: Weather-sensitivity summary

- BIP **load impacts** do not tend change significantly with temperatures because the biggest responders do not have weather-sensitive loads
- However, there are weather-sensitive customers in BIP that cause the program **reference load** to change somewhat with temperatures

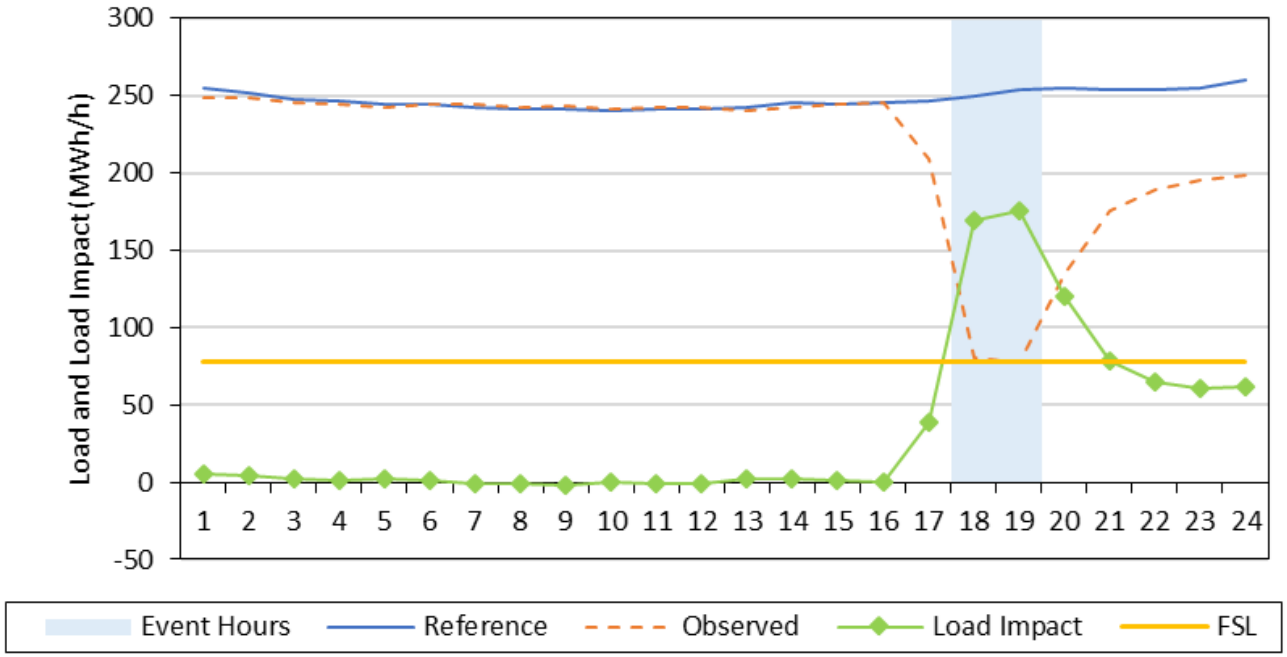
3. *Ex-post* Load Impacts: *Events*

Date	Day of Week	PG&E	SCE	SDG&E
2/23/2019	Saturday	Emergency Event, 7:00 – 10:00 p.m. (1 subLAP)		
3/12/2019	Tuesday	Test, 6:30 – 9:30 a.m. (14 subLAPs)		
6/6/2019	Thursday	Re-test, 6:30 – 9:30 a.m.		
9/4/2019	Wednesday		M&E Event, 3:20 – 7:00 p.m.	Temp. and System Load 12:00 – 4:00 p.m.
9/8/2019	Sunday		Erroneous Dispatch, 6:30 – 6:40 p.m.	
10/6/2019	Sunday	Test, 5:00 – 7:00 p.m.		

3. *Ex-post* Load Impacts: *Events (2)*

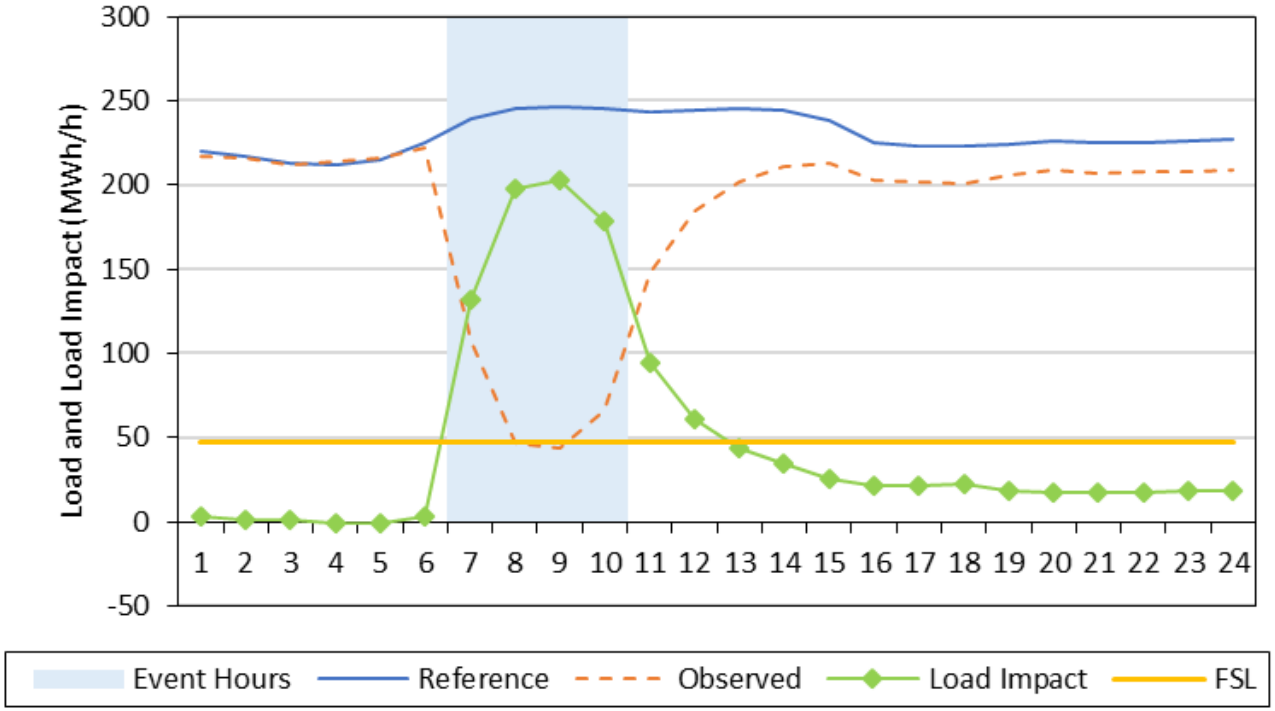
Utility	Hours of Availability	Hours of Actual Use	No. of Available Dispatches	No. of Actual Dispatches
PG&E	180 / year 4 / day	11	10 / month 1 / day	4
SCE	180 / year 6 / day	3.7	10 / month 1 / day	1
SDG&E	120 / year 4 / day	4	10 / month	1

3. *Ex-post* Load Impacts:
PG&E October 6th Event (Sunday)



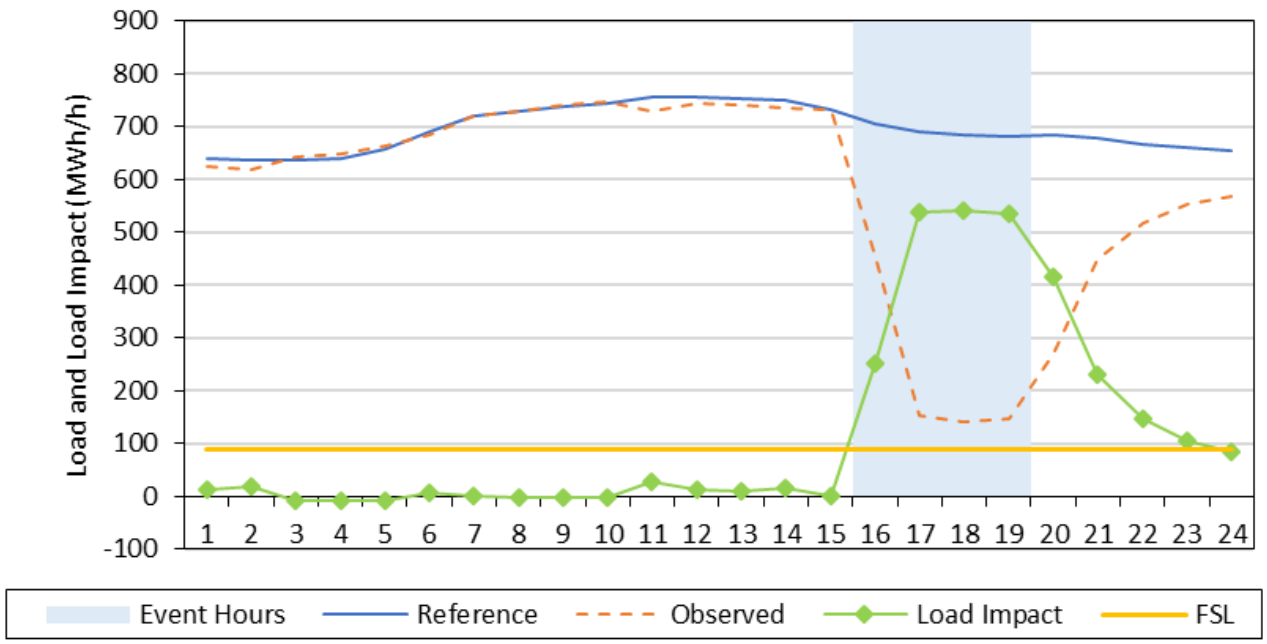
- Event from 5:00 to 7:00 p.m.
- 512 called customers
- Event took place on a Sunday, so reference load is low relative to a weekday
- Avg. Ref. Load = 252 MW
- Avg. Load Impact = 173 MW
- FSL = 78 MW
- % Load Impact = 69%
- FSL Achievement = 99%
- Top 10 responders account for 59% of the total load impact

3. *Ex-post* Load Impacts:
PG&E March 12th Event



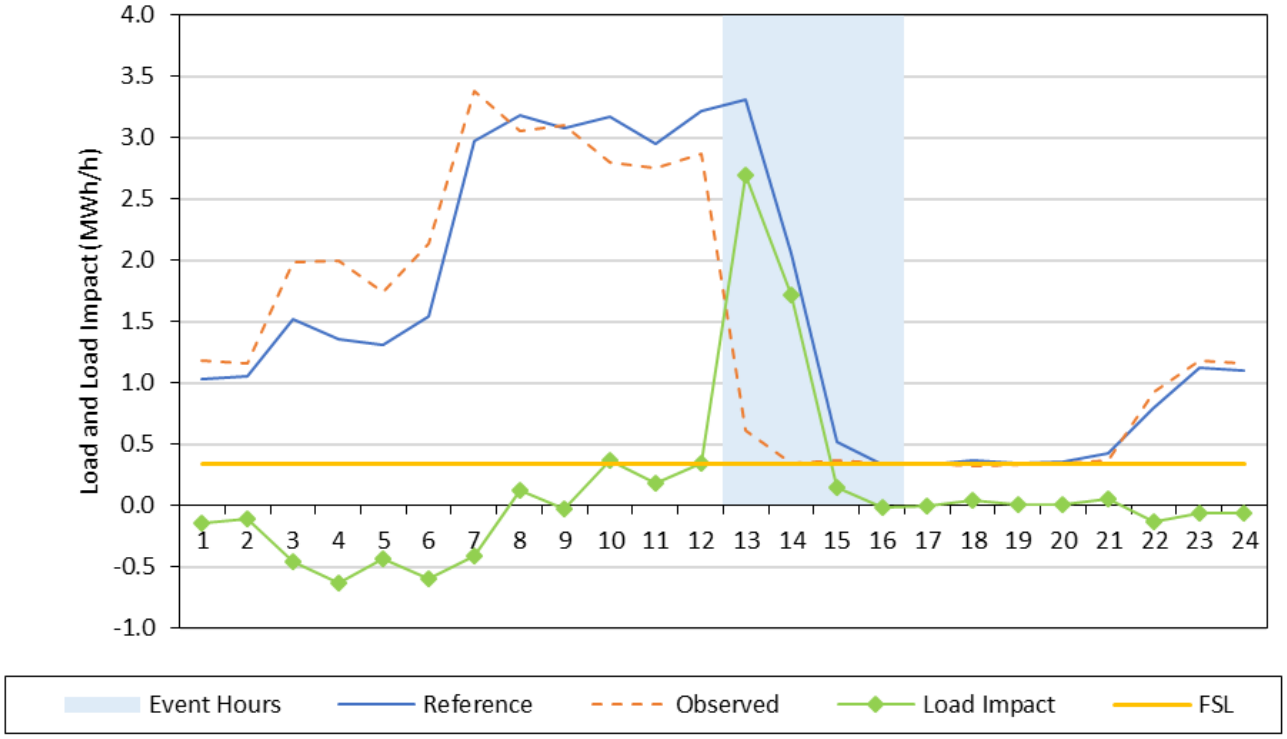
- Event from 6:30 to 9:30 a.m.
- 299 called customers
- Earlier than usual event window
- Avg. Ref. Load = 246 MW
- Avg. Load Impact = 201 MW
- FSL = 48 MW
- % Load Impact = 82%
- FSL Achievement = 101%
- Top 10 responders account for 54% of the total load impact

3. *Ex-post* Load Impacts:
SCE September 4th Event



- Event from 3:20 to 7:00 p.m.
- Values above represent HE 17-19, excluding the partial event hour of HE 16
- 484 customers enrolled
- 479 customers called
- Avg. Ref. Load = 685 MW
- Avg. Load Impact = 537 MW
- FSL = 88.8 MW
- % Load Impact = 78%
- FSL Achievement = 90%
- Top 10 responders account for 40% of the total load impact
- Top 40 responders account for 70% of the load impact

3. *Ex-post* Load Impacts:
SDG&E September 4th Event



- Event from 12:00 to 4:00 p.m.
- 5 enrolled customers
- Avg. Ref. Load = 3.4 MW
- Avg. Load Impact = 2.9 MW
- FSL = 0.4 MW
- % Load Impact = 85%
- FSL Achievement = 96%
- Reference load drops during event hours, so there's little need for customer response by the later event hours

4. *Ex-ante* Methodology

- *Ex-ante* load impacts are based on the most recent full or test / M&E event day for which customer's reference load was above their FSL, by customer
- Each customer's *ex-ante* load impact is set to its *ex-post* FSL achievement rate:
  - *ExPost* Achievement = *ExPost* Load Impact / (Ref. – FSL)
  - *ExAnte* Impact = *ExPost* Achievement x (Ref. – FSL)
- Load impact is zero if FSL is above the reference load
- We remove customers who have left BIP
- Customers who have joined BIP are assigned the program-level FSL achievement rate (applied to their own reference loads and FSL, if available)

4. *Ex-ante* Methodology (2)

- Reference loads are simulated using the following:
  - Customer-specific regressions to obtain effect of weather and time-period indicators on usage
  - *Ex-ante* day types and weather conditions (*e.g.*, August peak month day in a utility-specific 1-in-2 weather year)
- Load impacts display little to no relationship with weather conditions
  - Biggest responders do not tend to have weather-sensitive loads

5. Enrollment Forecast

- The table below shows August enrollment in each year of the forecast
  - PG&E forecasts flat enrollment
  - SCE forecasts slightly declining enrollment
  - SDG&E forecasts a small increase in enrollment

Utility	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
PG&E	512	512	512	512	512	512	512	512	512	512	512
SCE 15-min	53	49	49	49	49	49	49	49	49	49	49
SCE 30-min	411	403	403	403	403	403	403	403	403	403	403
SDG&E	5	6	7	7	7	7	7	7	7	7	7

6. *Ex-ante* Load Impacts:
by Year and Weather Scenario

PG&E

Year	Weather	# SAIDs	Load Impact (MW)	Temp. (°F)	FSL (MW)
Aug. All Years	PG&E 1in2	512	236.1	92.8	81.7
	PG&E 1in10		237.2	95.9	

SCE

Year	Weather	# SAIDs	Load Impact (MW)	Temp. (°F)	FSL (MW)
Aug. 2020	SCE 1in2	464	564.4	88.7	97.8
	SCE 1in10		567.3	93.7	
Aug. 2030	SCE 1in2	452	543.3	88.7	94.9
	SCE 1in10		546.0	93.7	

SDG&E

Year	Weather	# SAIDs	Load Impact (MW)	Temp. (°F)	FSL (MW)
Aug. 2020	SDG&E 1in2	5	0.9	87.9	0.4
	SDG&E 1in10		0.9	90.3	
Aug. 2030	SDG&E 1in2	7	1.1	87.9	0.6
	SDG&E 1in10		1.1	90.3	

6. *Ex-ante* Load Impacts:

PG&E Ex Post vs. Ex Ante

Ex Post / Ex Ante	Date / Scenario	# SAIDs	Reference Load (MW)	Load Impact (MW)	Temp. (°F)	FSL (MW)	FSL Achievement
Ex Post	10/6/2019	512	252	173	81	78	99%
Ex Ante	Aug. 2020 Typical Event Day	512	334	239	93	82	94%

- The total load impact increases even though enrollment remains the same
- The October 6th event day was a Sunday so reference loads were lower than those of a typical event day, which is assumed to occur on a non-holiday weekday
- Ex-post FSL achievement rate is higher because more customer reference loads are below their FSL
- All ex-ante forecasts from this point forward reflect the utility-specific 1-in-2 peak day

6. *Ex-ante* Load Impacts:

SCE Ex Post vs. Ex Ante

Ex Post / Ex Ante	Date / Scenario	# SAIDs	Reference Load (MW)	Load Impact (MW)	Temp. (°F)	FSL (MW)	FSL Achievement
Ex Post	9/4/2019	484	685	537	88	89	90%
Ex Ante	Aug. 2020 Typical Event Day	464	716	562	88	98	91%

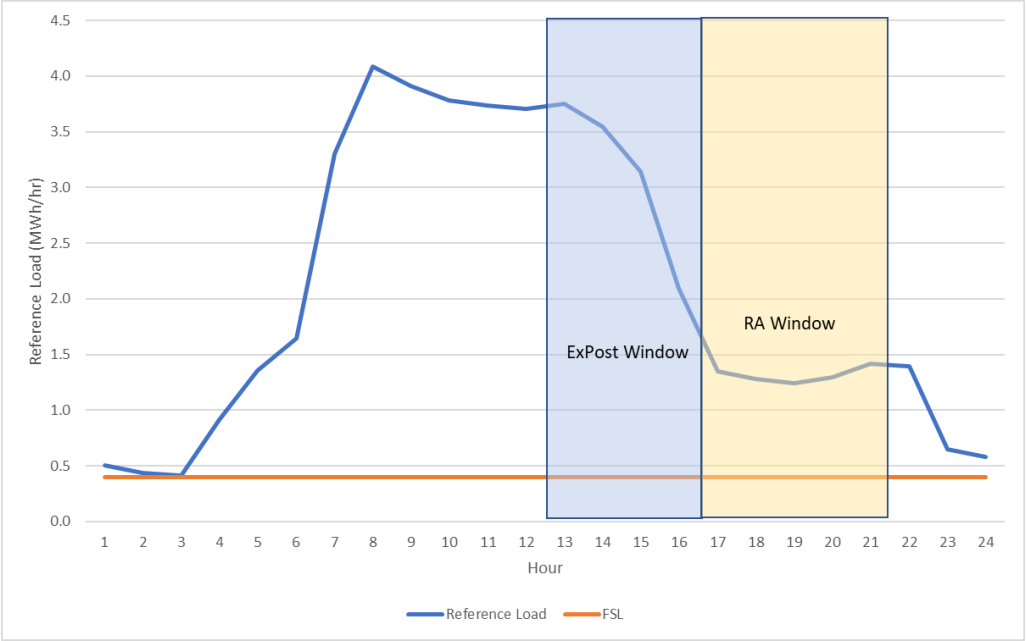
- Even though enrollment drops somewhat, the total reference load and load impact increases in the forecast
- This is primarily because five large and responsive customers were exempt from the ex-post event but are included in the ex-ante forecast (because they continue to be enrolled in BIP)

6. *Ex-ante* Load Impacts:

SDG&E Ex Post vs. Ex Ante

Ex Post / Ex Ante	Date / Scenario	# SAIDs	Reference Load (MW)	Load Impact (MW)	Temp. (°F)	FSL (MW)	FSL Achievement
Ex Post	9/4/2019	5	3.4	2.9	91.8	0.4	96%
Ex Ante	Aug. 2020 Typical Event Day	5	1.3	0.9	87.9	0.4	97%

- Differences are primarily due to program reference load dropping off prior to the RA window
  - *Ex-post* event hours = HE 13 to 16 (12 to 4:00 p.m.)
  - *Ex-ante* RA window = HE 17 to 21 (4 to 7 p.m.)
- As a result, there's a lot less load to curtail during the RA window



6. *Ex-ante* Load Impacts:

PG&E, Previous vs. Current Typical Event Day 2020

When Created	# SAIDs	Aggregate			Per-customer	
		Reference Load (MW)	Load Impact (MW)	FSL (MW)	Reference Load (kW)	Load Impact (kW)
Following PY2018 (Previous)	421	331	254	70	786	603
Following PY2019 (Current)	512	334	239	82	652	467

- Despite increase of 91 service accounts, reference load is only 3 MW higher and load impact is 15 MW lower
- Customers who remained in the program across years used less in PY2019
- Newly enrolled customers tend to use less (see decrease in per-customer reference loads and load impacts)

6. *Ex-ante* Load Impacts:

SCE, Previous vs. Current Typical Event Day 2020

When Created	# SAIDs	Aggregate			Per-customer	
		Reference Load (MW)	Load Impact (MW)	FSL (MW)	Reference Load (kW)	Load Impact (kW)
Following PY2018 (Previous)	480	765	598	80	1,593	1,246
Following PY2019 (Current)	464	716	562	98	1,542	1,211

- 16 fewer service accounts in the current forecast
- Most of the 36 MW drop in the program load impact is due to the de-enrollment of a single large and responsive customer

6. *Ex-ante* Load Impacts:

SDG&E, Previous vs. Current Typical Event Day 2020

When Created	# SAIDs	Aggregate			Per-customer	
		Reference Load (MW)	Load Impact (MW)	FSL (MW)	Reference Load (kW)	Load Impact (kW)
Following PY2018 (Previous)	7	1.5	1.0	0.6	219.6	143.6
Following PY2019 (Current)	5	1.3	0.9	0.4	263.6	178.5

- Two fewer enrolled service accounts assumed in the current forecast
- Higher per-customer loads and load impacts mitigate the program-level reductions due to lower enrollment

Questions?

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