OhmConnect 2022 LIP Evaluation

Presented at the Demand Response Providers' 2023 Load Impact Protocol Final Report Workshop hosted by the California Public Utilities Commission

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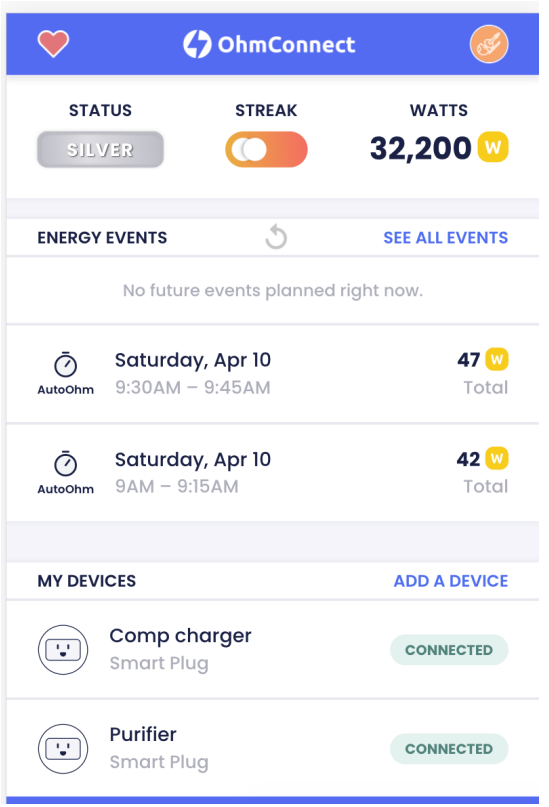
About OhmConnect

- OhmConnect is a free service that rewards residential customers for saving energy when it matters most to the grid and the environment: *"Save Energy. Get Paid"*
- Demand response events, which vary between one and four hours, are called *OhmHours*
- Users are typically notified a full day ahead that an OhmHour is scheduled—OhmConnect notifies users once it receives notice of a DAM award
- Rewards are proportional to the amount of energy saved
- Users participate in OhmHours automatically, through devices controlled by OhmConnect (their focus going forward) and behaviorally, by shutting off devices inside the home
- OhmConnect users receive a different status—Bronze, Silver, Gold, Platinum, or Diamond—based on how much energy they've saved, on average, during their OhmHours

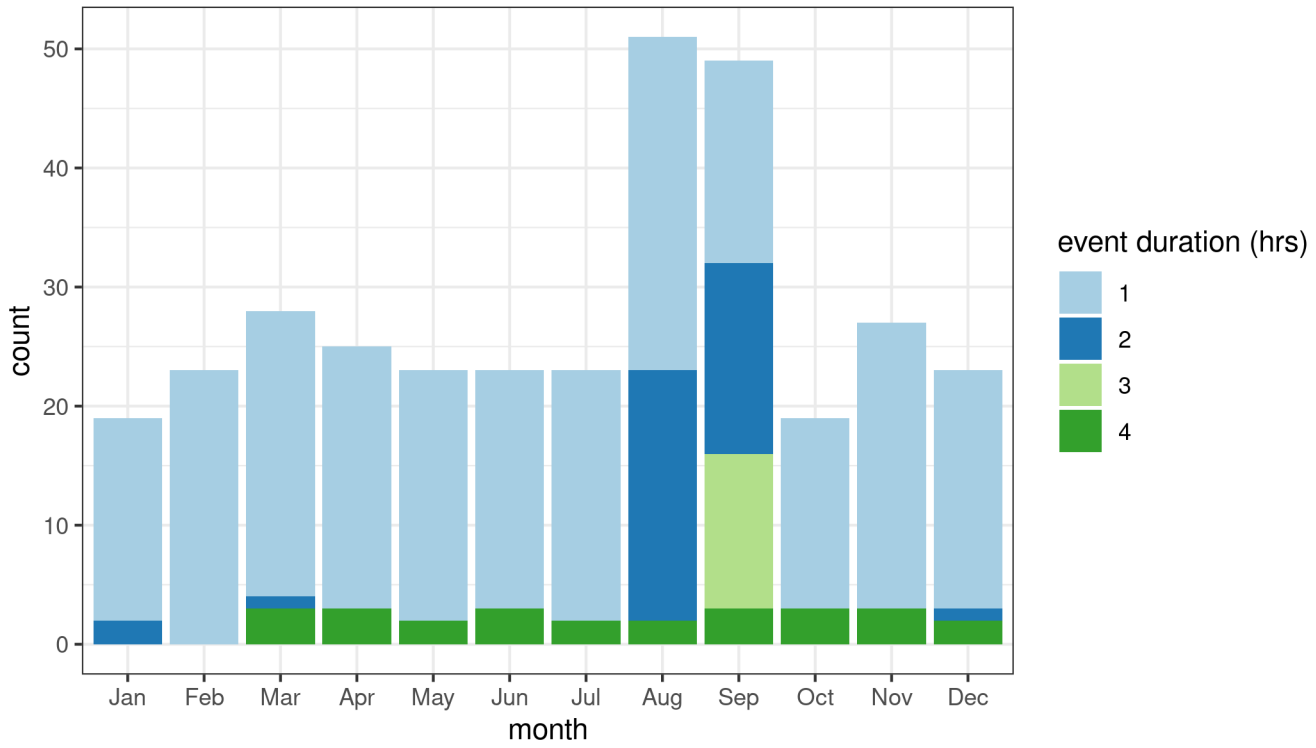


Events called in 2022

Events are defined by a unique combination of date, utility, event types, and start and end times.

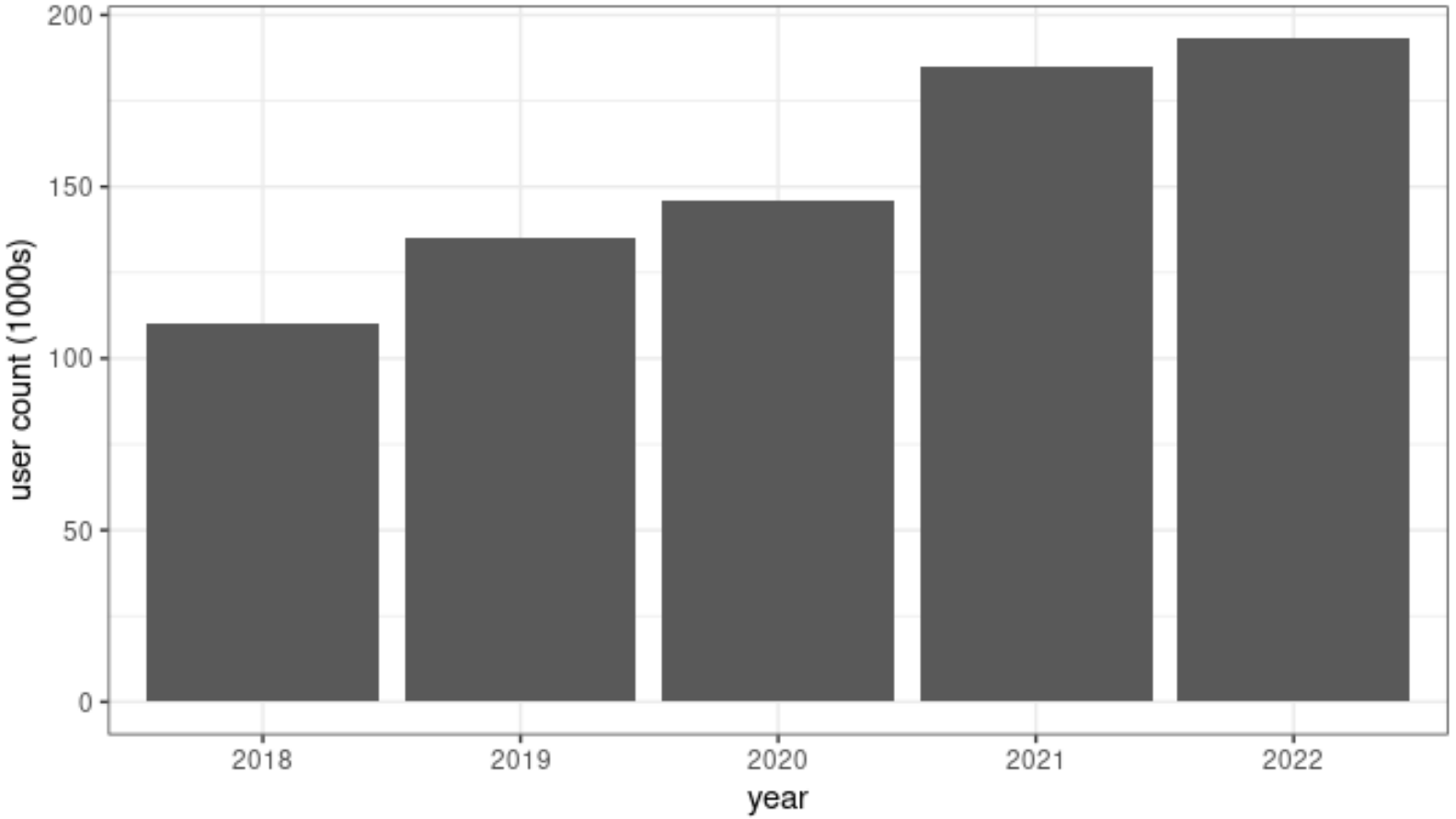
In 2022, 333 events occurred on 136 days, with multiple events being called on the same day.

start	count
4 pm	7
5 pm	103
6 pm	82
7 pm	125
8 pm	16
Total	333



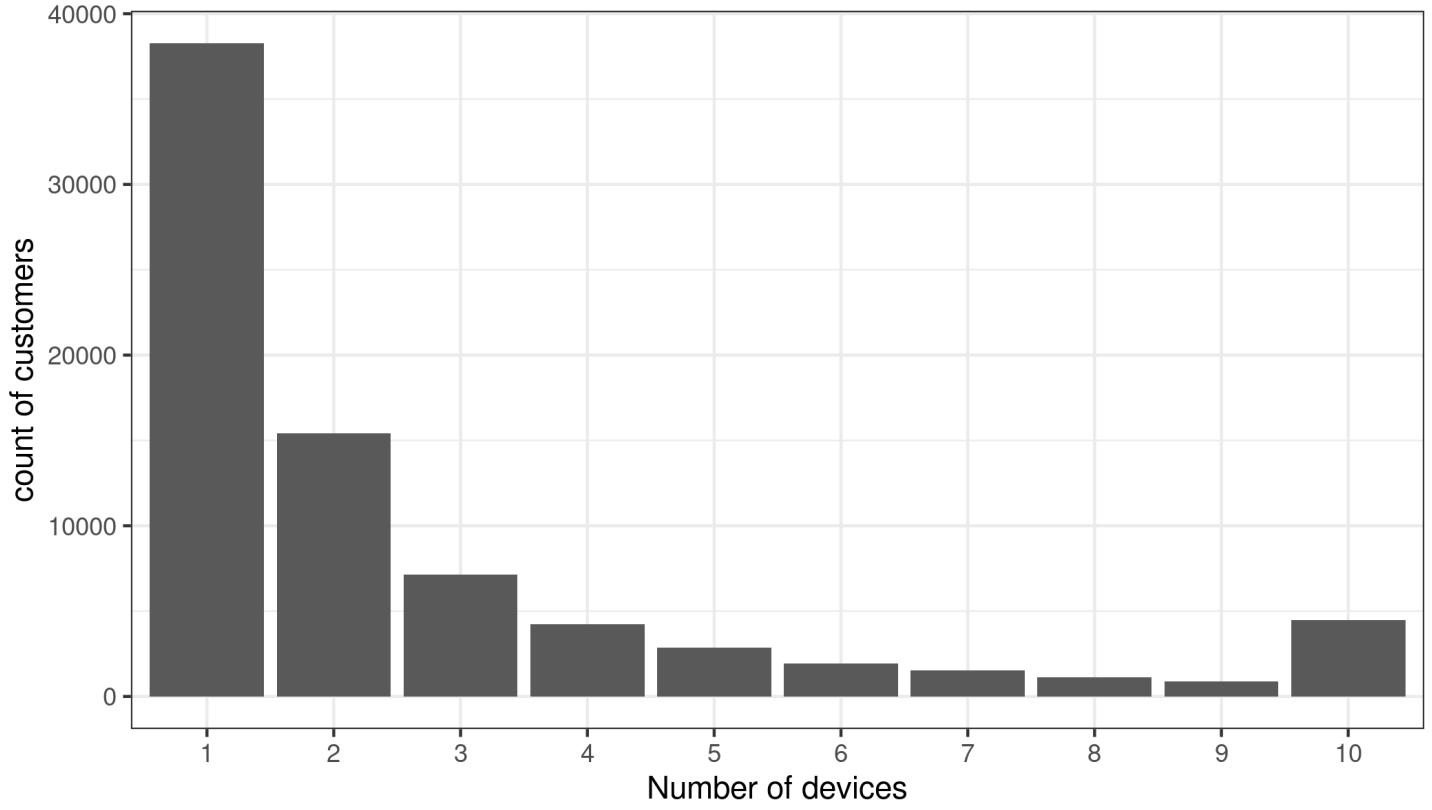
Annual unique participants

- 193,000 unique participants in 2022
- Up from 185,000 in 2021.



Controllable devices and tiers

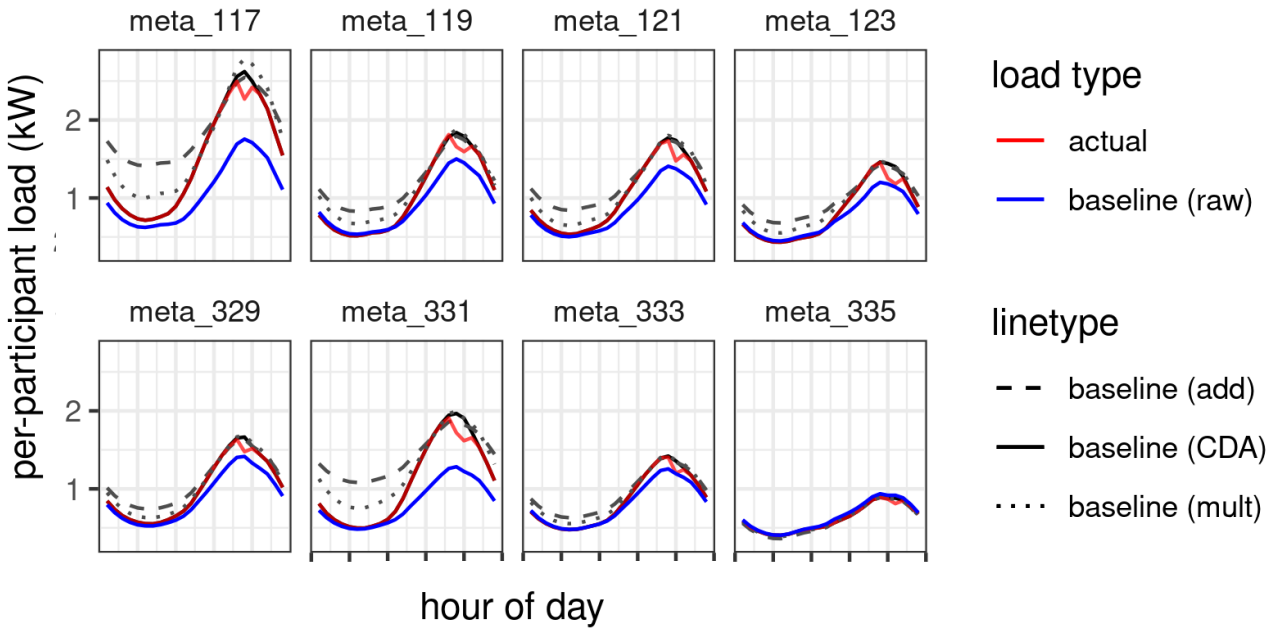
tier	% of customers in tier	% of tier with devices	% of devices in tier
Silver (and below)	41%	33%	39%
Gold	35%	33%	34%
Platinum (and above)	24%	38%	27%



Ex post

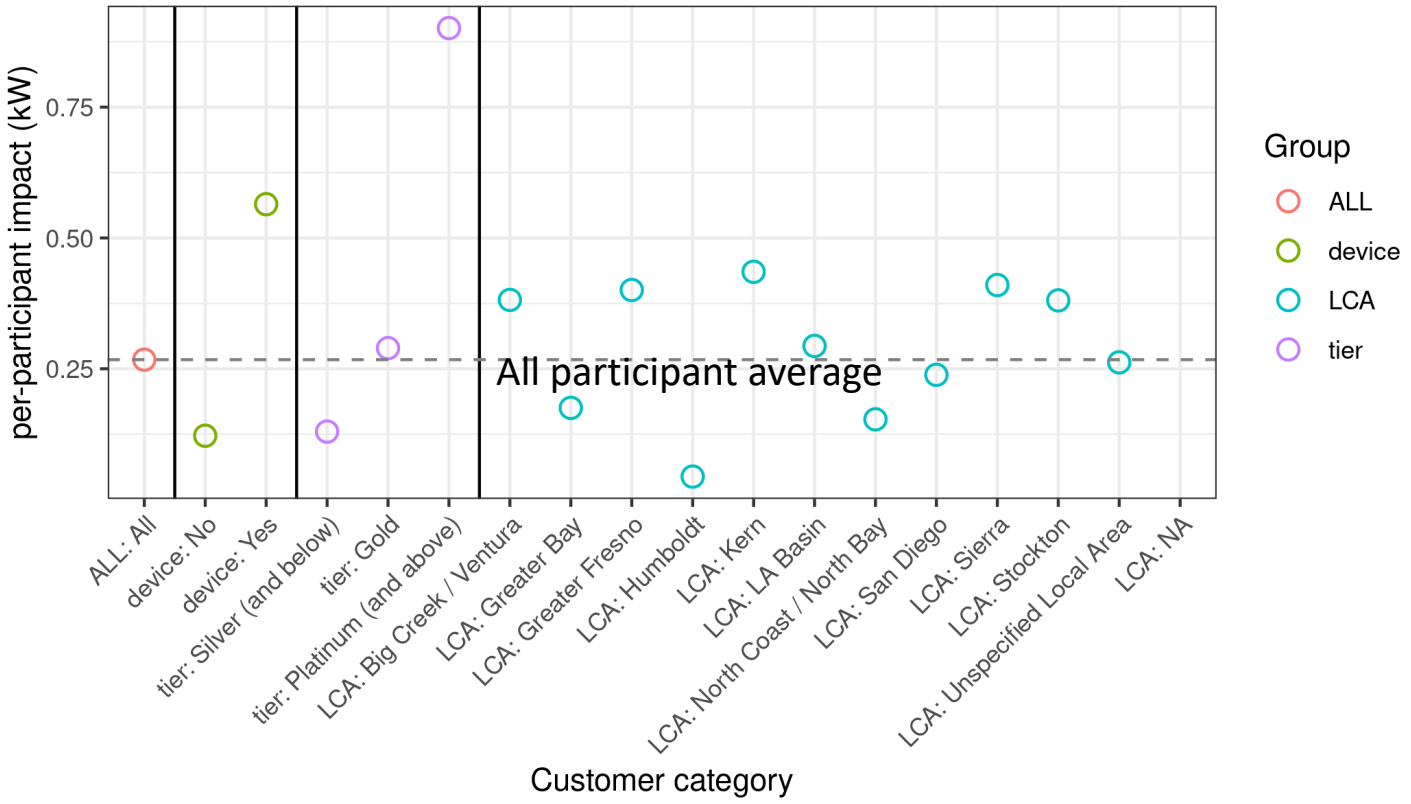
Ex post methods

- 10 of 10 baselines
  - Average of usage for the past 10 non-holiday weekdays
    - Adaptive additive same day adjustments
  - Aligns the baseline and event day data using the 2nd and 3rd hours before an event

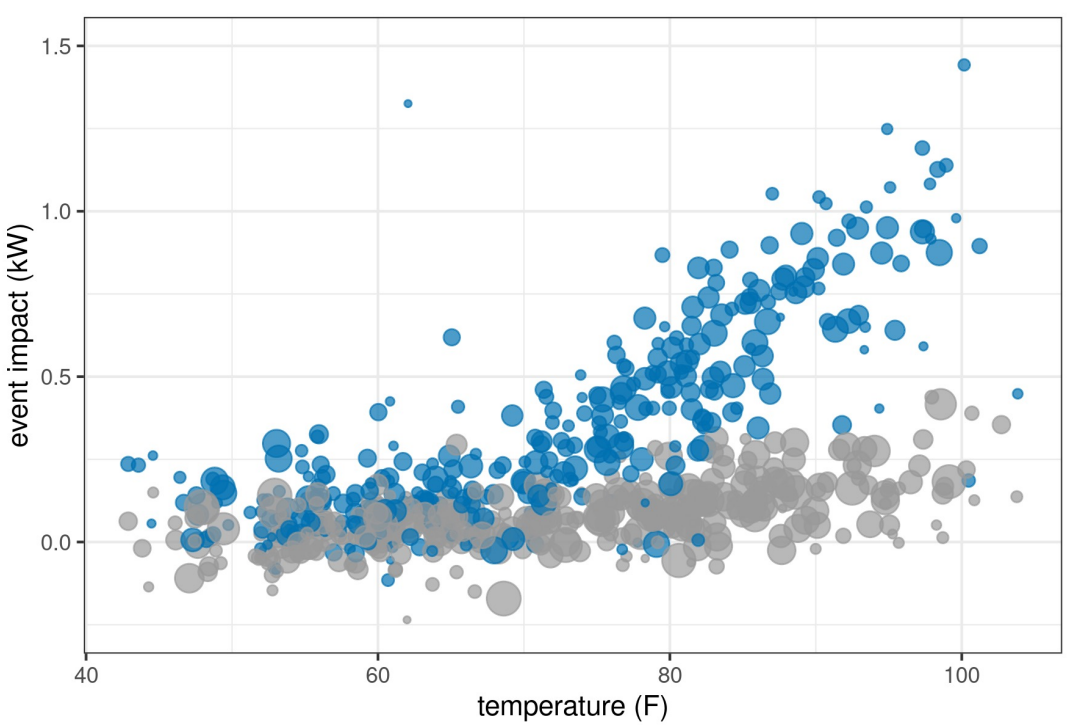


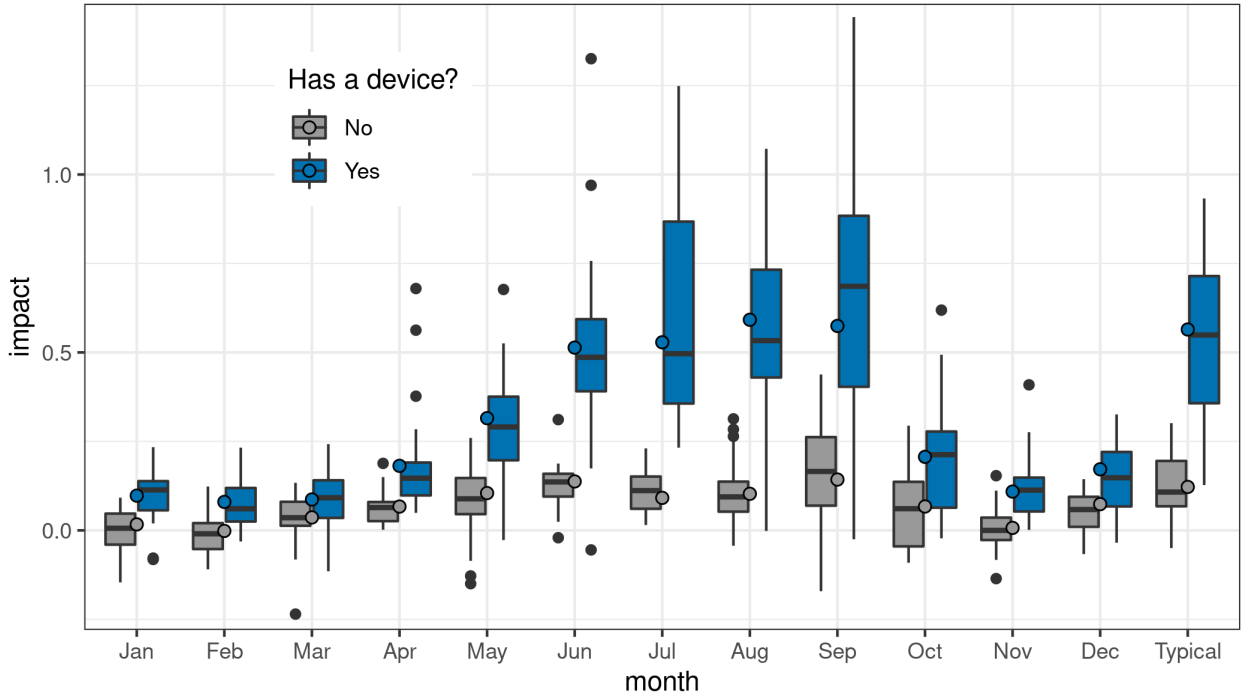
Ex post summary

Group	Category	# Jun-Sept unique participants	Average temp. (F)	per-participant ref. load (kW)	per-participant impact (kW)	Impact % (of ref)
ALL	All	183,840	83.75	1.72	0.27	15.55
device	No	129,753	84.12	1.71	0.12	7.13
	Yes	63,641	83.00	1.74	0.56	32.48
tier	Silver (and below)	171,289	83.87	1.78	0.13	7.30
	Gold	133,351	82.45	1.50	0.29	19.31
	Platinum (and above)	79,091	84.72	1.71	0.90	52.71



Device owner performance



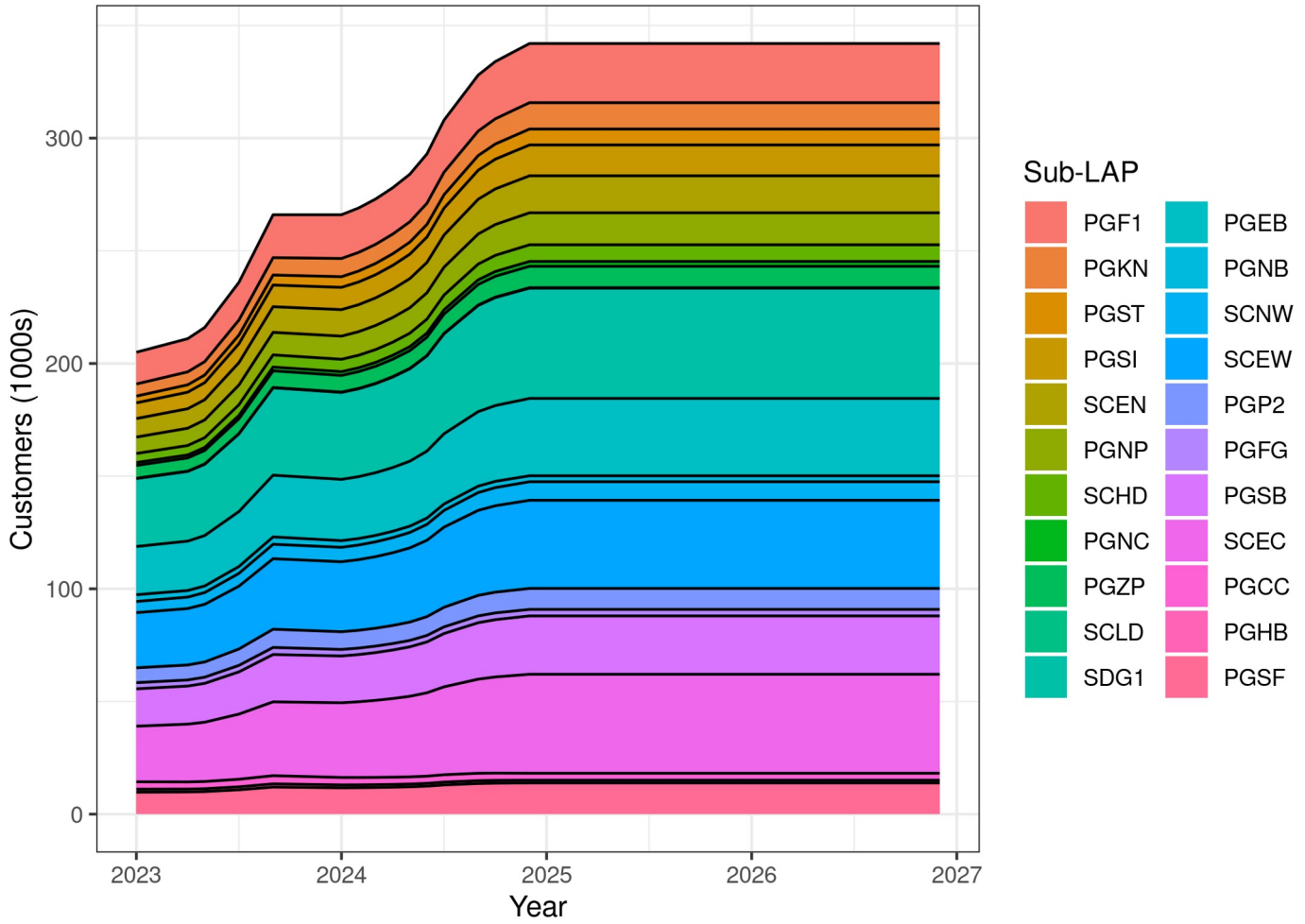


Ex ante

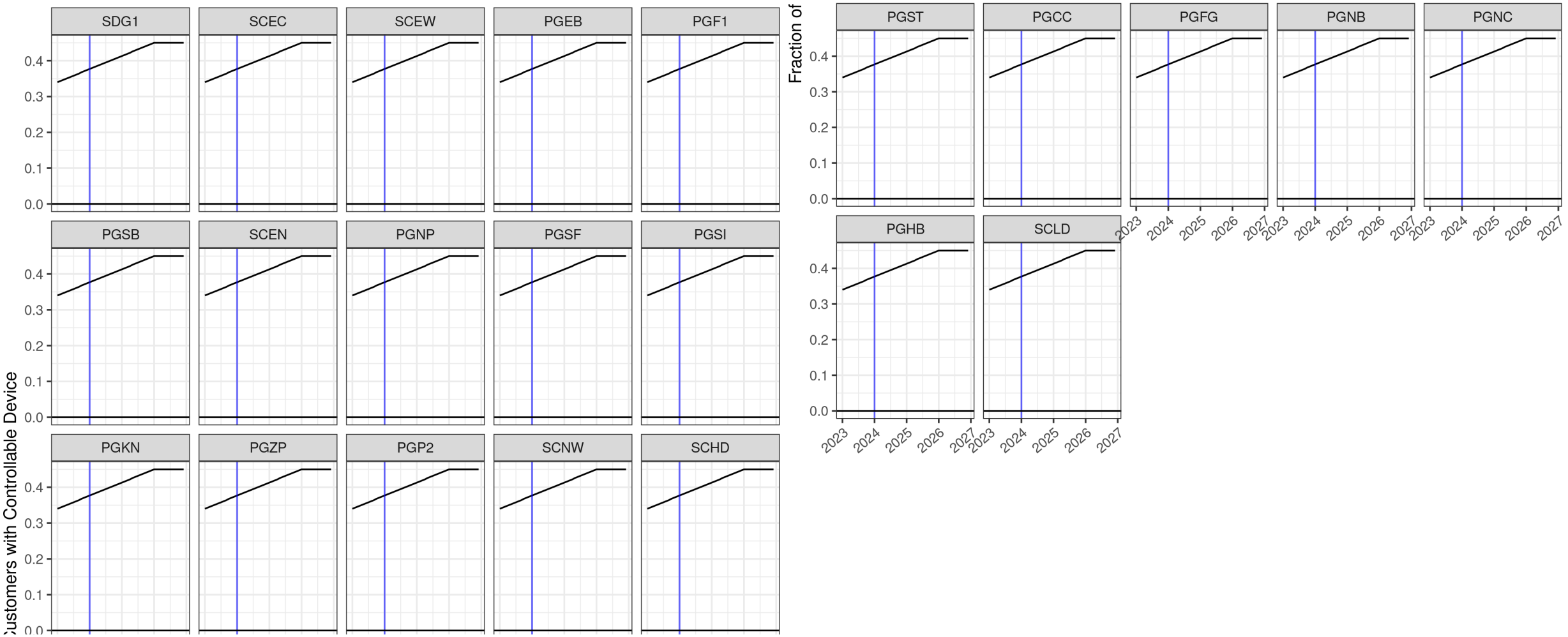
Ex ante methods

- Ex post events as inputs into ex ante regression model
- Primary explanatory variables: temperature, hour of day, device, tier, sub-LAP
  - Also, indicator variables for (May or October) and (June or September), interacted with sub-LAP

Projected enrollment - Medium scenario

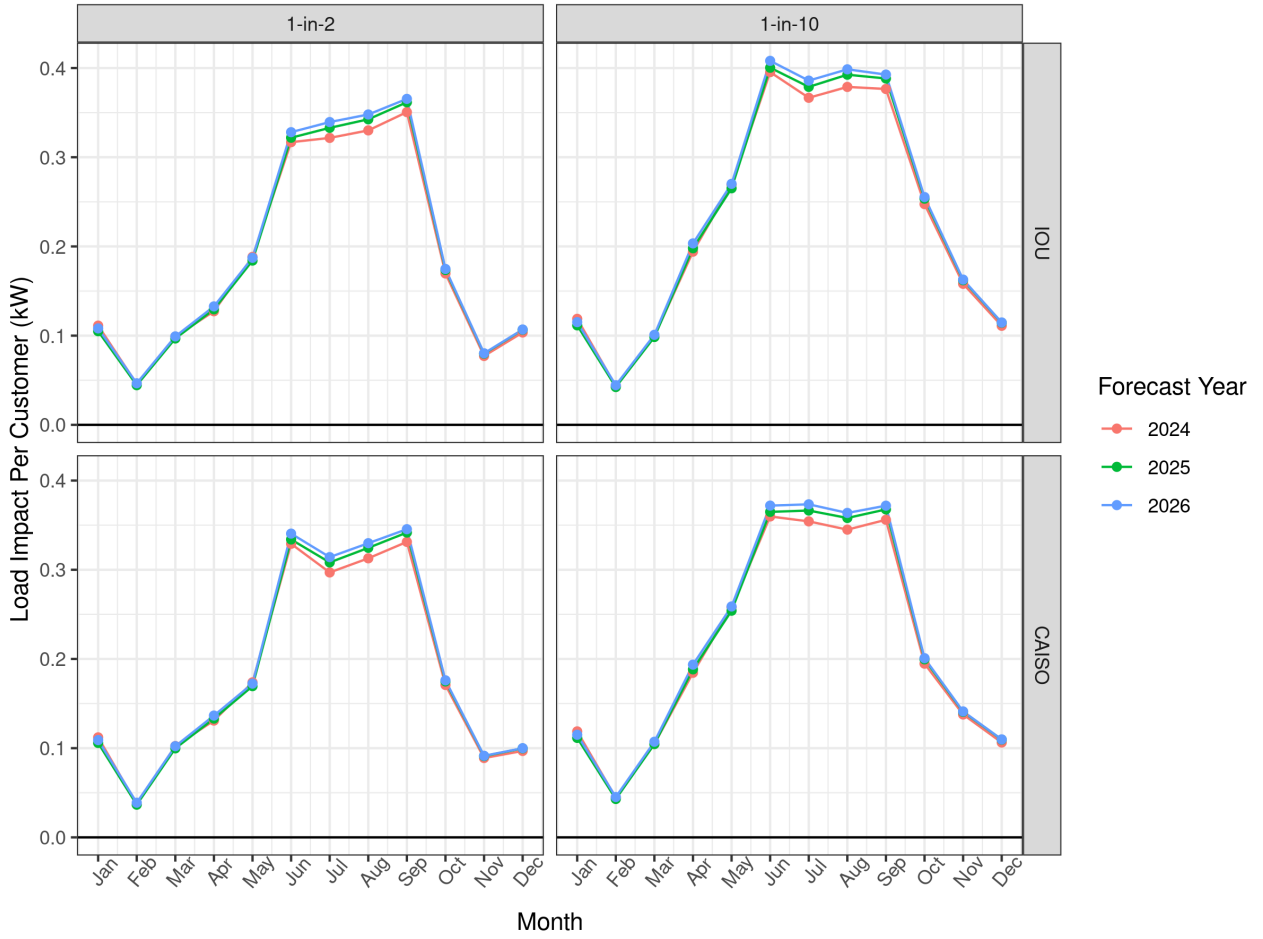


Projected fraction of device customers



Per-customer predicted monthly load impact (4-hour QC window)

- Modest increases primarily due to increasing fraction of device customers

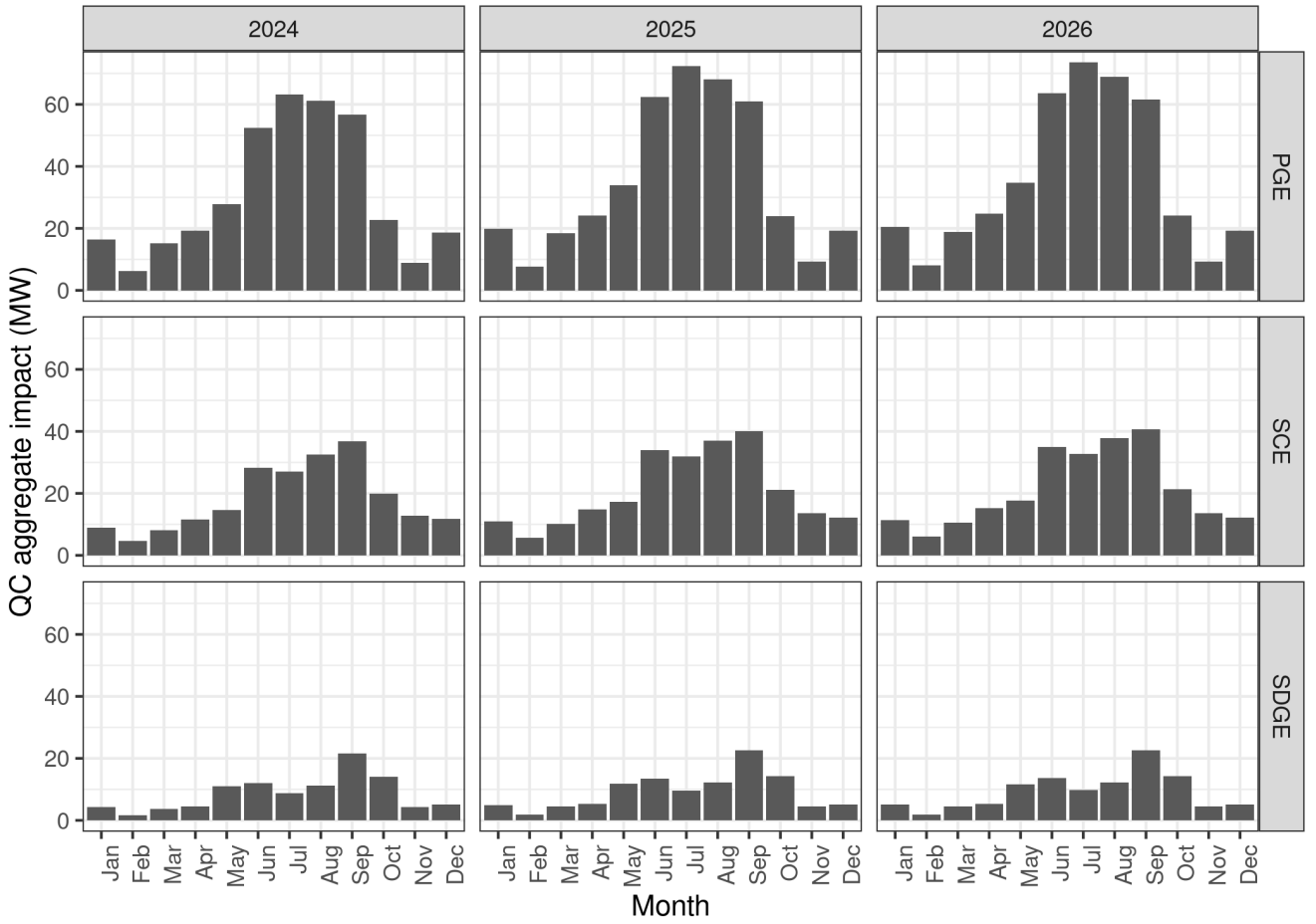


Ex post to ex ante load impact predictions, for events in hours 17-20 (2022)

Month	Ex post (kW)	Ex ante 2022 weather (kW)	Ex ante IOU 1-in-2 weather (kW)
January	0.04	0.07	0.08
February	0.02	0.04	0.03
March	0.07	0.08	0.07
April	0.1	0.09	0.10
May	0.17	0.15	0.16
June	0.26	0.25	0.24
July	0.23	0.22	0.23
August	0.28	0.29	0.29
September	0.36	0.36	0.28
October	0.13	0.16	0.17
November	0.04	0.06	0.08
December	0.11	0.10	0.11

Monthly IOU 1-in-2 (4-hour QC window)

Year	Temp (F)	Enrollment (August)	Aggregate Impact (MW)
2024	86.1	318,000	104.97
2025	86.2	342,000	117.14
2026	86.2	342,000	118.99



Questions?

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Convergence
Data Analytics

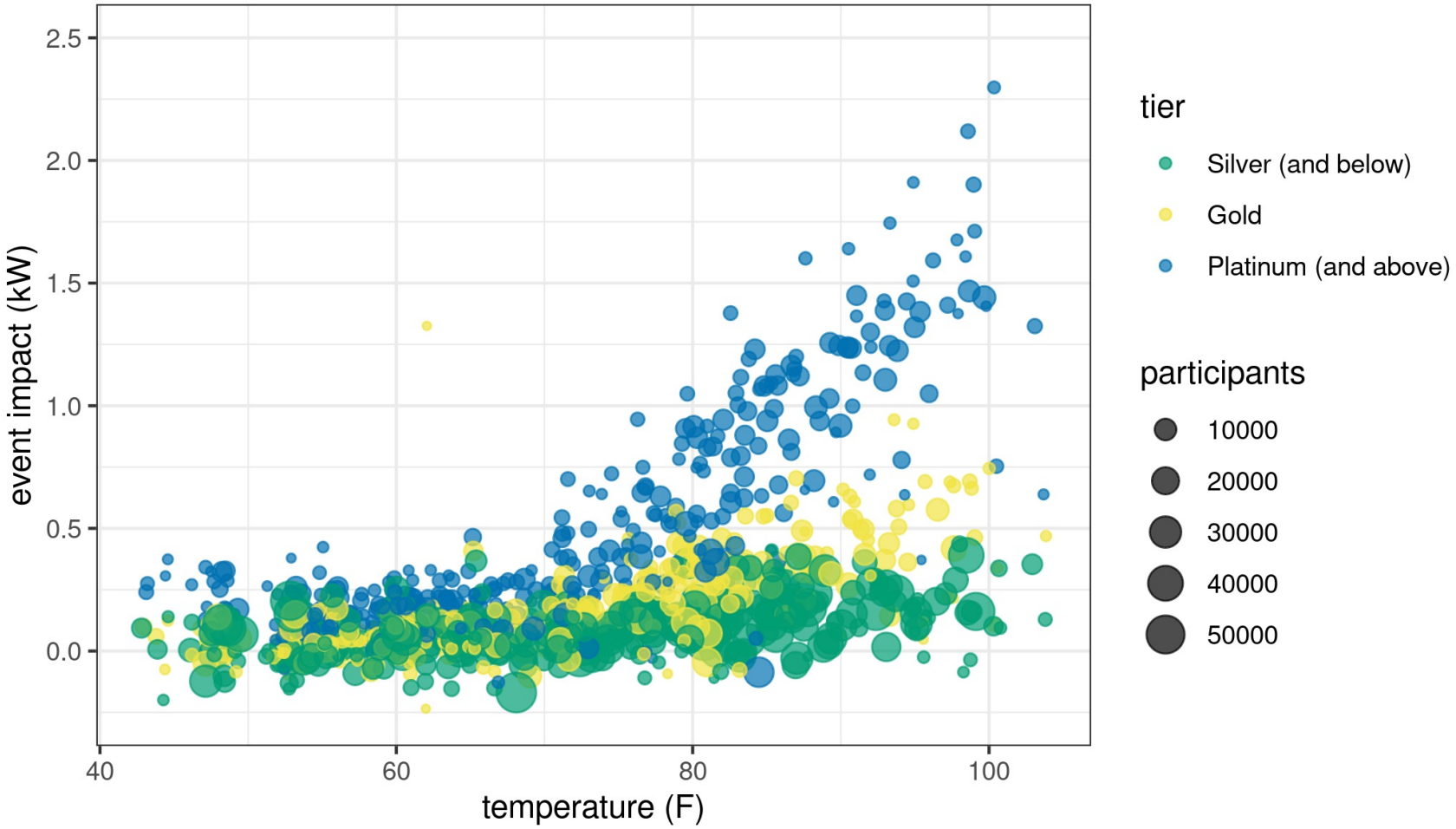
Ex post month by month summary

		Average Event-based Data (by Month, i.e., "monthly roll-ups") Individual events in appendix							Coincident Aggregate (using per-participant impacts)			
month	ave temp (F)	# of unique events	total # participants (not unique)	average # of parts	reference load (kW)	per-part. impact (kW)	Agg. reference load (MW)	Agg. impact (MW)	# monthly unique parts.	coincident reference load (MW)	coincident aggregate impact (MW)	impact %
Jan	58.44	19	304,642	16,029	0.85	0.04	13.64	0.68	138,207	117.64	5.88	5.00
Feb	53.97	23	444,604	19,325	0.89	0.03	17.18	0.49	145,248	129.13	3.70	2.86
Mar	65.59	27	419,394	15,531	0.80	0.05	12.38	0.82	140,607	112.11	7.44	6.64
Apr	68.07	25	654,646	26,179	0.88	0.10	23.15	2.74	143,290	126.72	14.97	11.81
May	73.95	23	563,819	24,048	1.07	0.17	25.83	4.16	142,566	153.11	24.66	16.11
Jun	80.19	22	480,006	21,472	1.58	0.26	33.85	5.58	143,759	226.66	37.38	16.49
Jul	81.06	23	653,419	28,406	1.66	0.24	47.09	6.70	145,862	241.81	34.38	14.22
Aug	84.66	51	1,129,945	22,155	1.76	0.27	38.92	5.90	149,559	262.70	39.80	15.15
Sep	85.22	49	1,661,133	33,576	1.76	0.28	59.13	9.51	171,971	302.84	48.69	16.08
Oct	74.81	19	498,619	26,242	1.01	0.12	26.59	3.06	150,729	152.73	17.57	11.50
Nov	58.78	27	355,939	13,182	0.84	0.04	11.09	0.55	154,192	129.76	6.42	4.95
Dec	53.47	23	705,356	30,667	1.03	0.11	31.53	3.31	158,577	163.02	17.12	10.50

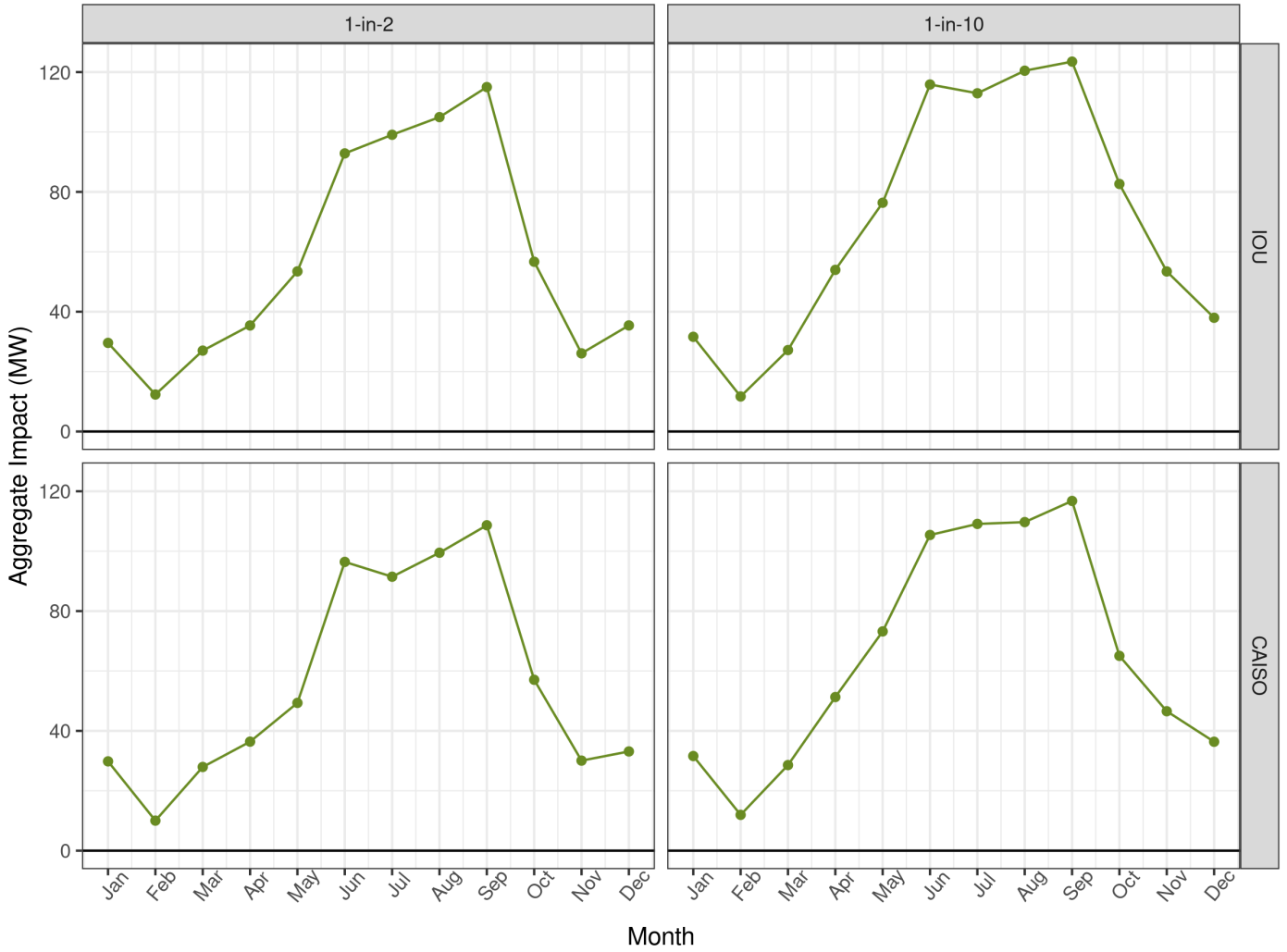
Ex ante monthly predictions (2024, IOU 1-in-2)

	Temp (F)	Impact Per Participant	Impact Per Customer	Agg Impact (MW)	Participants	Enrollment
Typical Event Day	84.9	0.32	0.31	100.13	314,716	318,000
January Peak	48.6	0.11	0.11	29.58	263,893	266,000
February Peak	52.8	0.05	0.05	12.35	266,678	269,000
March Peak	55.2	0.08	0.08	22.05	269,383	273,000
April Peak	73.7	0.11	0.11	30.57	275,059	278,000
May Peak	79.0	0.19	0.19	53.47	279,510	284,000
June Peak	82.4	0.32	0.32	92.85	289,200	293,000
July Peak	85.3	0.33	0.32	99.07	304,762	308,000
August Peak	86.1	0.33	0.33	104.97	314,716	318,000
September Peak	85.9	0.35	0.35	115	324,285	328,000
October Peak	78.5	0.17	0.17	56.68	328,277	334,000
November Peak	60.1	0.08	0.08	26.09	333,071	338,000
December Peak	48.6	0.11	0.1	35.41	335,491	342,000

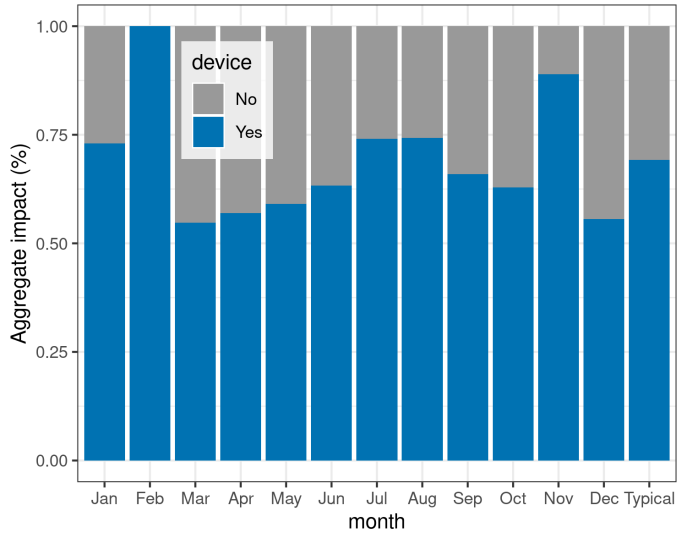
Performance by tier / temperature

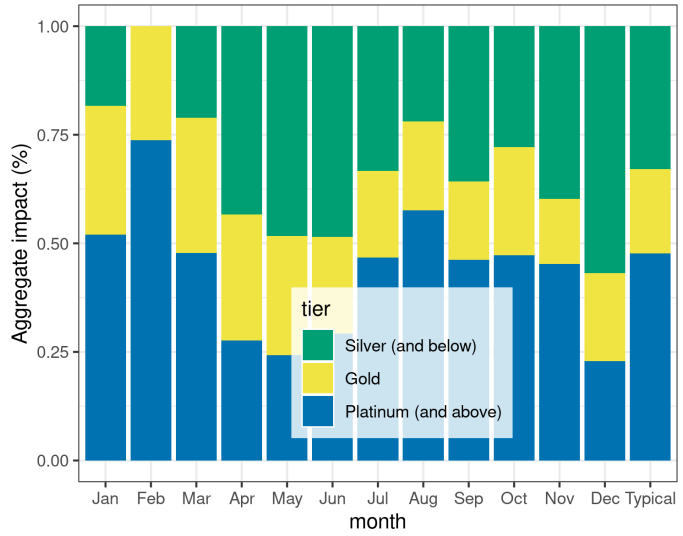


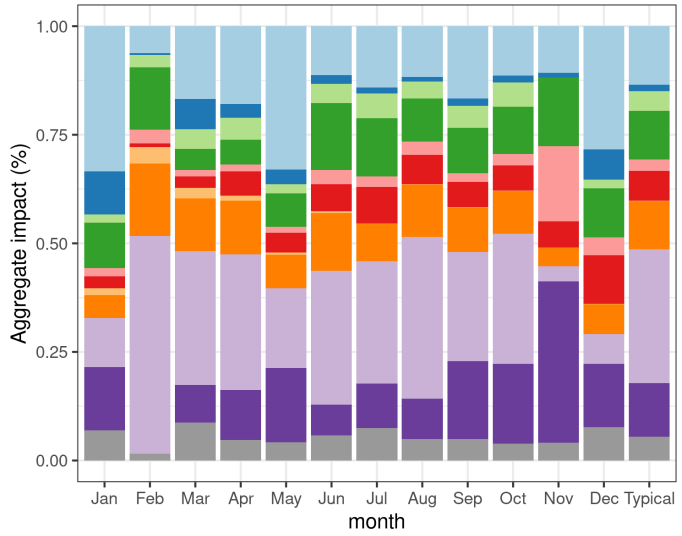
QC window Ex ante impact by weather day (2024)

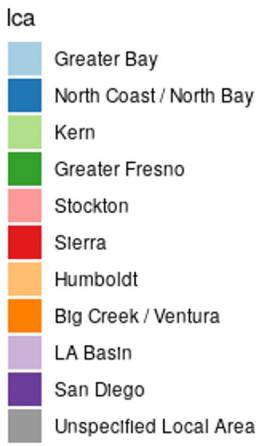


Ex post fraction of aggregate impact by device, event type, tier, and LCA

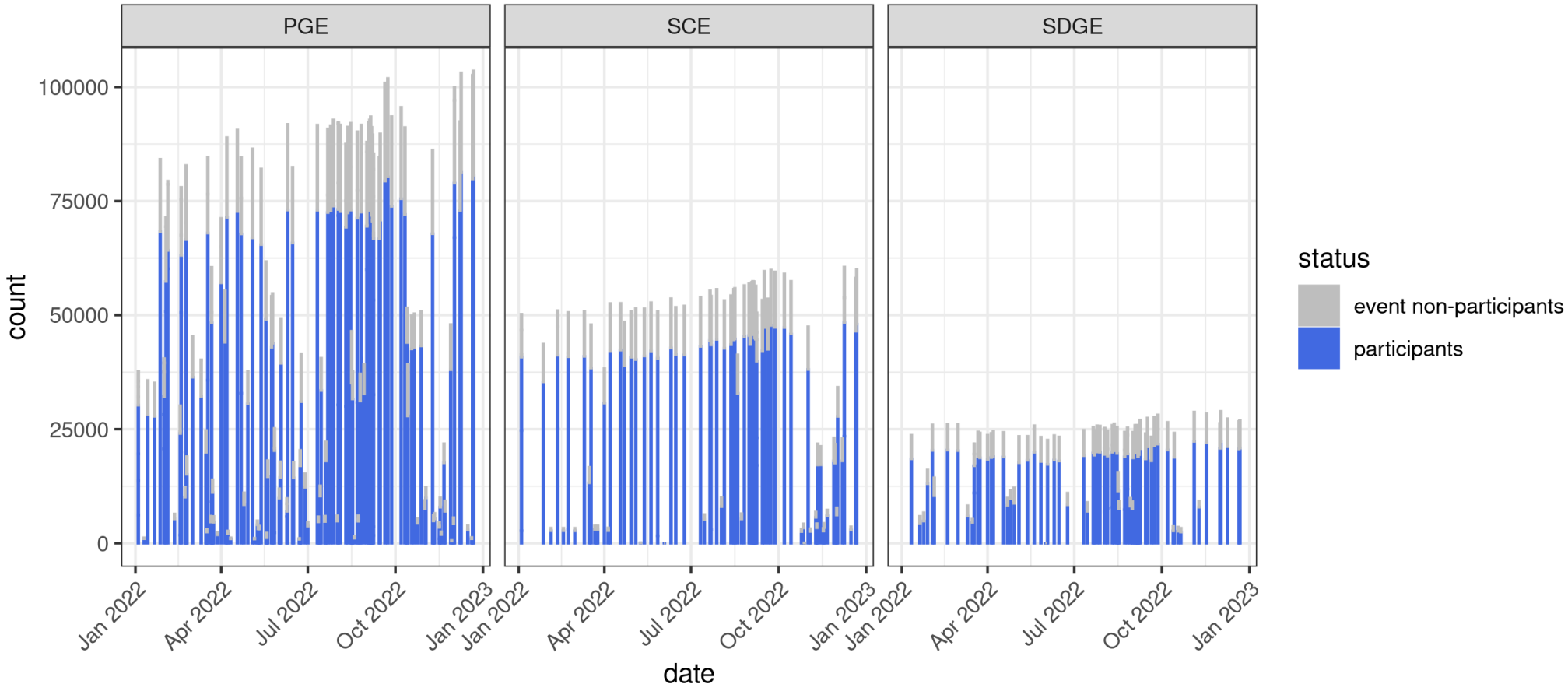




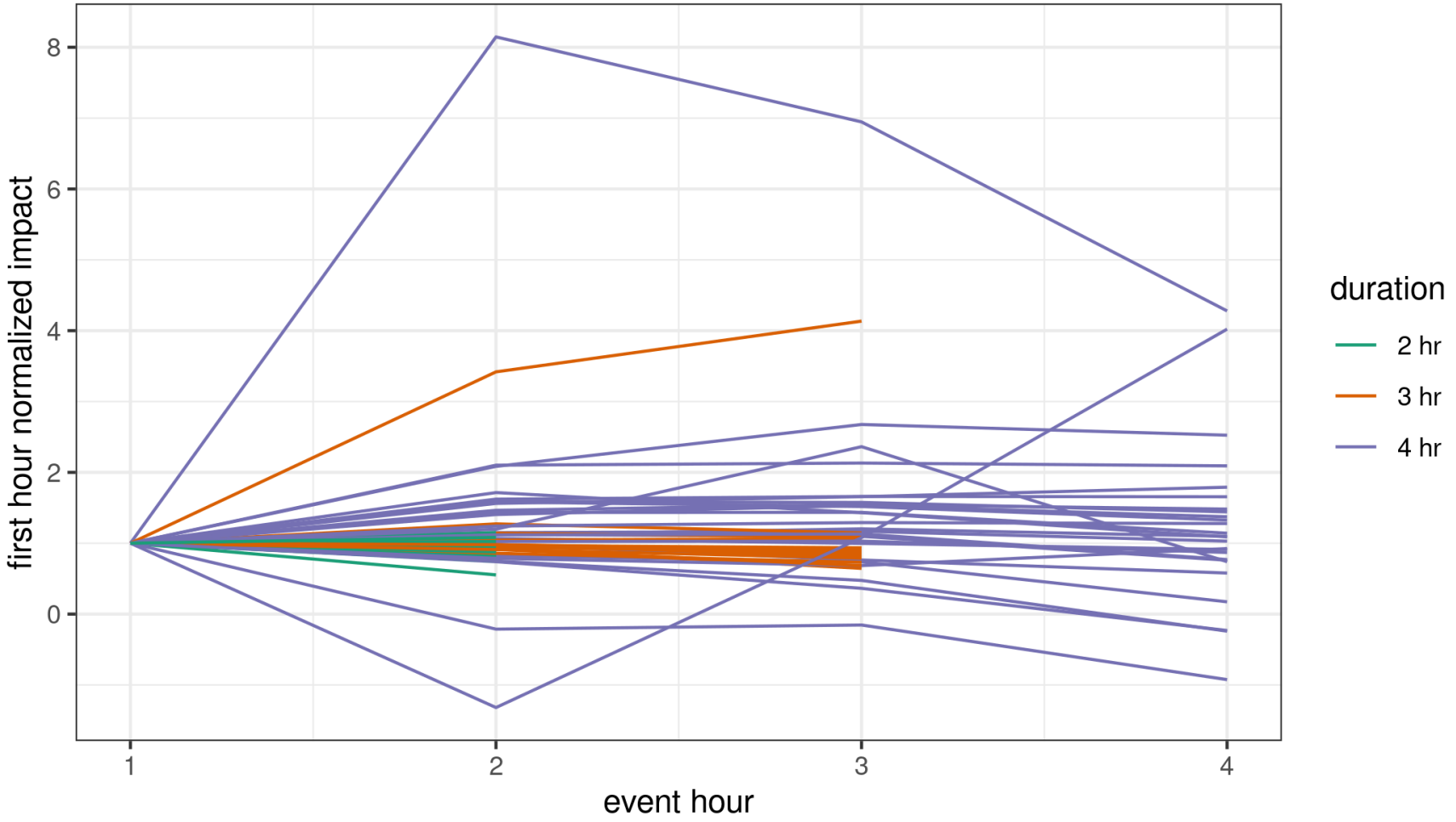




Participation rates



Sustained savings hour to hour



Slices: Ex ante impact, by LCA (PGE), IOU 1-in-2 August 2024