SDG&E ACSDA EVALUATION

DRMEC PRESENTATION, MAY 1, 2023

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DATA DRIVEN RESEARCH AND INSIGHTS

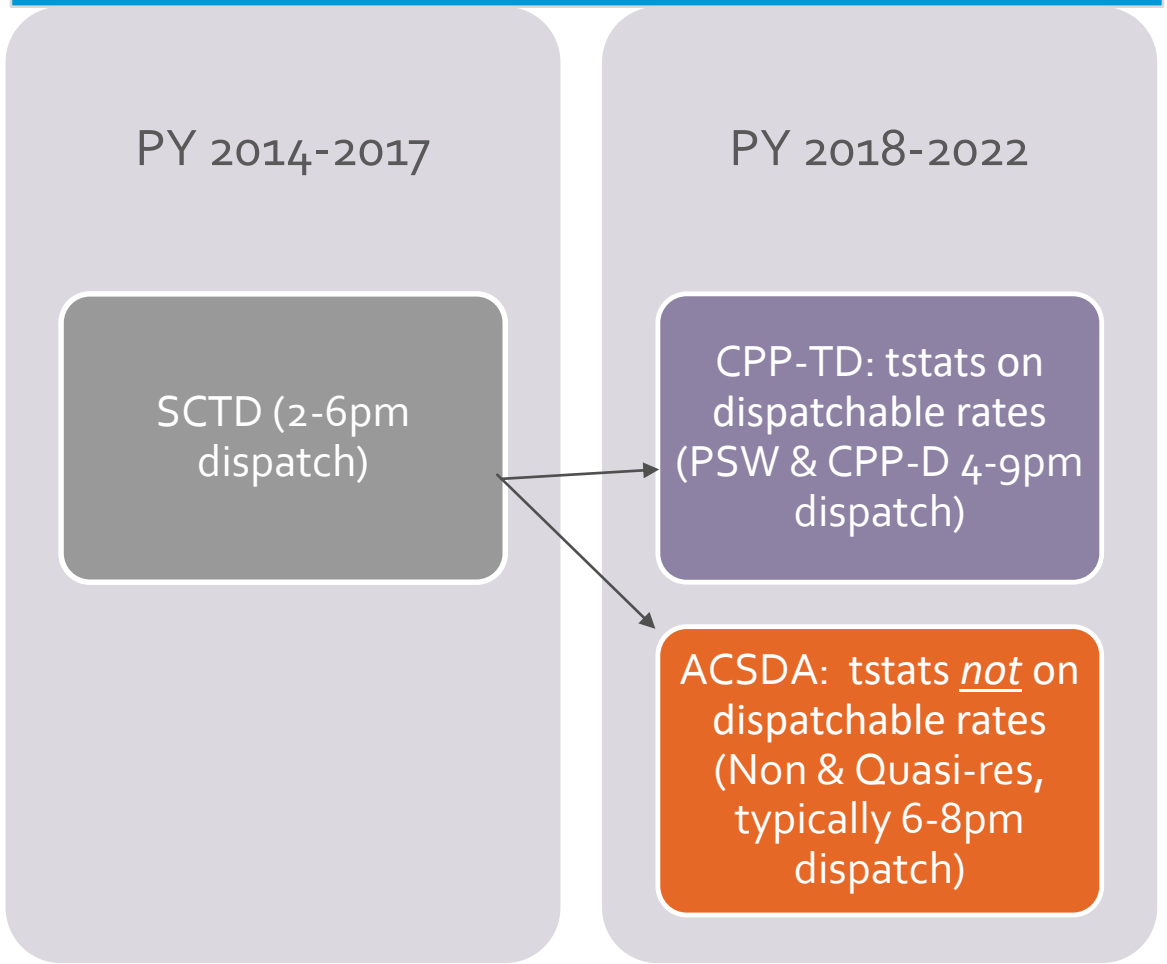
AGENDA

- Program overview
- Ex-post methodology
- Ex-post results
- Enrollment forecast
- Ex-ante methodology
- Ex-ante results

PROGRAM OVERVIEW

NON-RESIDENTIAL ACSDA PROGRAM OVERVIEW

Program Evolution



Event History

	Count of Sites (Aggregate Percent Reductions)		
Program	2020	2021	2022
ACSDA Non-Residential	397 (3.0%)	661 (No Events)	402 (No Events)
ACSDA Quasi-Res	544 (1.5%)	15 (No Events)	13 (No Events)

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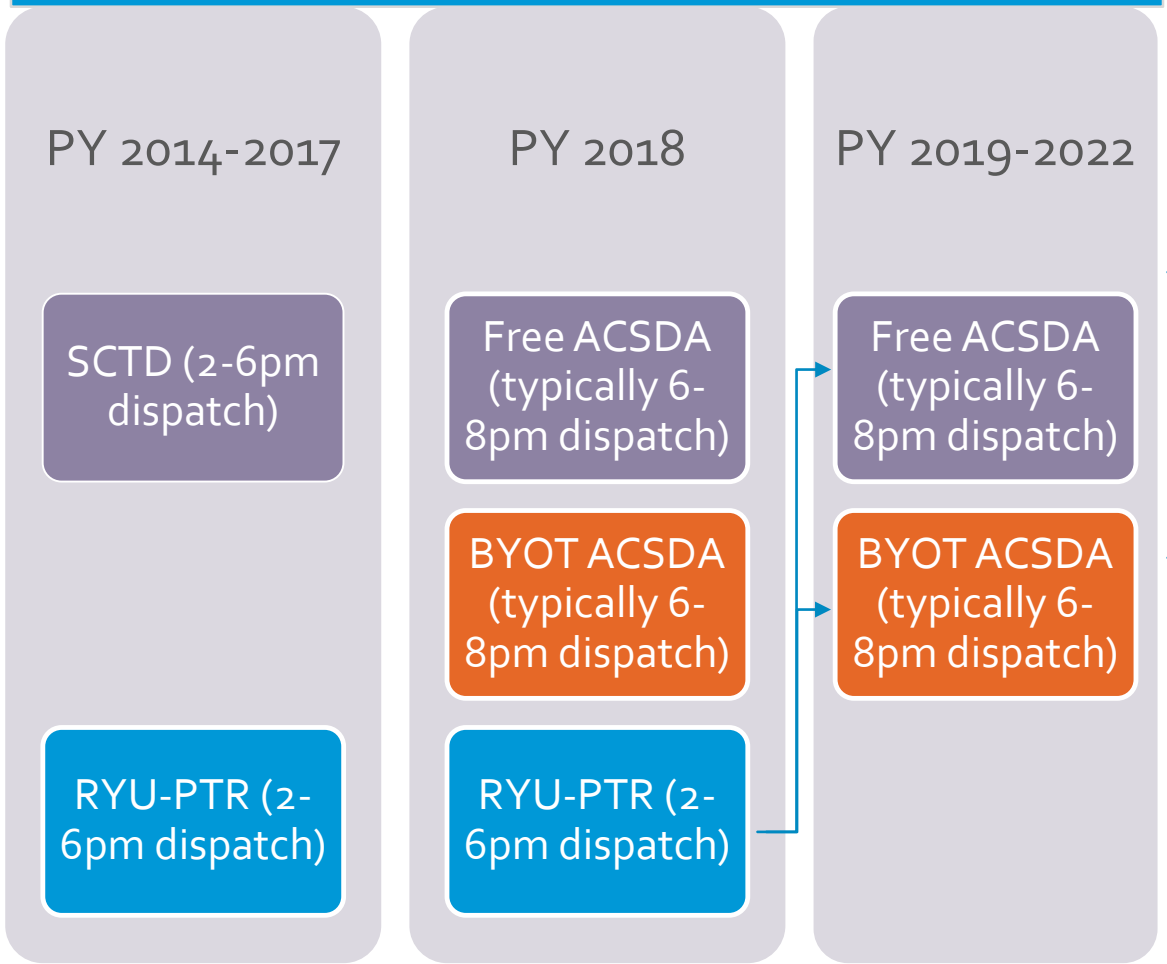
RESIDENTIAL ACSDA PROGRAM OVERVIEW

Program Evolution



Event History

	Count of Sites (Aggregate Percent Reductions)			
Program	2019	2020	2021	2022
ACSDA Free	6,916 (13.3%)	4,714 (13.5%)	3,114 (23.0%)	2,732 (26.6%)
ACSDA BYOT	10,281 (20.4%)	10,423 (24.1%)	11,725 (25.2%)	14,796 (26.0%)

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EX POST METHODOLOGY & RESULTS

EX POST DATA SOURCES AND METHODOLOGY

	Non-Residential ACSDA	Residential ACSDA
Data sources / samples	▪ N/A (no events)	▪ All event season data for up to the past three program years (2020-2022) for: ✓ ~17k Residential ACSDA participants ✓ Control pool of ~10k non participants
Segmentation	▪ N/A (no events)	▪ Rate ✓ Not on TOU rate ✓ On TOU rate ▪ Climate zone (Coastal vs Inland) ▪ Thermostat program ✓ Free ✓ BYOT ▪ Solar/NEM status
Estimation method: Ex-post	N/A (no events)	▪ Difference-in-differences with matched control sites

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OUT OF SAMPLE PROCESS FOR CONTROL GROUP SELECTION

1. Identify testing and training days

- Find non-event proxy days with the closest daily max system load to event days
- Calculate load characteristics for proxy days for participants anc control

2. Define multiple models

- Define 8 matched control methods (4 propensity, 4 Euclidean)
- Specify differing combinations of load characteristics and hard-matching criteria for each

3. Run each matching method using training data (leave out testing days)

4. Estimate out-of-sample bias and precision

- Identify the closest 5 control sites
- Calculate error for each participant relative to each control and calculate goodness-of-fit metrics for each model

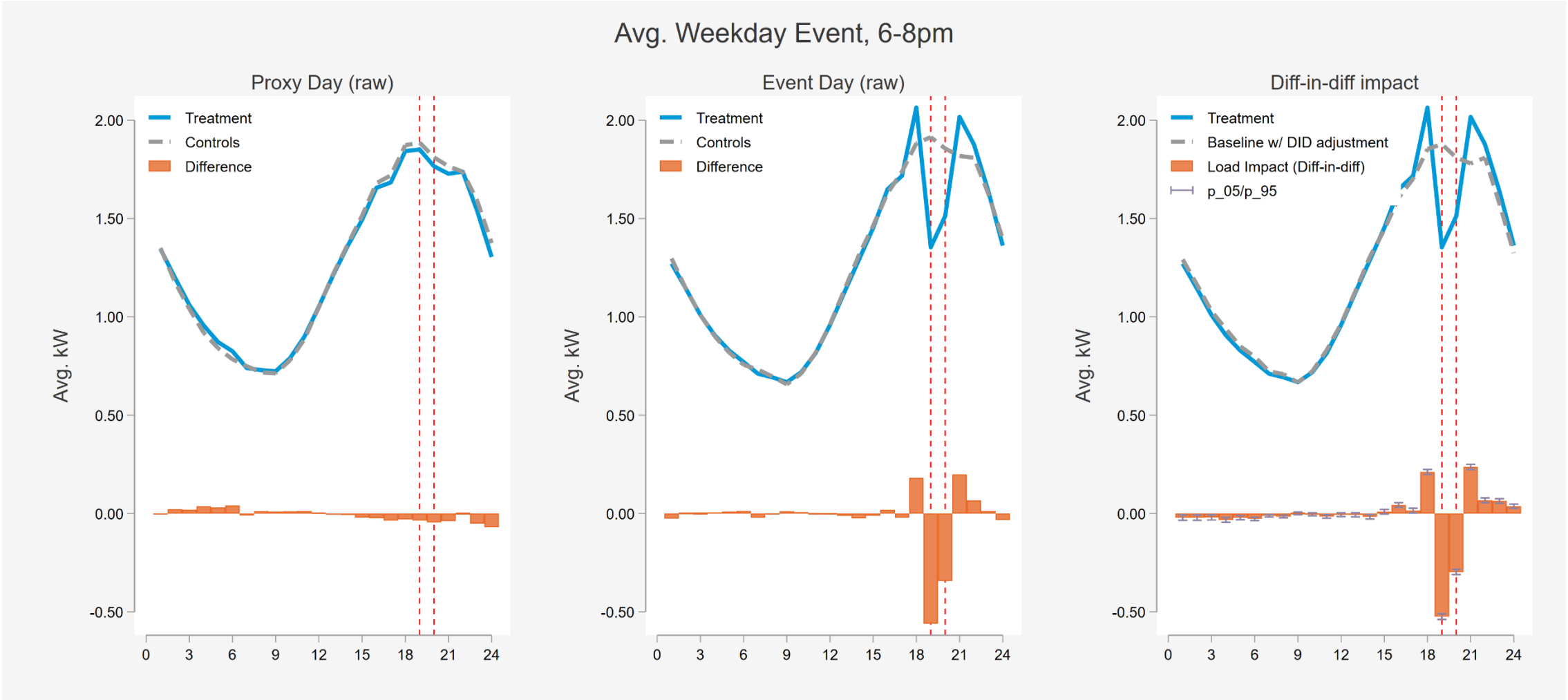
5. Select the best performing model

- Narrow to models with the least bias
- Calculate average precision (RMSE)
- Pick the model with the best precision

6. Estimate loads during actual events using selected matching method

- One control site per participant
- Use difference-in-differences to net out exogeneous differences between treatment and control

DIFFERENCE-IN-DIFFERENCES CALCULATION EXAMPLE



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ACSDA RESIDENTIAL PROGRAM WEEKDAY EVENT REDUCTIONS

Event Date	Event Window	Avg Event Temp (F)	Sites Enrolled	Enrolled Devices	Connect-ed Devices	Reduction			t-stat	Significant (90% CI)
						Aggregate (MW)	Average Site (kw)	Average Connected Tstat (kw)		
8/16/2022	6 to 8 pm	71.9	17,374	19,132	18,481	6.77	0.39	0.37	29.27	Yes
8/17/2022	6 to 8 pm	72.9	17,375	19,134	18,483	3.45	0.20	0.19	14.76	Yes
8/30/2022	6 to 8 pm	74.6	17,376	19,131	18,444	7.47	0.43	0.41	31.40	Yes
8/31/2022	6 to 8 pm	78.6	17,374	19,129	18,439	9.95	0.57	0.54	34.62	Yes
9/1/2022	6 to 8 pm	77.9	17,988	19,780	19,283	10.73	0.60	0.56	39.16	Yes
Avg Weekday Event	**6 to 8 pm**	**75.7**	**17,528**	**19,293**	**18,662**	**8.65**	**0.49**	**0.46**	**57.15**	**Yes**
9/7/2022	5 to 9 pm	79.1	17,985	19,778	18,701	7.73	0.43	0.41	35.85	Yes
9/8/2022	5 to 9 pm	84.4	17,985	19,781	18,703	6.39	0.36	0.34	26.86	Yes
Avg Weekday Event	**5 to 9 pm**	**78.5**	**17,985**	**19,780**	**18,702**	**5.95**	**0.33**	**0.32**	**38.03**	**Yes**
9/9/2022	5 to 7 pm	71.3	17,985	19,781	18,702	4.42	0.25	0.24	17.85	Yes
9/26/2022	5 to 7 pm	72.4	17,980	19,775	18,657	4.29	0.24	0.23	20.36	Yes

ACSDA RESIDENTIAL AVERAGE EVENT REDUCTIONS BY SEGMENT

Free Thermostats

TOU Status	Climate Zone	NEM	Event Window	Avg Event Temp (F)	Sites Enrolled	Enrolled Devices	Connect-ed Devices	Aggregate (MW)			Average connected tstat (kW)			t-stat
								Ref load (whole bldg)	Reduc-tion	% Reduc-tion	Ref load (cooling)	Reduc-tion	% Reduc-tion	
Non-TOU	Coastal	No	6 to 8 pm	74.7	275	313	296	0.42	0.10	24.9%	0.90	0.35	39%	6.67
	Inland	No	6 to 8 pm	76.8	512	566	549	1.09	0.30	27.2%	1.32	0.54	41%	12.35
TOU	Coastal	No	6 to 8 pm	74.8	683	825	783	1.02	0.23	22.5%	0.65	0.29	46%	8.53
		Yes	6 to 8 pm	74.3	151	184	176	0.31	0.08	26.1%	0.59	0.46	77%	5.56
	Inland	No	6 to 8 pm	76.3	798	916	879	1.42	0.38	26.9%	0.96	0.44	45%	12.31
		Yes	6 to 8 pm	76.0	302	368	353	0.73	0.24	32.3%	1.14	0.67	59%	11.35
			6 to 8 pm	**75.7**	**2,732**	**3,186**	**3,050**	**5.02**	**1.33**	**26.6%**	**0.98**	**0.44**	**45%**	**23.58**

BYOT

TOU Status	Climate Zone	NEM	Event Window	Avg Event Temp (F)	Sites Enrolled	Enrolled Devices	Connect-ed Devices	Aggregate (MW)			Average connected tstat (kW)			t-stat
								Ref load (whole bldg)	Reduc-tion	% Reduc-tion	Ref load (cooling)	Reduc-tion	% Reduc-tion	
Non-TOU	Coastal	No	6 to 8 pm	74.9	993	1,030	999	1.65	0.36	21.7%	0.96	0.36	37%	10.65
		Yes	6 to 8 pm	75.3	72	72	72	0.16	0.04	26.2%	1.46	0.57	39%	3.52
	Inland	No	6 to 8 pm	76.9	1,055	1,092	1,065	2.14	0.59	27.4%	1.41	0.55	39%	16.75
		Yes	6 to 8 pm	76.7	271	316	307	0.83	0.24	29.2%	1.83	0.79	43%	9.51
TOU	Coastal	No	6 to 8 pm	75.1	5,012	5,334	5,170	7.93	1.85	23.3%	0.86	0.36	42%	24.84
		Yes	6 to 8 pm	74.8	1,815	2,137	2,061	3.96	1.05	26.5%	1.11	0.51	46%	18.35
	Inland	No	6 to 8 pm	76.6	3,420	3,589	3,471	6.12	1.61	26.4%	1.12	0.46	42%	26.49
		Yes	6 to 8 pm	76.7	2,018	2,359	2,297	4.96	1.46	29.5%	1.36	0.64	47%	25.11
			6 to 8 pm	**75.7**	**14,796**	**16,107**	**15,612**	**28.17**	**7.32**	**26.0%**	**1.08**	**0.47**	**43%**	**52.15**

AVERAGE EVENT IMPACTS SIMILAR FOR BYOT VS FREE, BYOT USES PRE-COOLING

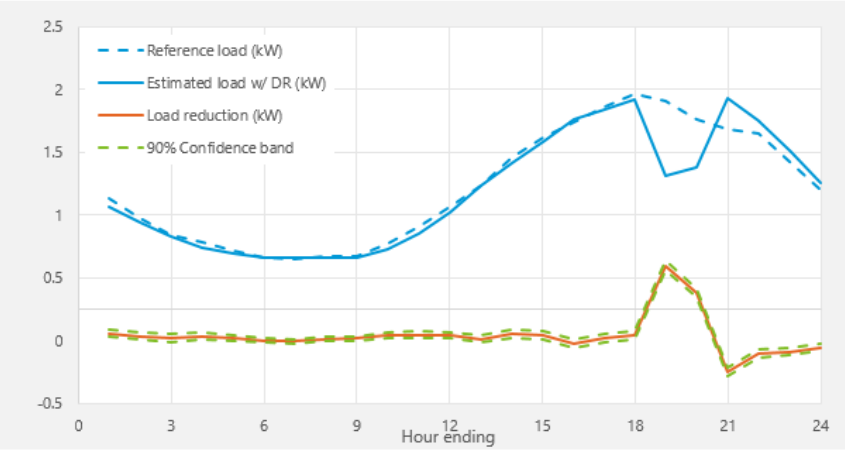
Free Thermostats

Table 1: Menu options

Program	ACSDARES (Free)
Type of result	Average Customer
Type of site	All
Category	All
Subcategory	All study segments
Event date	Avg. Weekday Event, 6-8pm

Table 2: Event day information

Event start	6:00 PM
Event end	8:00 PM
Total sites	2,732
Total enrolled thermostats	3,186
Total connected thermostats	3,050
Percent of thermostats connected	96%
Avg load reduction 6PM-8PM	0.49
% Load reduction 6PM-8PM	26.6%



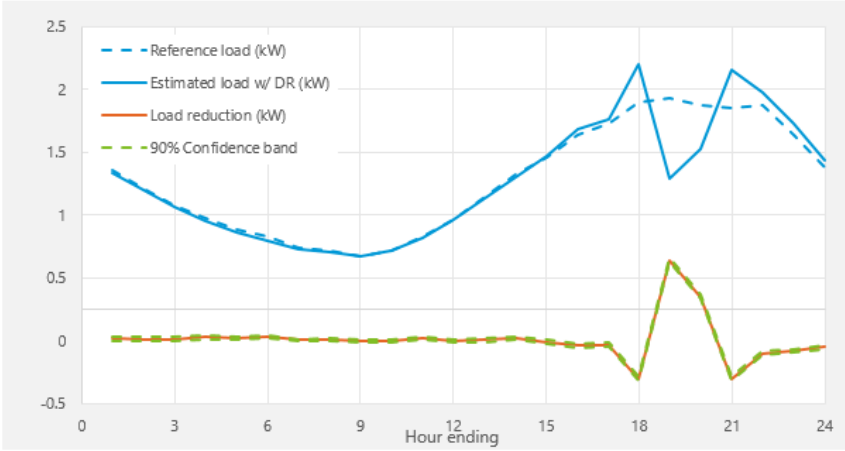
BYOT

Table 1: Menu options

Program	ACSDARES (BYOT)
Type of result	Average Customer
Type of site	All
Category	All
Subcategory	All study segments
Event date	Avg. Weekday Event, 6-8pm

Table 2: Event day information

Event start	6:00 PM
Event end	8:00 PM
Total sites	14,796
Total enrolled thermostats	16,107
Total connected thermostats	15,612
Percent of thermostats connected	97%
Avg load reduction 6PM-8PM	0.49
% Load reduction 6PM-8PM	26.0%



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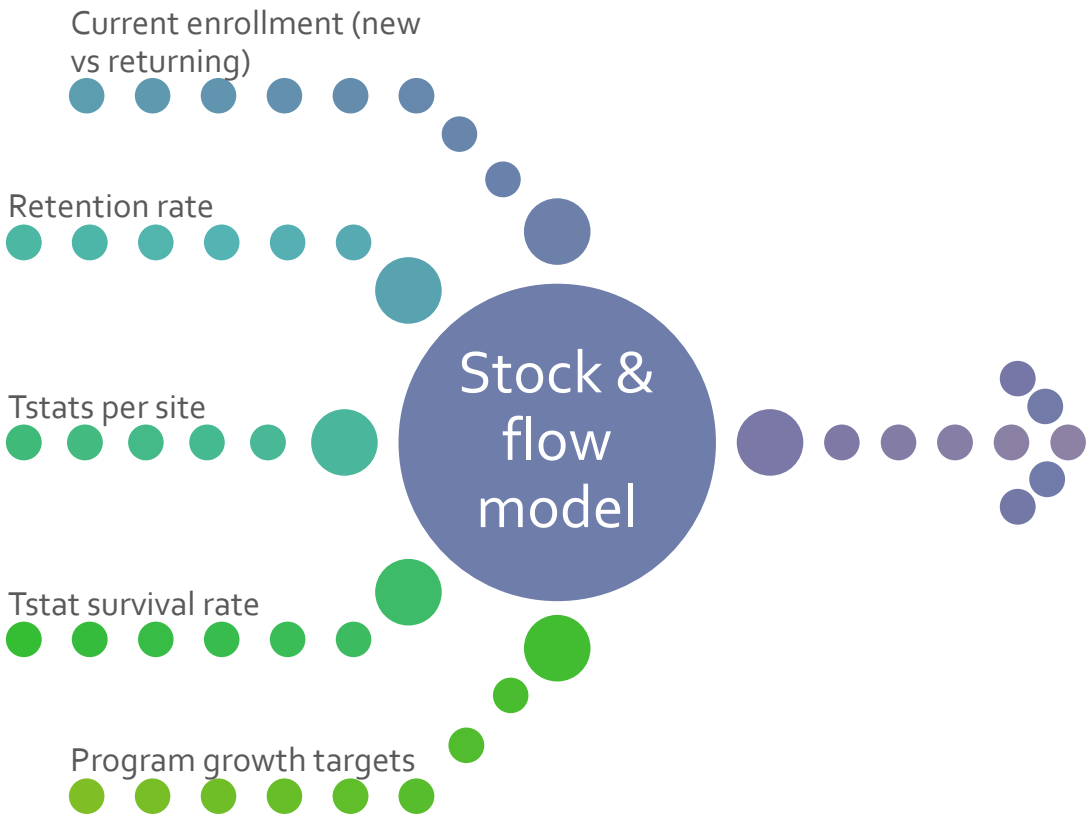
ENROLLMENT FORECAST

STOCK & FLOW INCORPORATES RETENTION AND DEVICE FAILURE

Program	Site retention rate	Tstat failure rate	Tstats per site (current)	Tstats per site (capped)	Projected New Enrollment
Non-Res	87%	6.9%	4.2	3.7	0
Quasi-Res	87%	6.9%	1.4	1.0	0
ACSDARES (Free)	97%	1.2%	1.1	1.2	0
ACSDARES (BYOT)	97%	1.2%	1.1	1.1	6,408



Annual counts by program

New vs returning

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KEY ASSUMPTIONS FOR ENROLLMENT FORECAST MODEL

Assumption	Description
New participant forecast for Non-Residential, Free Residential	Program not currently marketed. Assume no new enrollments.
New participant forecast for Residential BYOT ACSDA	Assumed to be 5,408, based on average new enrollments from 2017 through 2020, derated by 8%. Given rule change which open eligibility to NEM, assume incremental 1000/yr in new enrollments Total new enrollments of 6,408 per year
Long term flattening out of enrollments	Assume enrollments stabilize starting in 2029 (no new enrollments, no attrition, only change to connected thermostats is from connectivity)
Ramping of enrollments to mirror expected smart thermostat uptake	Thermostat market share of smart thermostats assumed to grow by 10% a year from 2023 through 2026, conservative application of market forecast projecting 18% annual growth. Enrollment growth is ramped to mirror this market share growth.
Thermostats enrolled per site	Also assume future enrollments reflect historical average, but cap historical figures at 4 thermostats per site before taking the average. This assumption was applied to both residential and non-residential forecasts but had minimal impact of the residential forecast.
Monthly ramp of enrollments	Annual forecast changes spread linearly across months

Aligned with PY 2021 model and DR Application

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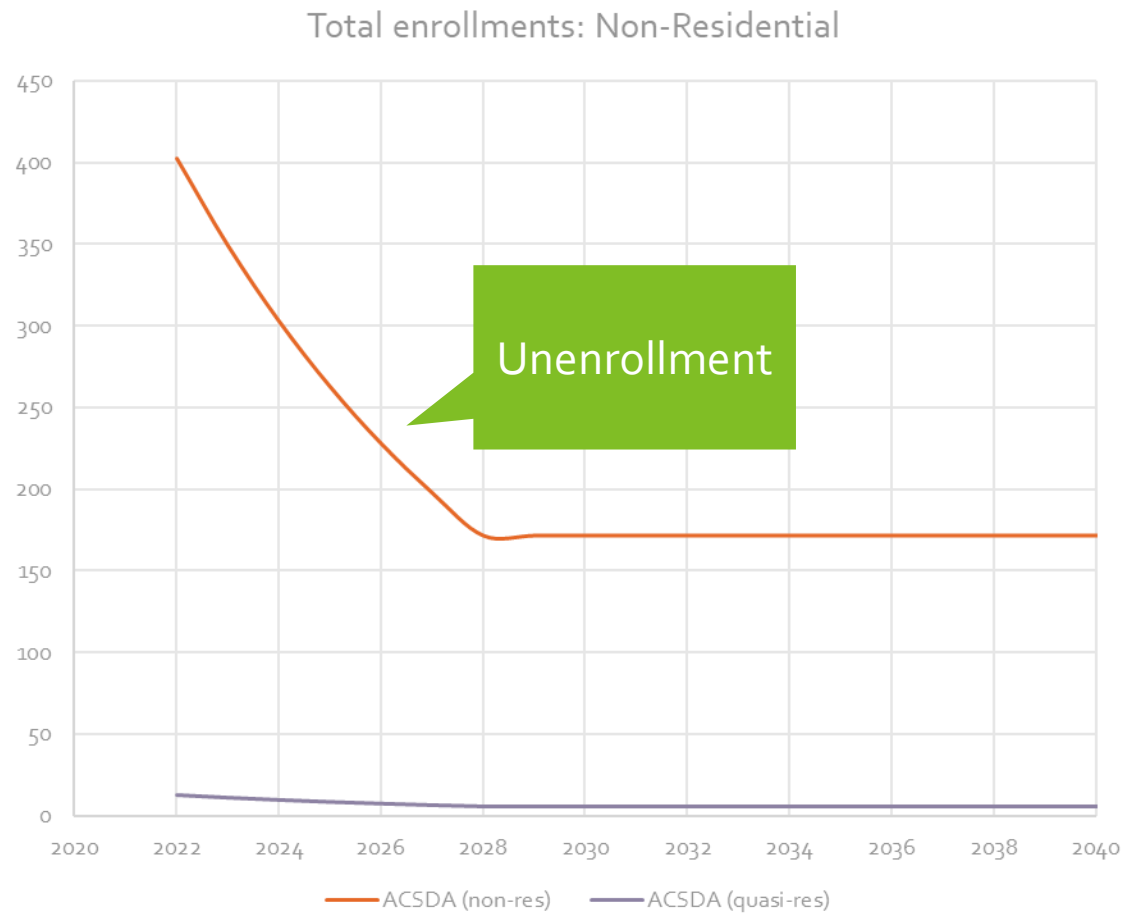
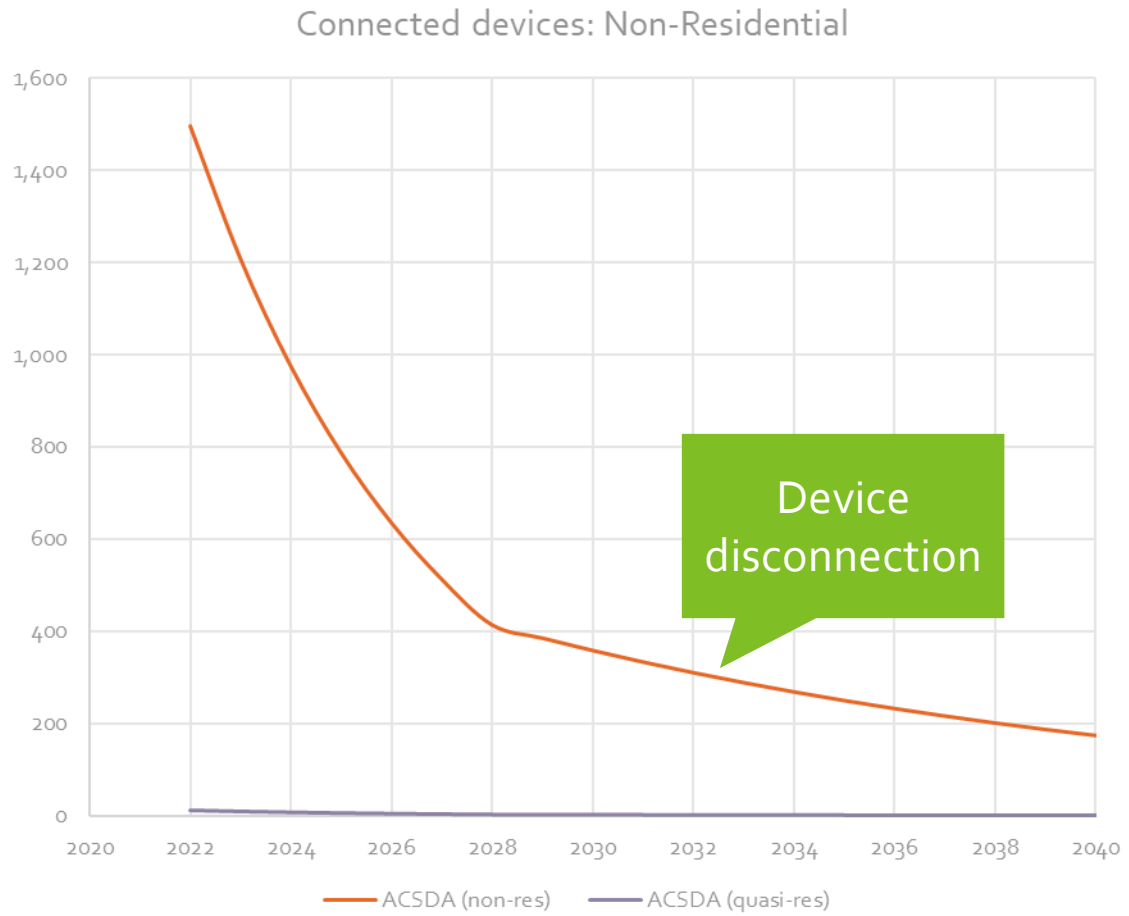
NON-RESIDENTIAL ENROLLMENTS FORECAST TO DECLINE

Enrollments



Connected Devices



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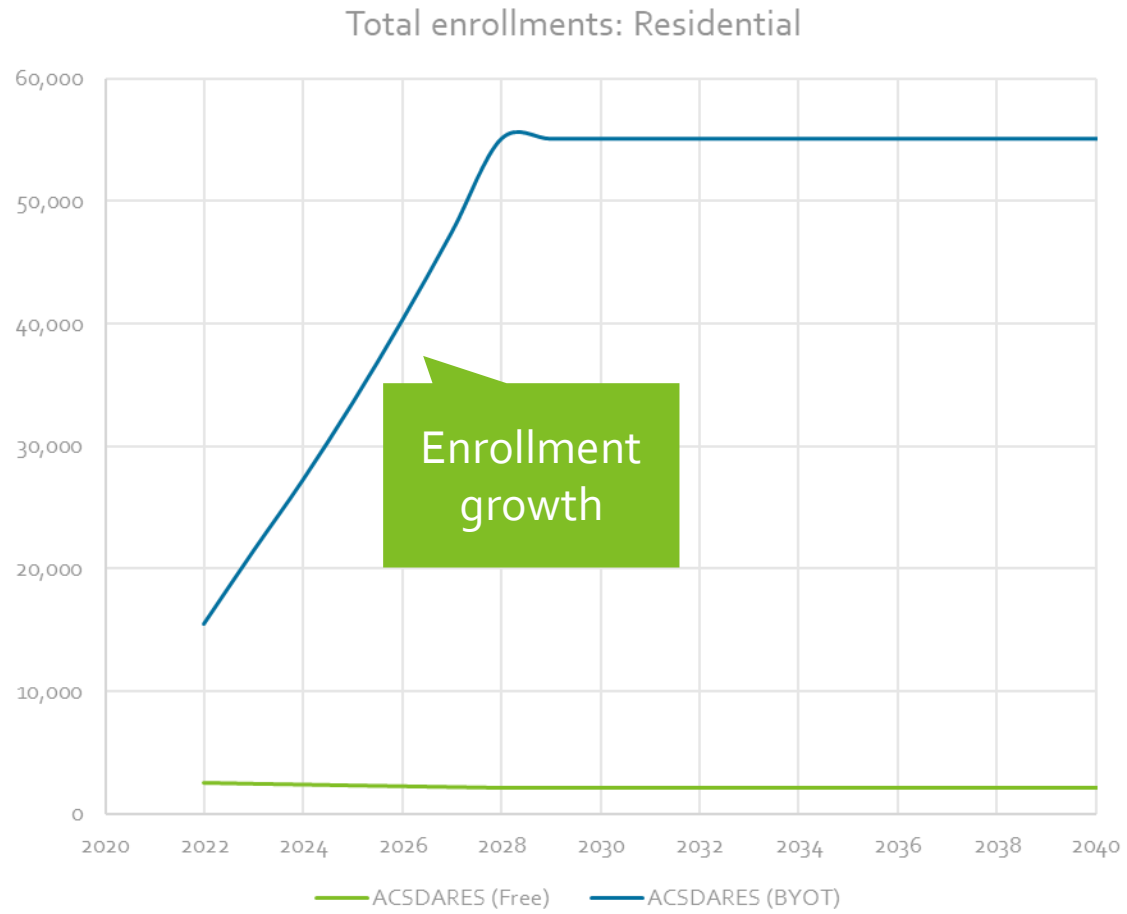
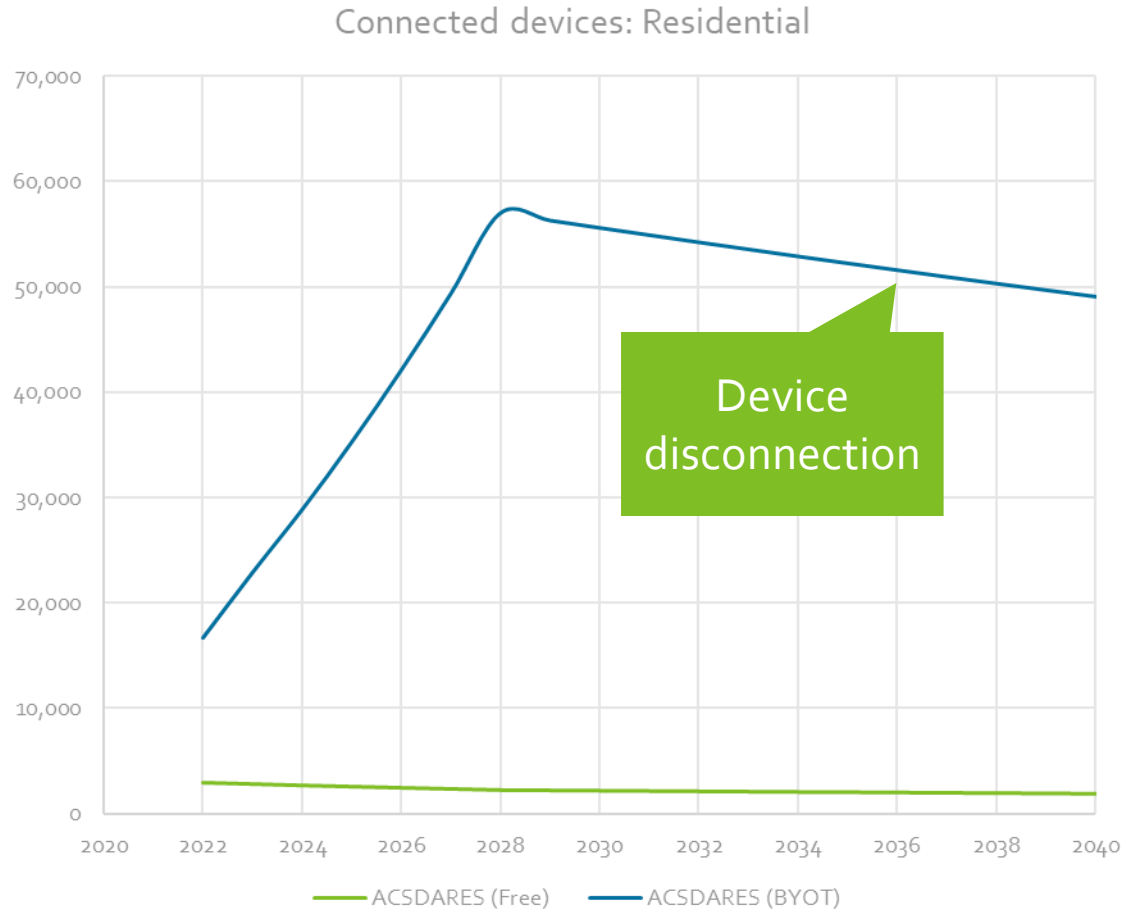
RESIDENTIAL ENROLLMENTS FORECAST TO GROW

Enrollments



Connected Devices



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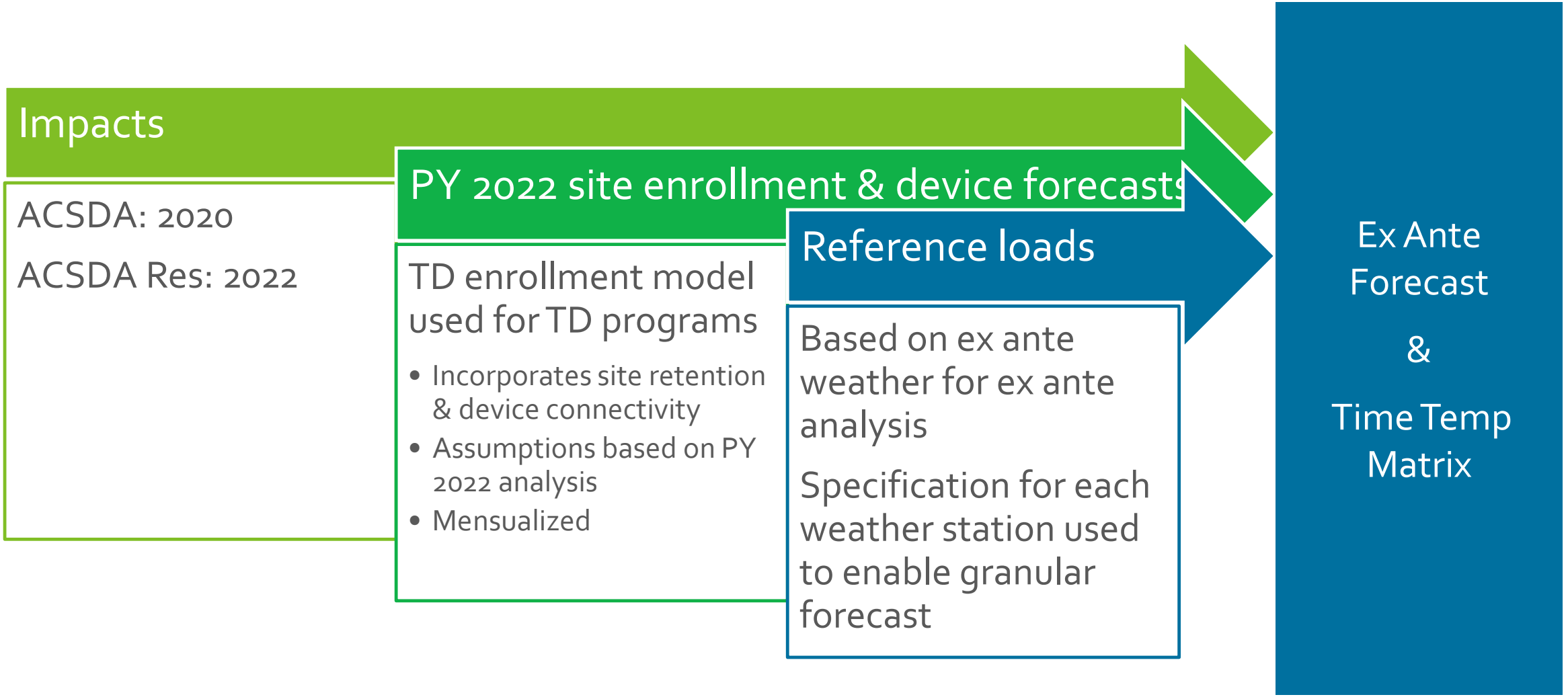
EX ANTE METHODOLOGY & RESULTS

EX ANTE METHODOLOGY OVERVIEW: PY 2022



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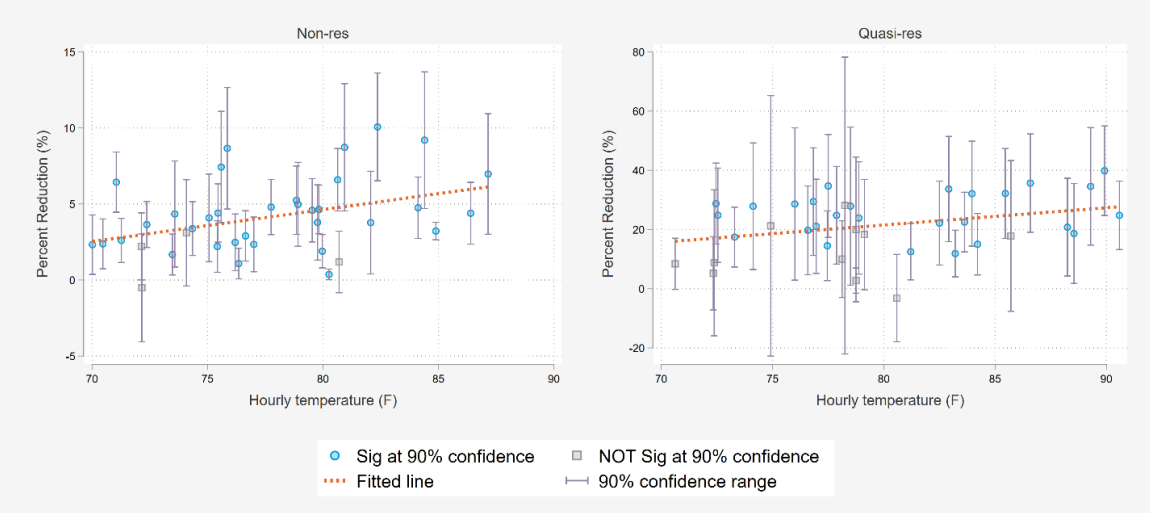
NON-RESIDENTIAL: IMPACT MODEL BASED ON 2020 TRENDS

PY 2020 Impact Trends



PY 2022 Ex Ante Summary

Result Type	Day Type and Period	Sites	Tstats connected	Load without DR (MW)	Load Reduction (MW)	% Reduction	Daily Max Temp (F)
Ex Post Avg. Weekday** (PY 2020 Results)	Event Period (6pm to 8pm)	941	3,543	15.17	0.44	2.9%	85.6
	Resource Adequacy Period (4 to 9pm)	941	3,543	15.46	0.15	1.0%	85.6
Ex ante SDG&E	1-in-2 Weather August Peak (4 to 9pm)	415	1,508	10.69	0.37	3.4%	88.0
Ex ante CAISO	1-in-2 Weather August Peak (4 to 9pm)	415	1,508	10.45	0.32	3.1%	85.8

*Table shows portfolio impacts. To avoid double counting, it excludes commercial thermostats and customers dually enrolled in other DR programs.
**For comparability to ex ante, only includes events with average event temperature above 70F
***Ex ante site counts are lower due to enrollment assumptions

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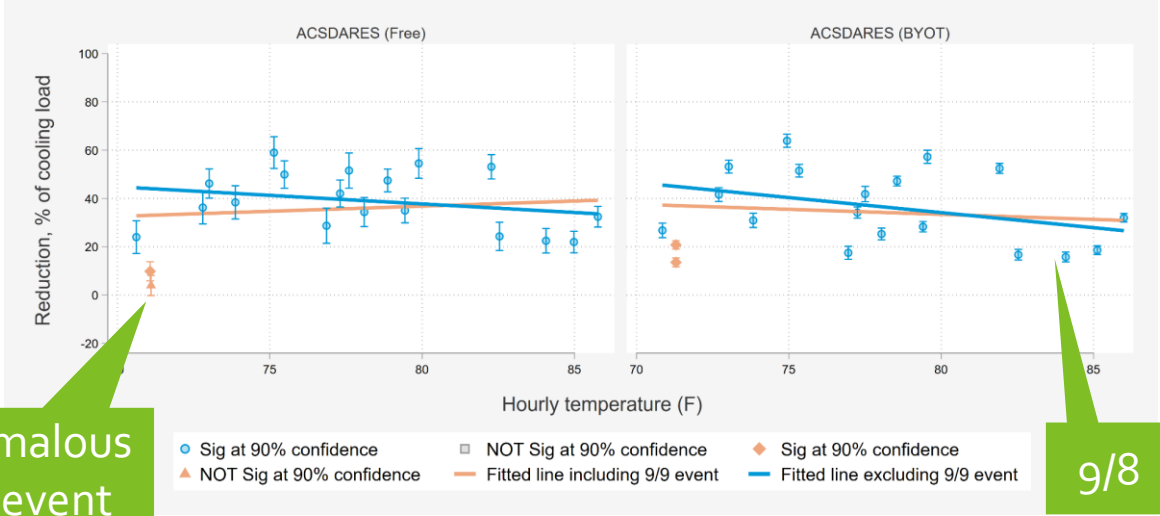
RESIDENTIAL:

PY 2022 Impact Trends



Anomalous 9/9 event excluded

9/8

PY 2022 Ex Ante Summary

Result Type	Day Type and Period	Sites	Tstats connected	Load without DR (MW)	Load Reduction (MW)	% Reduction	Daily Max Temp (F)	Event Avg Temp (F)
Ex Post Avg. Weekday**	Event Period (6pm to 8pm)	17,528	18,662	33.19	8.65	26.1%	86.5	75.7
	Resource Adequacy Period (4 to 9pm)	17,528	18,662	32.49	1.45	4.5%	86.5	77.1
Ex ante SDG&E	1-in-2 Weather August Peak (4 to 9pm)	18,049	19,534	32.66	4.01	12.3%	89.9	83.2
Ex ante CAISO	1-in-2 Weather August Peak (4 to 9pm)	18,049	19,534	30.58	4.01	13.1%	87.0	80.9

*Table shows portfolio impacts. To avoid double counting, it excludes customers dually enrolled in other DR programs.
**Ex post includes sites enrolled through beginning of October, but ex-ante site counts also include sites who enrolled through November

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ANNUAL FORECAST FOR 1-IN-2 SDG&E WEATHER CONDITIONS, AUGUST MONTHLY PEAK DAY

Non-Residential

Year	ACSDA		Total
	Non-Res	Quasi-Res	
2022	0.36	0.00	0.37
2023	0.32	0.00	0.32
2024	0.26	0.00	0.26
2025	0.21	0.00	0.21
2026	0.17	0.00	0.17
2027	0.14	0.00	0.14
2028	0.11	0.00	0.11
2029	0.10	0.00	0.10
2030	0.09	0.00	0.09
2031	0.08	0.00	0.08
2032	0.08	0.00	0.08
2033	0.07	0.00	0.07

Residential

Year	ACSDA - Residential		Total
	Free	BYOT	
2022	0.81	3.20	4.01
2023	0.78	4.00	4.78
2024	0.75	5.16	5.91
2025	0.72	6.36	7.08
2026	0.69	7.65	8.34
2027	0.67	9.02	9.68
2028	0.64	10.46	11.10
2029	0.62	10.86	11.49
2030	0.62	10.73	11.34
2031	0.61	10.59	11.20
2032	0.60	10.46	11.06
2033	0.59	10.33	10.93

COMPARISON OF 2022 FORECAST FROM PY 2021 AND PY 2022

Non-Residential

Result Type	PY Source	Sites	Tstats connected	Load without DR (MW)	Load Reduction (MW)	% Reduction	Daily Max Temp (F)	Event Avg Temp (F)
Ex Ante SDG&E (1-in-2 Weather August Peak, 4 to 9pm) 2022 forecast	2021	650	3,085	30.88	0.60	1.9%	92.8	83.3
	2022	415	1,508	10.69	0.37	3.4%	92.8	82.3
Ex Post Avg. Weekday (4 to 9pm)**	2020	941	3,546	15.75	0.18	1.1%	86.4	78.5
	2022	No 2022 or 2021 events						

*Table shows portfolio impacts. To avoid double counting, it excludes customers dually enrolled in other DR programs.
**Ex post includes sites enrolled through beginning of October, but ex-ante site counts also include sites who enrolled through November

Residential

Result Type	PY Source	Sites	Tstats connected	Load without DR (MW)	Load Reduction (MW)	% Reduction	Daily Max Temp (F)	Event Avg Temp (F)
Ex Ante SDG&E (1-in-2 Weather August Peak, 4 to 9pm) 2022 forecast	2021	18,829	16,149	32.35	3.42	10.6%	89.9	82.4
	2022	18,049	19,534	32.66	4.01	12.3%	89.9	83.2
Ex Post Avg. Weekday (4 to 9pm)**	2021	12,950	13,603	20.26	0.47	2.3%	84.2	74.7
	2022	17,503	18,632	31.99	1.64	5.1%	86.3	76.8

*Table shows portfolio impacts. To avoid double counting, it excludes customers dually enrolled in other DR programs.
**Ex post includes sites enrolled through beginning of October, but ex-ante site counts also include sites who enrolled through November

Ex post results spread 2 hours of impacts across 5 hour RA window

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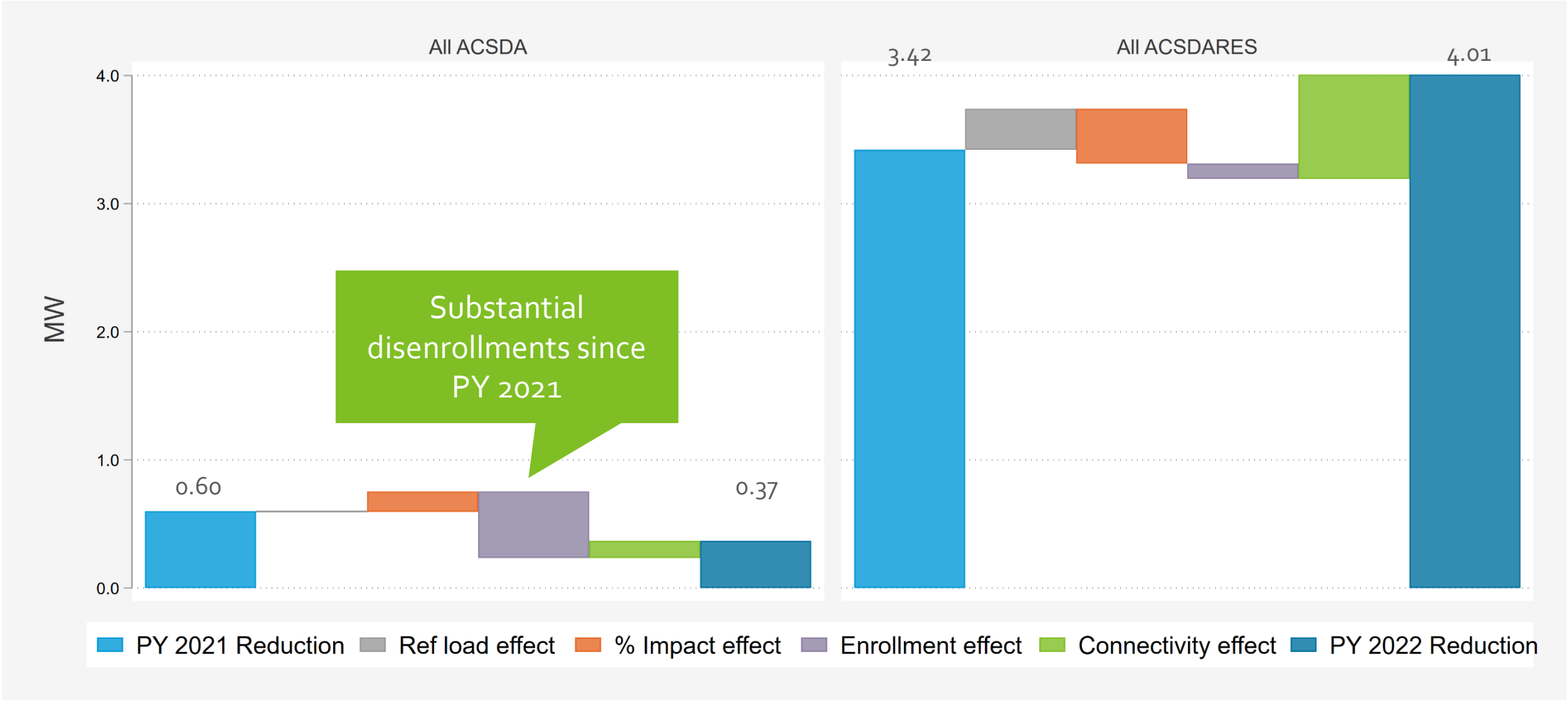
ENROLLMENT, CONNECTIVTY LARGEST DRIVER OF CHANGES FROM PY 2021



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QUESTIONS?

Alana Lemarchand
Partner & Principal
Demand Side Analytics
alana@demandsideanalytics.com
408.454.8158