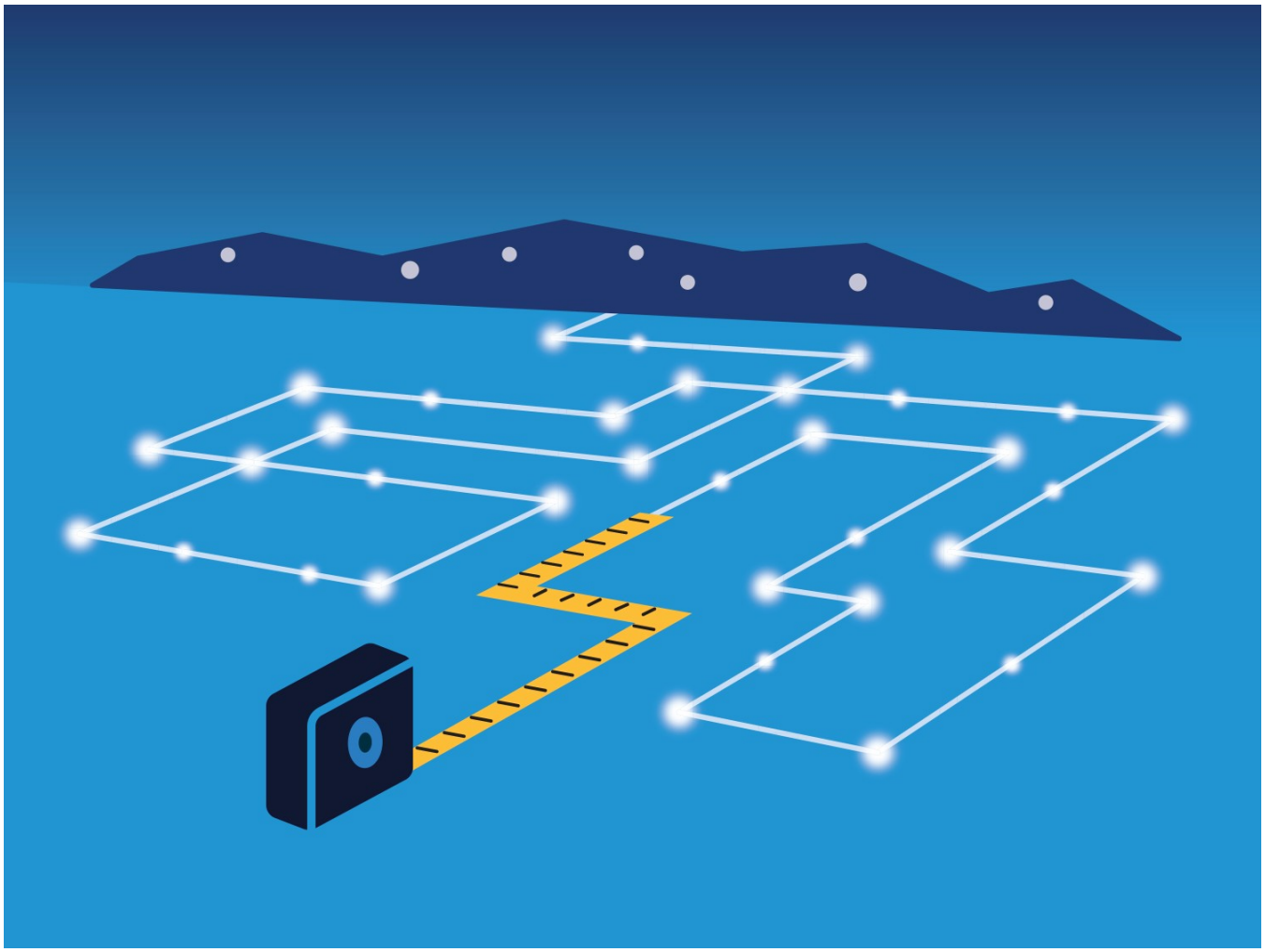
Opinion Dynamics

Boston | Headquarters

617 492 1400 tel
617 497 7944 fax
800 966 1254 toll free

1000 Winter St
Waltham, MA 02451



Ameren Missouri Program Year 2020 Annual EM&V Report

Volume 4: Demand Response Portfolio Appendices

June 10, 2021

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Appendix A. Residential Demand Response Program Appendix

Detailed Event Season Demand Impact Methodology

Runtime Data Cleaning

Table 1 summarizes drops, by device manufacturer and event day, made to the analytic data set as part of the data preparation and cleaning process.

Table 1. Event Day Modeling Data Cleaning Steps

Drop Reason	Number of Devices Remaining		
	Ecobee	Emerson	Nest
Event 1			
Initial number of devices	**5,884**	**1,662**	**13,939**
Drop non-central time zone	5,884	1,662	13,911
Drop duplicates	5,884	1,662	13,911
Drop ecobee and Emerson devices in telemetry data but not in treatment/control file	3,521	1,558	13,911
Drop invalid cooling minutes (-999 values or > 60 minutes)	3,289	1,485	12,699
Drop day type not equal demand-response	1,940	1,202	9,452
Drop day type equal demand-response but shown as control in treatment/control file	1,940	1,202	9,452
Drop Emerson devices by treatment type and device mode	1,940	1,202	9,452
Drop devices with all zero runtime in a day	1,903	1,177	9,303
Total	**1,903**	**1,177**	**9,303**
Event 2			
Initial number of devices	**6,293**	**2,426**	**15,297**
Drop non-central time zone	6,293	2,426	15,264
Drop duplicates	6,293	2,426	15,264
Drop ecobee and Emerson devices in telemetry data but not in treatment/control file	3,866	1,922	15,264
Drop invalid cooling minutes (-999 values or > 60 minutes)	3,524	1,820	13,621
Drop day type not equal demand-response	2,422	1,065	11,481
Drop day type equal demand-response but shown as control in treatment/control file	2,420	1,065	11,481
Drop Emerson devices by treatment type and device mode	2,420	1,061	11,481
Drop devices with all zero runtime in a day	2,402	1,058	11,297
Total	**2,402**	**1,058**	**11,297**
Event 3			
Initial number of devices	**6,293**	**2,408**	**15,312**
Drop non-central time zone	6,293	2,408	15,279
Drop duplicates	6,293	2,408	15,279
Drop ecobee and Emerson devices in telemetry data but not in treatment/control file	3,866	1,928	15,279
Drop invalid cooling minutes (-999 values or > 60 minutes)	3,527	1,822	13,414
Drop day type not equal demand-response	2,887	1,616	12,207
Drop day type equal demand-response but shown as control in treatment/control file	2,887	1,616	12,207
Drop Emerson devices by treatment type and device mode	2,887	813	12,207
Drop devices with all zero runtime in a day	2,864	805	12,014
Total	**2,864**	**805**	**12,014**

Drop Reason	Number of Devices Remaining		
	Ecobee	Emerson	Nest
Event 4			
Initial number of devices	**6,327**	**2,414**	**15,962**
Drop non-central time zone	6,327	2,414	15,929
Drop duplicates	6,327	2,414	15,929
Drop ecobee and Emerson devices in telemetry data but not in treatment/control file	3,856	1,989	15,929
Drop invalid cooling minutes (-999 values or > 60 minutes)	3,551	1,871	13,998
Drop day type not equal demand-response	2,442	1,253	11,658
Drop day type equal demand-response but shown as control in treatment/control file	2,409	1,191	11,658
Drop Emerson devices by treatment type and device mode	2,409	1,183	11,658
Drop devices with all zero runtime in a day	2,384	1,175	11,377
Total	**2,384**	**1,175**	**11,377**

Event Season Demand and Resource Capability Model Specification and Outputs

Equation 1 shows the model specification used to develop event day demand impacts. The same model specification was used to calculate resource capability impacts.

Equation 1. Residential DR Program – Event Day Impact and Resource Capability Model Specification

$$kW_{it} = \alpha_0 + \alpha_i + \beta_{Event} \cdot \text{Event} + \sum_{H=1}^{23} \beta_{\text{Hour}_H} \cdot \text{Hour}_H + \sum_{H=1}^{23} \beta_{Event\ \text{Hour}\ H} \cdot \text{Event} \cdot \text{Hour}_H + \beta_{\text{CDH}} \cdot \text{CDH}_t + \varepsilon_{it}$$

Where:

α_0 = Overall intercept

α_i = Device-specific intercept

$Event$ = Indicator variable for event day

$Hour$ = Set of 23 indicator variables of hours of the day (or reference hour for Resource Capability modeling)

$Event\ by\ Hour$ = The interaction of event day vs hour of the day

CDH = Base 75 cooling degree hours

ε_{it} = Error term

Table 2 shows the out-of-sample testing results from the model selection process

Table 2. Residential DR Program - Out-of-Sample Testing Results

Specification	Emerson RMSE	ecobee RMSE	Nest RMSE
kw ~ event * hour + cdh | odcid	0.0298	0.0237	0.0235
kw ~ event + hour + precool + event_hour + recovery + cdh | odcid	0.0591	0.0725	0.0727
kw ~ event * (hour + cdh) | odcid	0.0306	0.0238	0.0243

Table 3, Table 4, and Table 5 provide impact values for each event and event day hour by device manufacturer.

Table 3. Residential DR Program – Average Hour Ex Post DR kW Impacts by Event, Event Hour (Nest)

Event	Hour Beginning	Baseline Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
1	0	1.08	1.00	0.08	7.52%	0.01	0.06	0.10
	1	0.88	0.83	0.05	5.49%	0.01	0.03	0.07
	2	0.71	0.70	0.01	1.44%	0.01	-0.01	0.03
	3	0.59	0.60	-0.01	-1.77%	0.01	-0.03	0.01
	4	0.53	0.51	0.02	3.23%	0.01	0.00	0.03
	5	0.45	0.44	0.02	3.79%	0.01	0.00	0.03
	6	0.46	0.40	0.06	12.40%	0.01	0.04	0.07
	7	0.47	0.46	0.01	1.75%	0.01	-0.01	0.03
	8	0.48	0.55	-0.07	-13.57%	0.01	-0.08	-0.05
	9	0.64	0.71	-0.07	-11.16%	0.01	-0.09	-0.05
	10	0.77	0.87	-0.10	-13.51%	0.01	-0.12	-0.09
	11	0.97	1.09	-0.12	-11.92%	0.01	-0.13	-0.10
	12	1.25	1.96	-0.71	-56.38%	0.01	-0.72	-0.69
	13	1.50	2.09	-0.59	-39.12%	0.01	-0.60	-0.57
	14	1.60	0.26	1.34	83.86%	0.01	1.32	1.36
	15	1.87	0.64	1.23	65.55%	0.01	1.21	1.24
	16	2.03	1.03	1.00	49.35%	0.01	0.98	1.02
	17	2.10	2.53	-0.43	-20.63%	0.01	-0.45	-0.42
	18	2.02	2.31	-0.29	-14.28%	0.01	-0.31	-0.27
	19	1.93	2.13	-0.20	-10.24%	0.01	-0.22	-0.18
	20	1.82	1.94	-0.12	-6.79%	0.01	-0.14	-0.11
	21	1.78	1.83	-0.05	-2.67%	0.01	-0.06	-0.03
	22	1.61	1.69	-0.08	-5.26%	0.01	-0.10	-0.07
	23	1.37	1.48	-0.11	-8.31%	0.01	-0.13	-0.10
2	0	1.04	1.09	-0.05	-4.92%	0.01	-0.07	-0.04
	1	0.86	0.90	-0.04	-4.95%	0.01	-0.06	-0.03
	2	0.73	0.77	-0.04	-5.22%	0.01	-0.05	-0.02
	3	0.63	0.66	-0.03	-5.25%	0.01	-0.05	-0.02
	4	0.55	0.58	-0.02	-4.23%	0.01	-0.04	-0.01
	5	0.49	0.51	-0.02	-3.67%	0.01	-0.03	0.00

Event	Hour Beginning	Baseline Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
	6	0.42	0.44	-0.02	-3.98%	0.01	-0.03	0.00
	7	0.50	0.44	0.06	11.65%	0.01	0.04	0.07
	8	0.56	0.49	0.06	11.12%	0.01	0.05	0.08
	9	0.70	0.60	0.10	13.74%	0.01	0.08	0.11
	10	0.88	0.77	0.11	11.97%	0.01	0.09	0.12
	11	1.11	1.01	0.10	8.96%	0.01	0.08	0.12
	12	1.37	1.99	-0.62	-45.30%	0.01	-0.64	-0.61
	13	1.57	2.09	-0.51	-32.73%	0.01	-0.53	-0.50
	14	1.74	0.23	1.50	86.52%	0.01	1.49	1.52
	15	1.85	0.66	1.19	64.27%	0.01	1.17	1.20
	16	1.99	1.06	0.93	46.81%	0.01	0.91	0.95
	17	2.07	2.54	-0.47	-22.67%	0.01	-0.48	-0.45
	18	2.07	2.37	-0.30	-14.43%	0.01	-0.31	-0.28
	19	1.98	2.18	-0.20	-10.05%	0.01	-0.21	-0.18
	20	1.85	2.03	-0.18	-9.64%	0.01	-0.19	-0.16
	21	1.76	1.87	-0.11	-6.43%	0.01	-0.13	-0.10
	22	1.61	1.66	-0.05	-2.80%	0.01	-0.06	-0.03
	23	1.31	1.36	-0.04	-3.30%	0.01	-0.06	-0.03
3	0	1.14	1.11	0.03	2.51%	0.01	0.01	0.04
	1	0.96	0.89	0.07	7.56%	0.01	0.06	0.09
	2	0.79	0.75	0.04	4.78%	0.01	0.02	0.05
	3	0.65	0.63	0.02	2.68%	0.01	0.00	0.03
	4	0.59	0.54	0.05	8.59%	0.01	0.04	0.07
	5	0.51	0.47	0.04	7.58%	0.01	0.02	0.05
	6	0.44	0.41	0.04	8.76%	0.01	0.02	0.05
	7	0.51	0.43	0.08	16.23%	0.01	0.07	0.10
	8	0.62	0.50	0.12	18.71%	0.01	0.10	0.13
	9	0.76	0.61	0.15	20.35%	0.01	0.14	0.17
	10	0.93	0.77	0.16	17.40%	0.01	0.15	0.18
	11	1.11	0.99	0.13	11.37%	0.01	0.11	0.14
	12	1.33	1.90	-0.56	-42.21%	0.01	-0.58	-0.55
	13	1.55	1.98	-0.43	-28.06%	0.01	-0.45	-0.42
	14	1.66	0.20	1.46	87.82%	0.01	1.44	1.47
	15	1.82	0.56	1.26	69.12%	0.01	1.24	1.28
	16	1.90	0.86	1.04	54.93%	0.01	1.03	1.06
	17	2.03	2.44	-0.42	-20.68%	0.01	-0.43	-0.40
	18	2.02	2.24	-0.21	-10.55%	0.01	-0.23	-0.20
	19	1.94	2.04	-0.10	-5.34%	0.01	-0.12	-0.09
	20	1.81	1.91	-0.10	-5.52%	0.01	-0.12	-0.08

Event	Hour Beginning	Baseline Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
	21	1.76	1.80	-0.04	-2.43%	0.01	-0.06	-0.03
	22	1.60	1.62	-0.02	-1.48%	0.01	-0.04	-0.01
	23	1.39	1.40	-0.01	-0.60%	0.01	-0.02	0.01
4	0	1.01	0.99	0.02	1.82%	0.01	0.00	0.03
	1	0.84	0.82	0.02	2.87%	0.01	0.01	0.04
	2	0.72	0.69	0.03	4.53%	0.01	0.02	0.05
	3	0.68	0.61	0.07	10.00%	0.01	0.05	0.08
	4	0.56	0.54	0.02	3.81%	0.01	0.01	0.04
	5	0.48	0.47	0.01	1.37%	0.01	-0.01	0.02
	6	0.31	0.40	-0.09	-28.87%	0.01	-0.11	-0.07
	7	0.28	0.40	-0.11	-40.21%	0.01	-0.13	-0.10
	8	0.45	0.45	0.00	0.69%	0.01	-0.01	0.02
	9	0.48	0.54	-0.06	-11.58%	0.01	-0.07	-0.04
	10	0.79	0.67	0.12	14.76%	0.01	0.10	0.13
	11	0.86	1.51	-0.65	-75.52%	0.01	-0.66	-0.63
	12	1.13	1.65	-0.52	-45.49%	0.01	-0.53	-0.50
	13	1.32	0.12	1.20	90.79%	0.01	1.18	1.21
	14	1.49	0.32	1.17	78.38%	0.01	1.15	1.19
	15	1.52	0.55	0.97	63.69%	0.01	0.95	0.98
	16	1.82	2.11	-0.29	-15.78%	0.01	-0.30	-0.27
	17	1.64	1.77	-0.13	-7.73%	0.01	-0.14	-0.11
	18	1.49	1.60	-0.10	-7.02%	0.01	-0.12	-0.09
	19	1.35	1.48	-0.13	-9.29%	0.01	-0.14	-0.11
	20	1.24	1.43	-0.18	-14.85%	0.01	-0.20	-0.17
	21	1.26	1.29	-0.02	-1.92%	0.01	-0.04	-0.01
	22	1.15	1.12	0.03	2.57%	0.01	0.01	0.05
	23	0.95	0.87	0.08	8.11%	0.01	0.06	0.09

Table 4. Residential DR Program – Average Hour Ex Post DR kW Impacts by Event, Event Hour (ecobee)

Event	Hour Beginning	Reference Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
1	0	0.93	0.69	0.23	25.23%	0.02	0.20	0.27
	1	0.77	0.56	0.21	26.73%	0.02	0.17	0.24
	2	0.64	0.47	0.17	26.60%	0.02	0.14	0.20
	3	0.55	0.39	0.16	29.06%	0.02	0.13	0.19
	4	0.51	0.34	0.17	33.43%	0.02	0.14	0.20
	5	0.44	0.29	0.16	35.61%	0.02	0.13	0.19
	6	0.44	0.26	0.18	41.13%	0.02	0.15	0.21
	7	0.41	0.30	0.12	28.32%	0.02	0.09	0.15
	8	0.43	0.40	0.03	6.03%	0.02	-0.01	0.06
	9	0.57	0.57	0.00	-0.81%	0.02	-0.04	0.03
	10	0.70	0.74	-0.04	-5.99%	0.02	-0.07	-0.01
	11	0.88	0.95	-0.07	-7.99%	0.02	-0.10	-0.04
	12	1.07	1.25	-0.18	-17.30%	0.02	-0.22	-0.15
	13	1.25	1.63	-0.37	-29.71%	0.02	-0.40	-0.34
	14	1.35	0.36	1.00	73.55%	0.02	0.96	1.03
	15	1.58	0.66	0.91	57.99%	0.02	0.88	0.95
	16	1.70	1.03	0.67	39.19%	0.02	0.64	0.70
	17	1.76	2.36	-0.61	-34.60%	0.02	-0.64	-0.58
	18	1.67	2.10	-0.43	-25.65%	0.02	-0.46	-0.40
	19	1.58	1.86	-0.27	-17.30%	0.02	-0.31	-0.24
	20	1.49	1.65	-0.16	-10.66%	0.02	-0.19	-0.13
	21	1.49	1.52	-0.03	-2.25%	0.02	-0.06	0.00
	22	1.31	1.39	-0.08	-5.98%	0.02	-0.11	-0.05
	23	1.14	1.18	-0.04	-3.86%	0.02	-0.08	-0.01
2	0	0.83	0.93	-0.10	-12.52%	0.02	-0.13	-0.08
	1	0.70	0.78	-0.08	-11.39%	0.02	-0.11	-0.05
	2	0.61	0.69	-0.08	-13.91%	0.02	-0.11	-0.06
	3	0.53	0.58	-0.05	-10.35%	0.02	-0.08	-0.03
	4	0.47	0.53	-0.06	-13.58%	0.02	-0.09	-0.04
	5	0.43	0.47	-0.04	-10.42%	0.02	-0.07	-0.02
	6	0.38	0.42	-0.03	-8.37%	0.02	-0.06	-0.01
	7	0.40	0.39	0.01	2.69%	0.02	-0.02	0.04
	8	0.46	0.44	0.02	4.81%	0.02	0.00	0.05
	9	0.61	0.56	0.04	6.91%	0.02	0.02	0.07
	10	0.80	0.74	0.05	6.52%	0.02	0.03	0.08
	11	1.01	0.94	0.07	6.50%	0.02	0.04	0.09
	12	1.21	1.15	0.05	4.52%	0.02	0.03	0.08
	13	1.34	1.71	-0.36	-26.79%	0.02	-0.39	-0.33

Event	Hour Beginning	Reference Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
	14	1.49	0.35	1.15	76.76%	0.02	1.12	1.17
	15	1.59	0.67	0.92	57.81%	0.02	0.89	0.95
	16	1.68	1.07	0.61	36.27%	0.02	0.58	0.64
	17	1.76	2.34	-0.58	-33.24%	0.02	-0.61	-0.56
	18	1.73	2.14	-0.41	-23.45%	0.02	-0.43	-0.38
	19	1.62	1.69	-0.08	-4.75%	0.02	-0.10	-0.05
	20	1.52	1.65	-0.13	-8.51%	0.02	-0.16	-0.10
	21	1.45	1.55	-0.10	-7.09%	0.02	-0.13	-0.08
	22	1.31	1.46	-0.15	-11.25%	0.02	-0.17	-0.12
	23	1.08	1.17	-0.10	-8.84%	0.02	-0.12	-0.07
3	0	0.91	0.92	-0.01	-1.20%	0.01	-0.03	0.01
	1	0.77	0.77	0.01	0.76%	0.01	-0.02	0.03
	2	0.64	0.65	-0.01	-1.83%	0.01	-0.04	0.01
	3	0.54	0.57	-0.03	-4.78%	0.01	-0.05	0.00
	4	0.50	0.50	0.00	-0.56%	0.01	-0.03	0.02
	5	0.44	0.45	-0.02	-3.69%	0.01	-0.04	0.01
	6	0.40	0.40	0.00	0.38%	0.01	-0.02	0.03
	7	0.41	0.39	0.02	5.33%	0.01	0.00	0.05
	8	0.52	0.45	0.07	14.15%	0.01	0.05	0.10
	9	0.66	0.58	0.08	12.27%	0.01	0.06	0.10
	10	0.84	0.74	0.09	11.25%	0.01	0.07	0.12
	11	1.00	0.90	0.09	9.46%	0.01	0.07	0.12
	12	1.16	1.09	0.07	5.95%	0.01	0.05	0.09
	13	1.31	1.64	-0.33	-25.35%	0.01	-0.36	-0.31
	14	1.42	0.33	1.09	76.82%	0.01	1.06	1.11
	15	1.55	0.56	0.99	64.06%	0.01	0.97	1.02
	16	1.61	0.84	0.77	47.86%	0.01	0.75	0.80
	17	1.70	2.24	-0.54	-31.55%	0.01	-0.56	-0.51
	18	1.68	2.01	-0.32	-19.18%	0.01	-0.35	-0.30
	19	1.59	1.57	0.02	1.01%	0.01	-0.01	0.04
	20	1.48	1.53	-0.05	-3.30%	0.01	-0.07	-0.02
	21	1.43	1.46	-0.03	-2.13%	0.01	-0.05	-0.01
	22	1.29	1.46	-0.17	-12.87%	0.01	-0.19	-0.14
	23	1.10	1.20	-0.10	-9.12%	0.01	-0.12	-0.08
4	0	0.89	1.60	-0.71	-79.83%	0.02	-0.74	-0.68
	1	0.80	1.49	-0.69	-86.16%	0.02	-0.72	-0.66
	2	0.71	1.61	-0.91	-128.31%	0.02	-0.94	-0.88
	3	0.68	1.48	-0.80	-118.14%	0.02	-0.83	-0.77
	4	0.56	1.17	-0.61	-107.63%	0.02	-0.64	-0.58

Event	Hour Beginning	Reference Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
	5	0.48	0.81	-0.33	-68.10%	0.02	-0.36	-0.30
	6	0.33	0.98	-0.65	-198.30%	0.02	-0.68	-0.63
	7	0.28	1.08	-0.80	-290.46%	0.02	-0.83	-0.77
	8	0.43	1.05	-0.62	-143.20%	0.02	-0.65	-0.59
	9	0.47	1.05	-0.58	-123.92%	0.02	-0.61	-0.55
	10	0.76	1.10	-0.34	-44.32%	0.02	-0.37	-0.31
	11	0.80	1.17	-0.37	-46.92%	0.02	-0.40	-0.34
	12	1.01	1.78	-0.77	-76.70%	0.02	-0.80	-0.75
	13	1.12	0.71	0.41	36.33%	0.02	0.38	0.43
	14	1.26	0.92	0.34	27.21%	0.02	0.31	0.37
	15	1.26	1.18	0.08	6.33%	0.02	0.05	0.11
	16	1.54	1.96	-0.42	-27.41%	0.02	-0.46	-0.39
	17	1.34	2.20	-0.86	-63.65%	0.02	-0.89	-0.82
	18	1.18	1.25	-0.07	-6.30%	0.02	-0.10	-0.05
	19	1.04	1.21	-0.17	-16.37%	0.02	-0.20	-0.14
	20	0.98	1.40	-0.42	-42.63%	0.02	-0.45	-0.39
	21	1.02	1.95	-0.93	-91.77%	0.02	-0.97	-0.90
	22	0.94	1.84	-0.90	-95.99%	0.02	-0.93	-0.87
	23	0.82	1.55	-0.73	-89.42%	0.02	-0.76	-0.70

Table 5. Residential DR Program – Average Hour Ex Post DR kW Impacts by Event, Event Hour (Emerson)

Event	Hour Beginning	Reference Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
1	0	0.93	0.69	0.23	25.23%	0.02	0.20	0.27
	1	0.77	0.56	0.21	26.73%	0.02	0.17	0.24
	2	0.64	0.47	0.17	26.60%	0.02	0.14	0.20
	3	0.55	0.39	0.16	29.06%	0.02	0.13	0.19
	4	0.51	0.34	0.17	33.43%	0.02	0.14	0.20
	5	0.44	0.29	0.16	35.61%	0.02	0.13	0.19
	6	0.44	0.26	0.18	41.13%	0.02	0.15	0.21
	7	0.41	0.30	0.12	28.32%	0.02	0.09	0.15
	8	0.43	0.40	0.03	6.03%	0.02	-0.01	0.06
	9	0.57	0.57	0.00	-0.81%	0.02	-0.04	0.03
	10	0.70	0.74	-0.04	-5.99%	0.02	-0.07	-0.01
	11	0.88	0.95	-0.07	-7.99%	0.02	-0.10	-0.04
	12	1.07	1.25	-0.18	-17.30%	0.02	-0.22	-0.15
	13	1.25	1.63	-0.37	-29.71%	0.02	-0.40	-0.34
	14	1.35	0.36	1.00	73.55%	0.02	0.96	1.03
	15	1.58	0.66	0.91	57.99%	0.02	0.88	0.95
	16	1.70	1.03	0.67	39.19%	0.02	0.64	0.70
	17	1.76	2.36	-0.61	-34.60%	0.02	-0.64	-0.58
	18	1.67	2.10	-0.43	-25.65%	0.02	-0.46	-0.40
	19	1.58	1.86	-0.27	-17.30%	0.02	-0.31	-0.24
	20	1.49	1.65	-0.16	-10.66%	0.02	-0.19	-0.13
	21	1.49	1.52	-0.03	-2.25%	0.02	-0.06	0.00
	22	1.31	1.39	-0.08	-5.98%	0.02	-0.11	-0.05
	23	1.14	1.18	-0.04	-3.86%	0.02	-0.08	-0.01
2	0	0.83	0.93	-0.10	-12.52%	0.02	-0.13	-0.08
	1	0.70	0.78	-0.08	-11.39%	0.02	-0.11	-0.05
	2	0.61	0.69	-0.08	-13.91%	0.02	-0.11	-0.06
	3	0.53	0.58	-0.05	-10.35%	0.02	-0.08	-0.03
	4	0.47	0.53	-0.06	-13.58%	0.02	-0.09	-0.04
	5	0.43	0.47	-0.04	-10.42%	0.02	-0.07	-0.02
	6	0.38	0.42	-0.03	-8.37%	0.02	-0.06	-0.01
	7	0.40	0.39	0.01	2.69%	0.02	-0.02	0.04
	8	0.46	0.44	0.02	4.81%	0.02	0.00	0.05
	9	0.61	0.56	0.04	6.91%	0.02	0.02	0.07
	10	0.80	0.74	0.05	6.52%	0.02	0.03	0.08
	11	1.01	0.94	0.07	6.50%	0.02	0.04	0.09
	12	1.21	1.15	0.05	4.52%	0.02	0.03	0.08
	13	1.34	1.71	-0.36	-26.79%	0.02	-0.39	-0.33

Event	Hour Beginning	Reference Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
	14	1.49	0.35	1.15	76.76%	0.02	1.12	1.17
	15	1.59	0.67	0.92	57.81%	0.02	0.89	0.95
	16	1.68	1.07	0.61	36.27%	0.02	0.58	0.64
	17	1.76	2.34	-0.58	-33.24%	0.02	-0.61	-0.56
	18	1.73	2.14	-0.41	-23.45%	0.02	-0.43	-0.38
	19	1.62	1.69	-0.08	-4.75%	0.02	-0.10	-0.05
	20	1.52	1.65	-0.13	-8.51%	0.02	-0.16	-0.10
	21	1.45	1.55	-0.10	-7.09%	0.02	-0.13	-0.08
	22	1.31	1.46	-0.15	-11.25%	0.02	-0.17	-0.12
	23	1.08	1.17	-0.10	-8.84%	0.02	-0.12	-0.07
3	0	0.91	0.92	-0.01	-1.20%	0.01	-0.03	0.01
	1	0.77	0.77	0.01	0.76%	0.01	-0.02	0.03
	2	0.64	0.65	-0.01	-1.83%	0.01	-0.04	0.01
	3	0.54	0.57	-0.03	-4.78%	0.01	-0.05	0.00
	4	0.50	0.50	0.00	-0.56%	0.01	-0.03	0.02
	5	0.44	0.45	-0.02	-3.69%	0.01	-0.04	0.01
	6	0.40	0.40	0.00	0.38%	0.01	-0.02	0.03
	7	0.41	0.39	0.02	5.33%	0.01	0.00	0.05
	8	0.52	0.45	0.07	14.15%	0.01	0.05	0.10
	9	0.66	0.58	0.08	12.27%	0.01	0.06	0.10
	10	0.84	0.74	0.09	11.25%	0.01	0.07	0.12
	11	1.00	0.90	0.09	9.46%	0.01	0.07	0.12
	12	1.16	1.09	0.07	5.95%	0.01	0.05	0.09
	13	1.31	1.64	-0.33	-25.35%	0.01	-0.36	-0.31
	14	1.42	0.33	1.09	76.82%	0.01	1.06	1.11
	15	1.55	0.56	0.99	64.06%	0.01	0.97	1.02
	16	1.61	0.84	0.77	47.86%	0.01	0.75	0.80
	17	1.70	2.24	-0.54	-31.55%	0.01	-0.56	-0.51
	18	1.68	2.01	-0.32	-19.18%	0.01	-0.35	-0.30
	19	1.59	1.57	0.02	1.01%	0.01	-0.01	0.04
	20	1.48	1.53	-0.05	-3.30%	0.01	-0.07	-0.02
	21	1.43	1.46	-0.03	-2.13%	0.01	-0.05	-0.01
	22	1.29	1.46	-0.17	-12.87%	0.01	-0.19	-0.14
	23	1.10	1.20	-0.10	-9.12%	0.01	-0.12	-0.08
4	0	0.89	1.60	-0.71	-79.83%	0.02	-0.74	-0.68
	1	0.80	1.49	-0.69	-86.16%	0.02	-0.72	-0.66
	2	0.71	1.61	-0.91	-128.31%	0.02	-0.94	-0.88
	3	0.68	1.48	-0.80	-118.14%	0.02	-0.83	-0.77
	4	0.56	1.17	-0.61	-107.63%	0.02	-0.64	-0.58

Event	Hour Beginning	Reference Load (kW)	Event Day Load (kW)	Load Impact (kW)	% Load Impact	Standard Error	Lower Bound (90%)	Upper Bound (90%)
	5	0.48	0.81	-0.33	-68.10%	0.02	-0.36	-0.30
	6	0.33	0.98	-0.65	-198.30%	0.02	-0.68	-0.63
	7	0.28	1.08	-0.80	-290.46%	0.02	-0.83	-0.77
	8	0.43	1.05	-0.62	-143.20%	0.02	-0.65	-0.59
	9	0.47	1.05	-0.58	-123.92%	0.02	-0.61	-0.55
	10	0.76	1.10	-0.34	-44.32%	0.02	-0.37	-0.31
	11	0.80	1.17	-0.37	-46.92%	0.02	-0.40	-0.34
	12	1.01	1.78	-0.77	-76.70%	0.02	-0.80	-0.75
	13	1.12	0.71	0.41	36.33%	0.02	0.38	0.43
	14	1.26	0.92	0.34	27.21%	0.02	0.31	0.37
	15	1.26	1.18	0.08	6.33%	0.02	0.05	0.11
	16	1.54	1.96	-0.42	-27.41%	0.02	-0.46	-0.39
	17	1.34	2.20	-0.86	-63.65%	0.02	-0.89	-0.82
	18	1.18	1.25	-0.07	-6.30%	0.02	-0.10	-0.05
	19	1.04	1.21	-0.17	-16.37%	0.02	-0.20	-0.14
	20	0.98	1.40	-0.42	-42.63%	0.02	-0.45	-0.39
	21	1.02	1.95	-0.93	-91.77%	0.02	-0.97	-0.90
	22	0.94	1.84	-0.90	-95.99%	0.02	-0.93	-0.87
	23	0.82	1.55	-0.73	-89.42%	0.02	-0.76	-0.70

Event Season Impacts and Resource Capability – Model Fit

Figure 1- 6 show the model fit when predicting both baseline and event-day load compared to the actual load curves for both event days and proxy days. This comparison is done for both the event-specific models as well as the pooled-event resource capability models across all device manufacturers. Overall, these figures show that both the event-specific models as well as the pooled resource capability model are able to properly capture the load curve information for both baseline (proxy) and event days.

Figure 1. Residential DR Program – Nest Event Model Fit

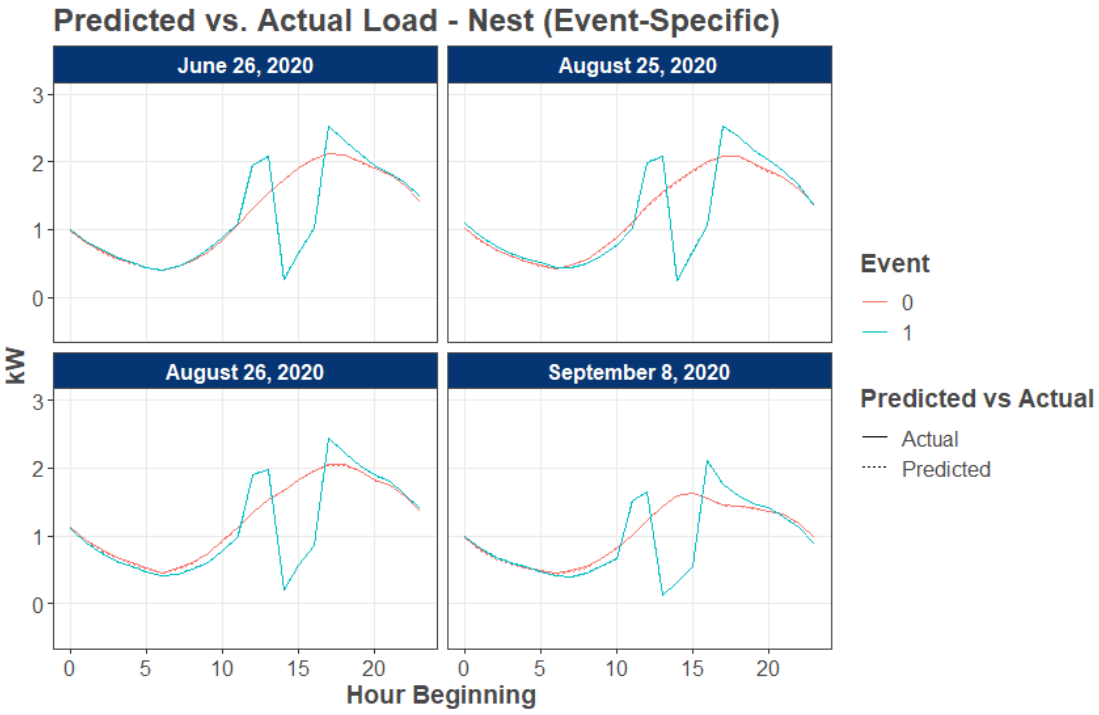


Figure 2. Residential DR Program – ecobee Event model fit

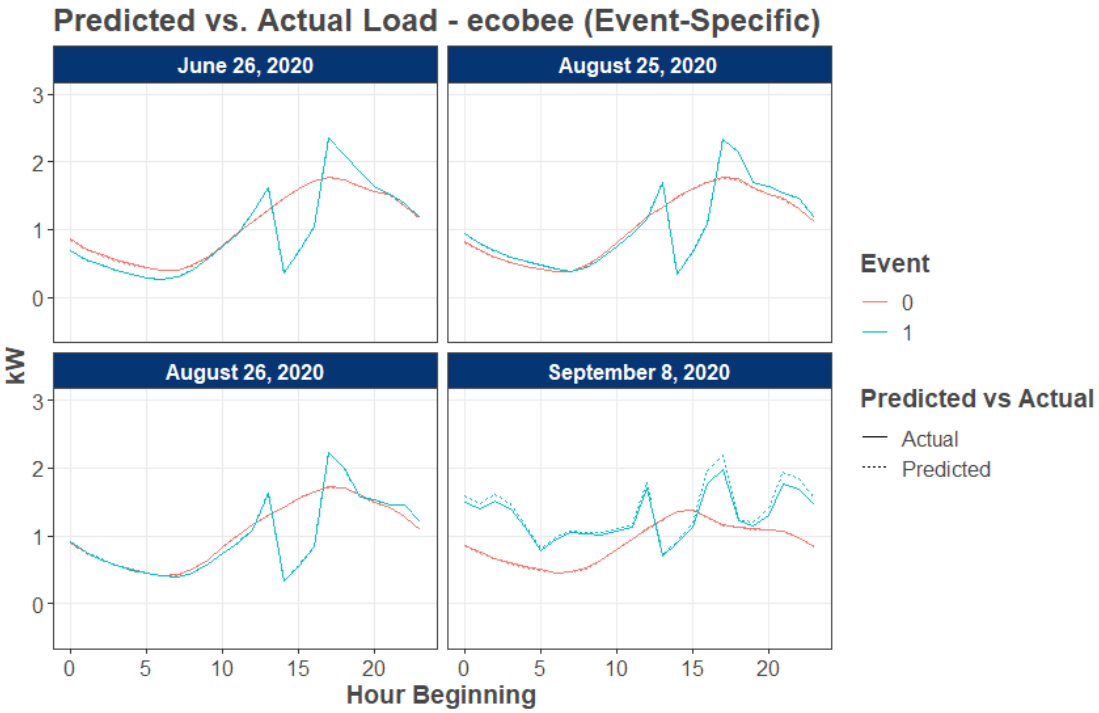


Figure 3. Residential DR Program – Emerson Event Model Fit

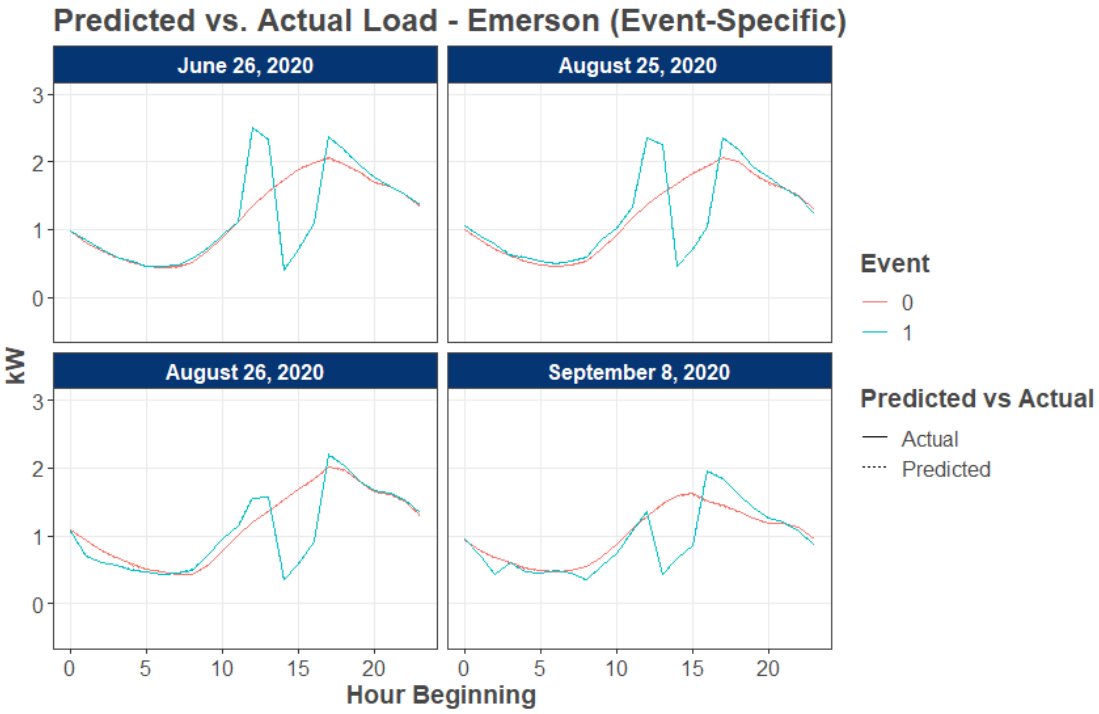


Figure 4. Residential DR Program – Nest Resource Capability Model Fit

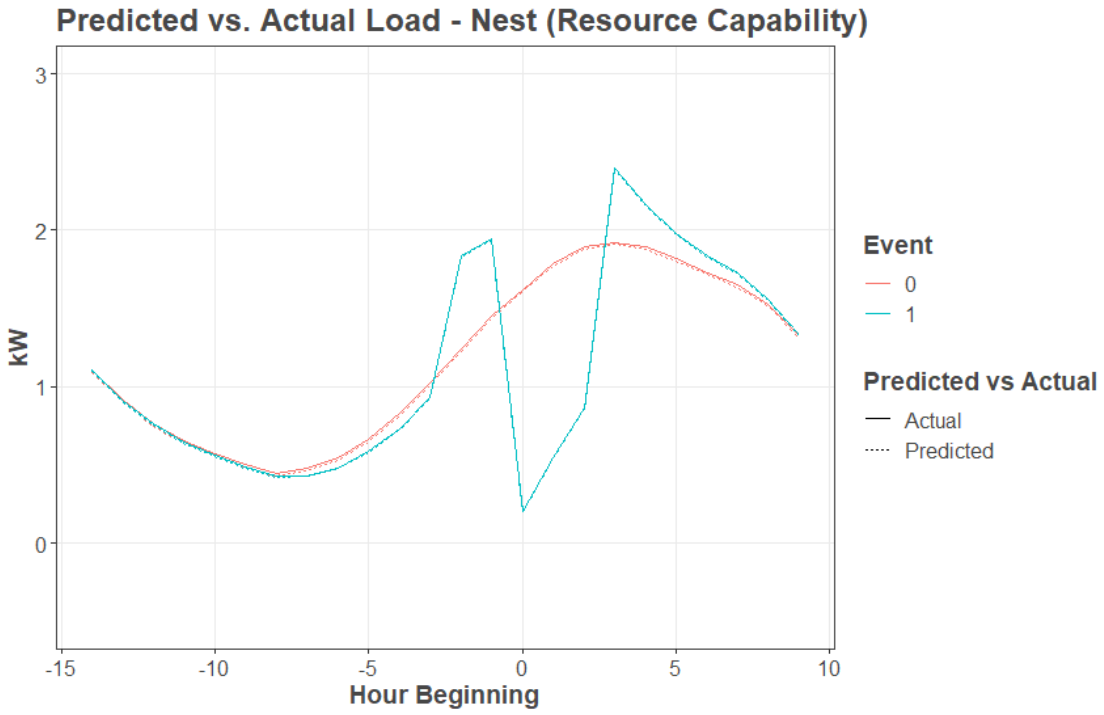


Figure 5. Residential DR Program – Per Thermostat Resource Capability Model Fit (ecobee)

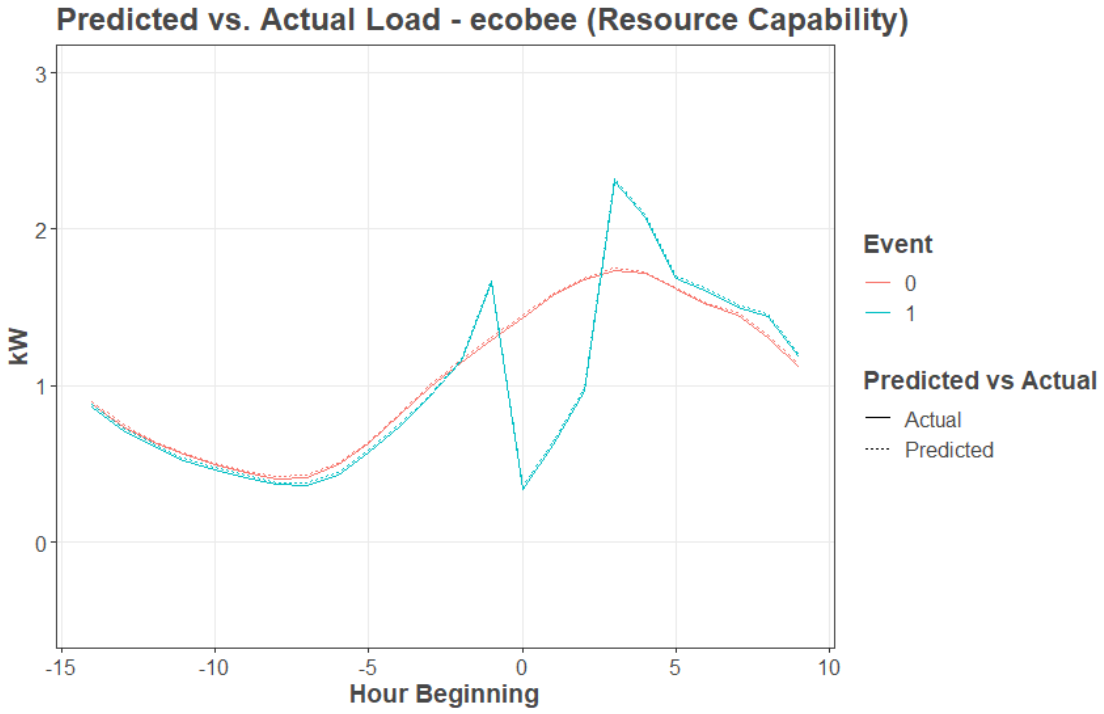
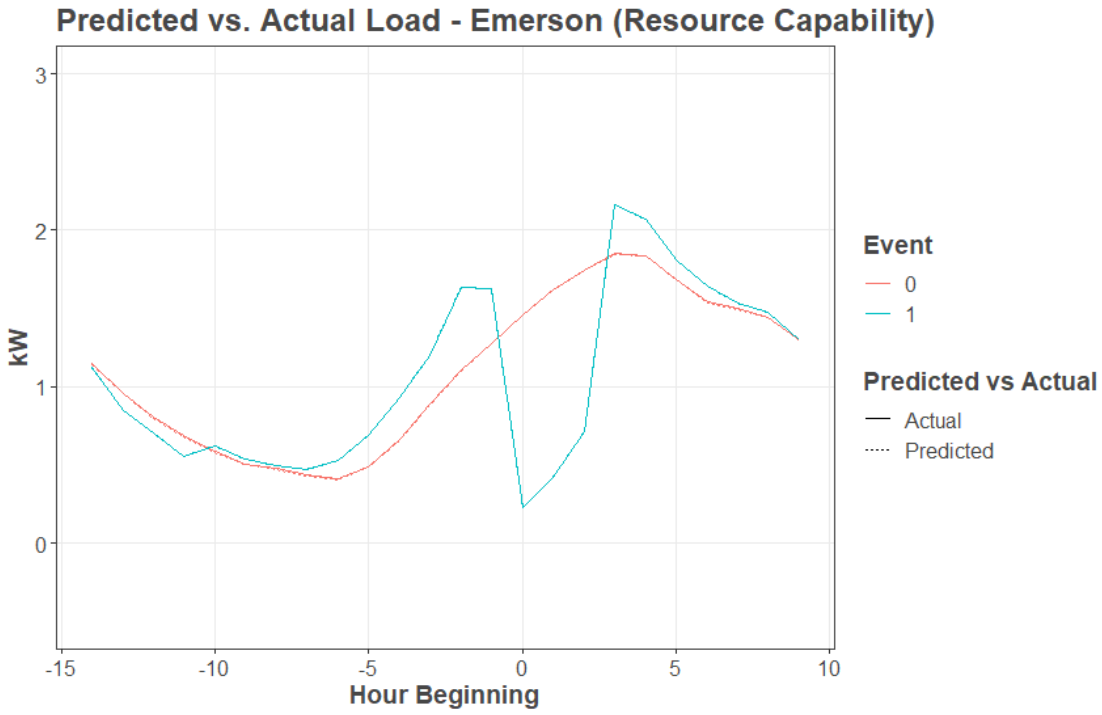


Figure 6. Residential DR Program – Per Device Resource Capability Model Fit (Emerson)



Event Season Impacts and Resource Capability Estimates – Additional Outputs

Figure 7-12 show the predicted event day kW (red) and the predicted baseline kW (blue) for each event and thermostat manufacturer. Each line shows the corresponding 90% confidence interval of the estimated load. The vertical grey area shows the event hours for each event. All events show clear evidence of kW reduction (except for the September 8 event for Ecobee devices – identified as event 4). All events also show some amount of precooling (an increase in kW prior to the event) and a snapback period (an increase in demand following the event as temperatures return to their pre-event levels). Pre-cooling practices vary by device manufacturer, with Nest and Emerson devices having a considerably more intense pre-cooling period than ecobee devices.

Figure 7. Residential DR Program – Per Thermostat kW Impacts by Event (Nest)

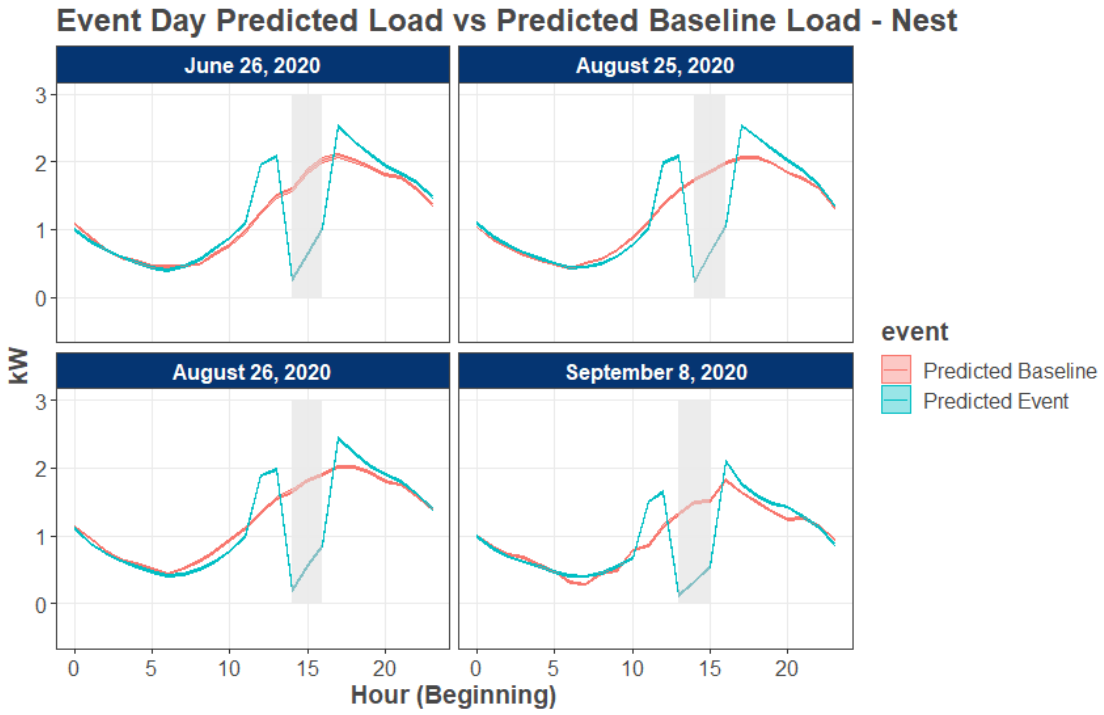


Figure 8. Residential DR Program – Per Thermostat kW Impacts by Event (ecobee)

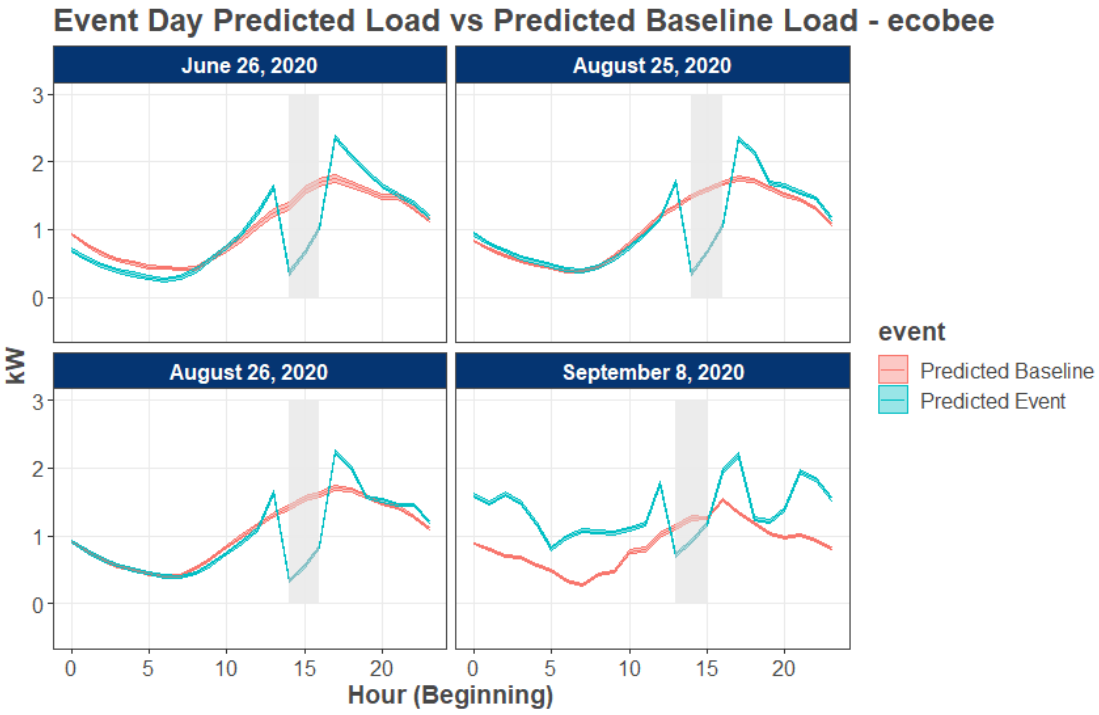


Figure 9. Residential DR Program – Per Thermostat kW Impacts by Event (Emerson)

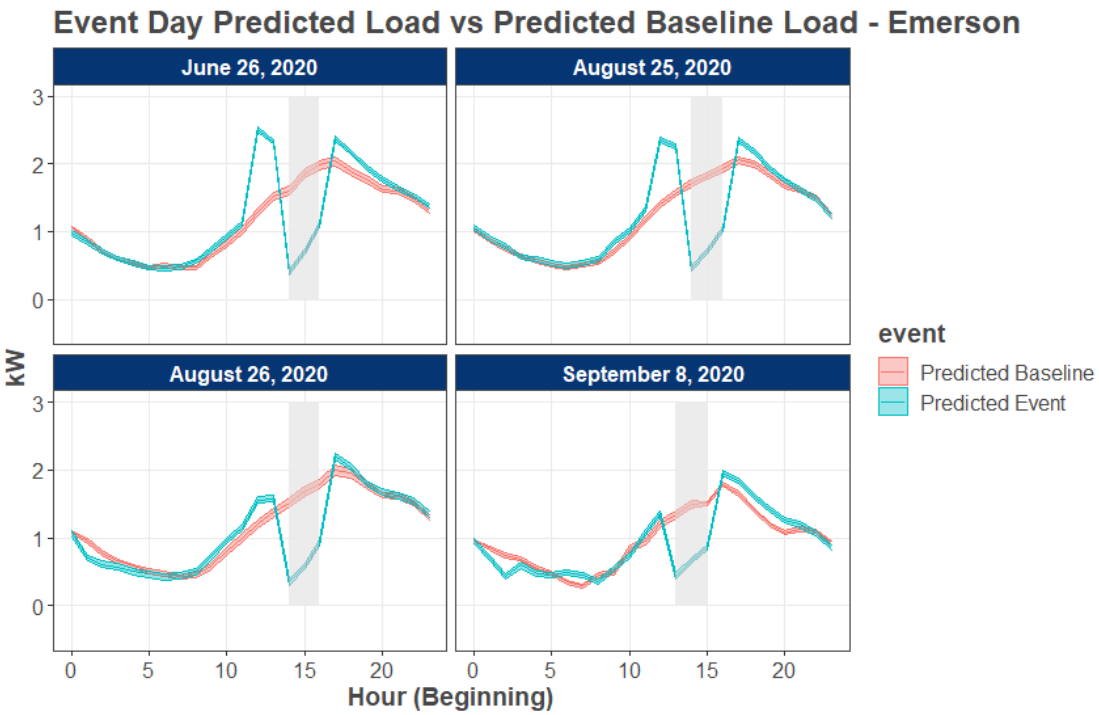


Figure 10. Residential DR Program – Resource Capability per Device Impacts (Nest)

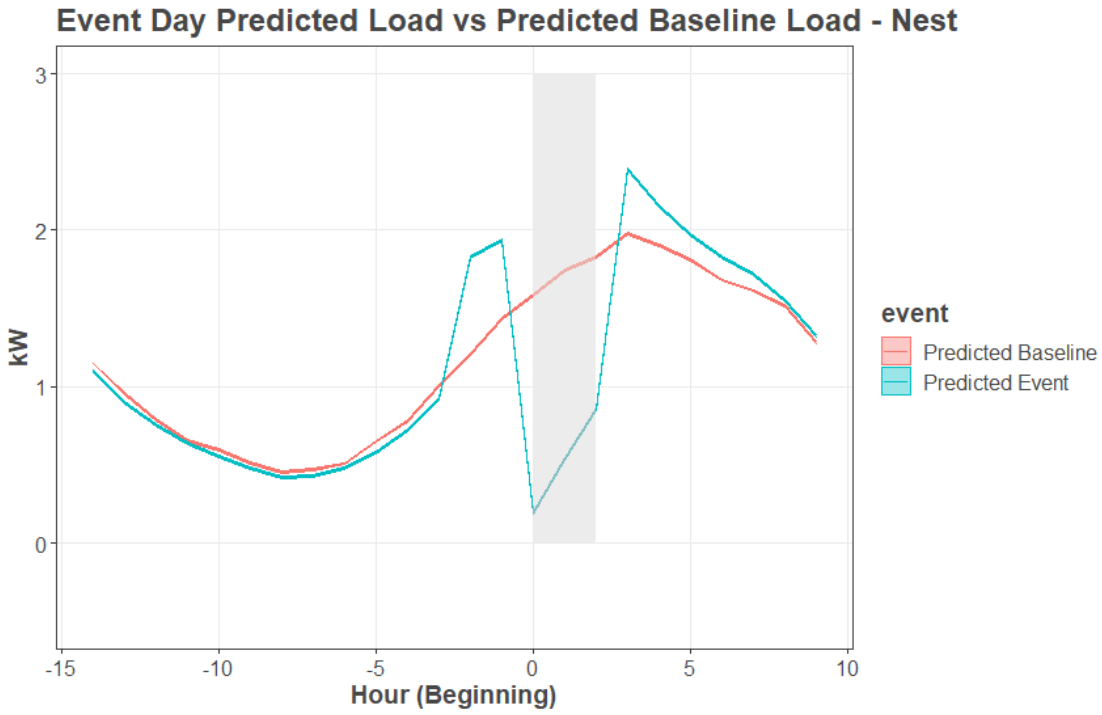


Figure 11. Residential DR Program – Resource Capability per Device Impacts (ecobee)

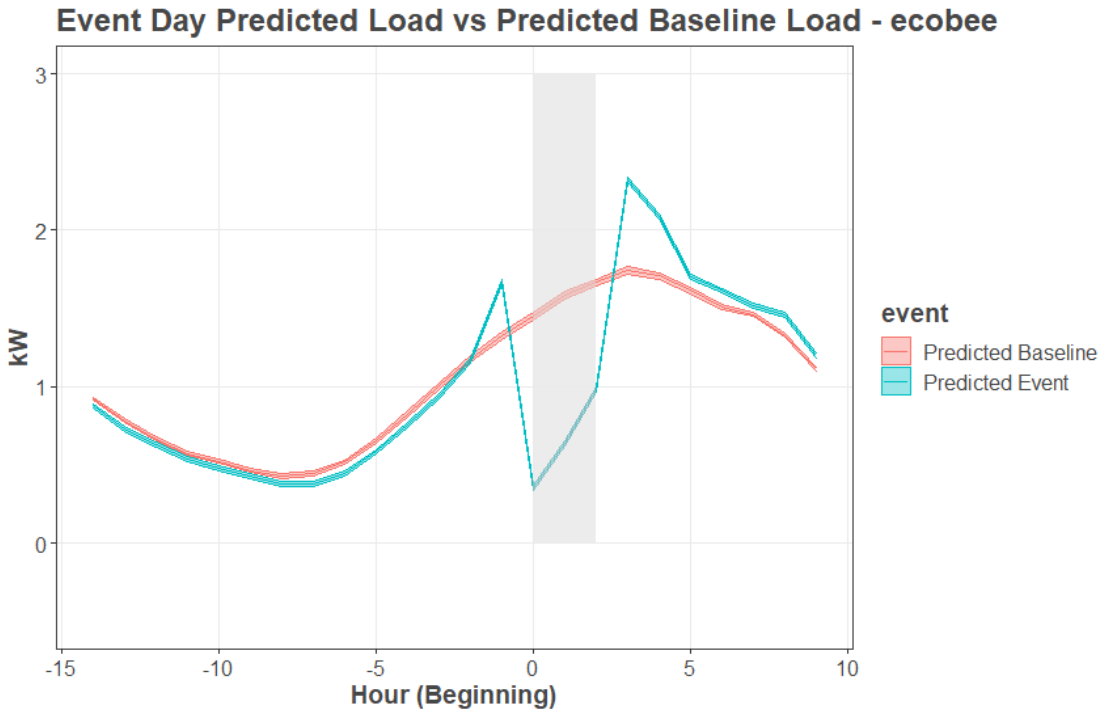
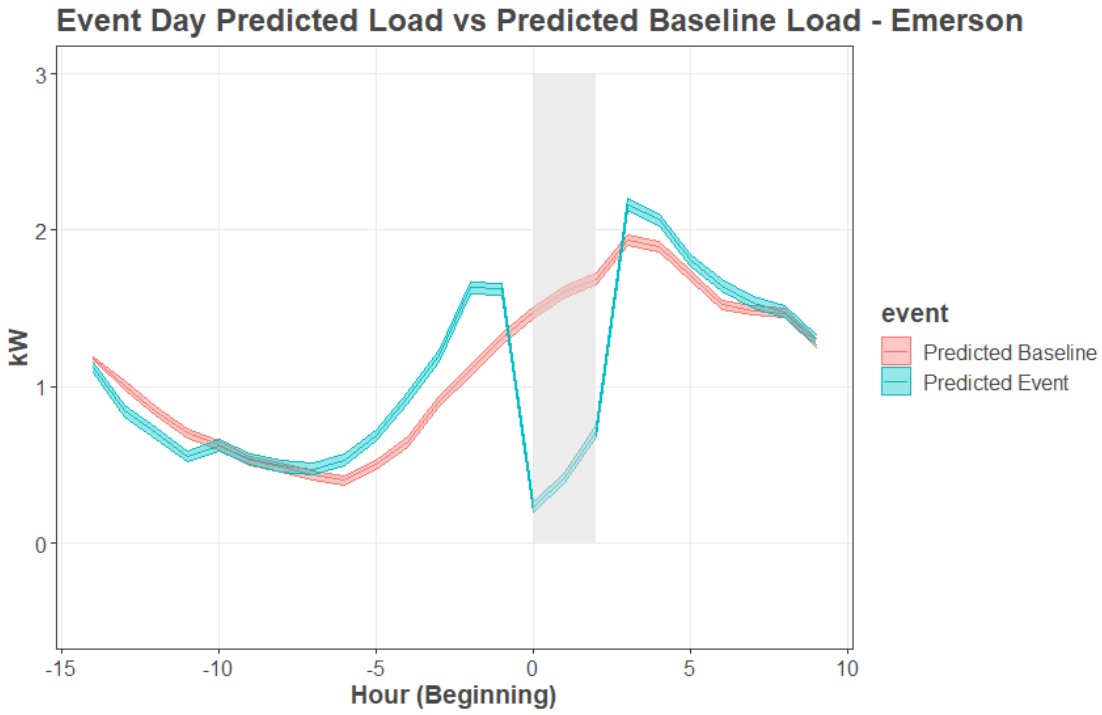


Figure 12. Residential DR Program – Resource Capability per Device Impacts (Emerson)



Connected Load Assumption Development

We leveraged onsite data collected as part of the Residential Baseline study completed as part of a broader 2020 DSM Market Potential study[1] as a data source to support the development of the connected load assumptions. We used the information on the respondents' central air conditioning system SEER rating and size. We reviewed the data and made adjustments to it for more accurate calculations. In cases where the central air conditioning system size was missing, we imputed it using home type weighted sample average for missing observations. In cases where SEER values were missing, we imputed them using other variables available in the data, including home vintage. We made additional adjustments to the SEER for aging and wear based on the central air conditioning system's vintage and tune-ups performed recently.

We calculated connected load for each device associated with the central air conditioning systems. To ensure that per-device connected load assumptions were representative of the population of the Residential DR program participants, we checked the differences in connected load results by key observable demographics that were available to us through the participant survey and the baseline study. We applied weights by home type and income to better align the connected load with the distribution of the participant population. Table 6 details the distribution of the Residential Baseline study respondents and Residential DR participants across demographic characteristics and summarizes the resulting weights.

[1] GDS Associates. Ameren Missouri 2020 DSM Market Potential Study. Final Report. March 2020. https://efis.psc.mo.gov/mpsc/commoncomponents/viewdocument.asp?DocId=936289645

Table 6. Participant Survey Weighting Scheme

Stratum	% of Residential Baseline Study Participants	% of Residential DR Participants	Weight
Low-income multifamily	22.5%	0.7%	.0317965
Low-income single-family	28.3%	3.7%	.1290564
Non-low-income multifamily	14.2%	6.9%	.4881698
Non-low-income single-family	35.0%	88.7%	2.534636

Table 7 presents the final weighted per device connected load. We applied the average connected load estimate to all participating device runtime results to convert the runtime reductions into demand reductions.

Table 7. Per Device Connected Load Results

Metric	Result
Sample size	119
Connected load	3.07

Table 8 provides a comparison of the connected load estimates without missing data imputations as well as without the weights applied and offers insight into the changes caused by those adjustments. As can be seen in the table, the connected load estimates are comparable across the scenarios and the difference in estimates is driven by the application of weights primarily.

Table 8. Per Device Connected Load Results

Scenario	Connected Load Estimate
Weighted and with missing data imputations	3.07
Unweighted and without missing data imputations	2.99
Unweighted and with missing data imputations	2.99

Appendix B. Business Demand Response Program Appendix

Table 9 below contains detailed impact results for each participating account.

Table 9. PY2020 Performance Across Events by Account

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2042383031680	50	43.18	86%	78.29	8.07	
2059176280351	50	5.59	11%	2.51	8.68	
2025526942946	133	218.37	164%	120.70	316.04	
2028910332023	47	19.07	41%	-47.01	85.14	
2072279853282	100	19.31	19%	19.31	19.31	
2018343965104	25	23.59	94%	34.34	12.83	
2078067361960	180	115.99	64%	124.24	107.75	
2077891092363	40	3.12	8%	-7.68	13.92	
2084357284822	70	199.36	285%	228.39	170.33	
2032338101736	200	67.14	34%	94.74	39.54	
2031676622925	50	60.55	121%	57.59	63.52	
2069550564508	75	14.92	20%	13.23	16.61	
2042373942940	500	918.90	184%	352.60	1485.20	
2056848019941	10	1.43	14%	1.43	1.43	
2086011121223	40	13.63	34%	27.80	-0.55	
0207979742019	66	88.52	134%	87.56	89.47	
0207908823754	50	42.66	85%	37.46	47.86	
2022416587796	71	22.44	32%	19.57	25.31	
2059028815258	10	-17.31	-173%	-40.03	5.40	
2018811049832	50	139.42	279%	168.35	110.50	
2079850142634	250	-405.60	-162%		-405.60	
2037025221429	238	115.02	48%	139.66	90.38	
2040353180903	50	45.99	92%	49.68	42.30	
2011303302476	250	-87.00	-35%		-87.00	
2056129902626	300	214.06	71%	194.83	233.28	
2049799760607	20	-17.21	-86%	-53.87	19.44	

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2044140774527	10	-24.24	-242%	-33.31	-15.16	
2079303761646	75	14.37	19%	17.61	11.13	
2012053133274	430	278.98	65%	167.64	390.31	
2050235282607	55	-4.56	-8%	-4.64	-4.48	
2066346897236	45	5.33	12%	7.32	3.33	
2023668295729	400	14.08	4%	30.25	-2.08	
2084546293983	2600	504.93	19%	-30.00	1039.86	
2067217165940	117	106.74	91%	106.88	106.60	
2056903598604	450	444.24	99%	507.35	381.12	
0206889984642	50	64.56	129%	63.45	65.68	
2040617687715	25	33.51	134%	18.36	48.66	
2078760757626	25	1.94	8%	11.53	-7.65	
2052081779206	50	10.08	20%	-0.26	20.42	
2057105183247	75	18.27	24%	17.36	19.18	
0206036052346	50	3.12	6%	-2.40	8.64	
2075995872324	20	-17.92	-90%	-30.81	-5.03	
2016132590465	50	101.72	203%	104.83	98.62	
0204182465207	110	88.02	80%	78.77	97.27	
2014915552781	120	172.88	144%	150.03	195.73	
2036920502956	1500	2502.75	167%	2652.00	2353.50	
0208664997089	50	57.51	115%	102.80	12.22	
2072659552423	50	51.40	103%	52.45	50.36	
2049354611498	35	189.89	543%	225.70	154.07	
2058383709109	35	17.55	50%	-14.78	49.88	
2062428196095	75	16.10	21%	24.50	7.70	
0209956215047	450	446.08	99%	629.47	262.70	
2014205970101	75	50.49	67%	86.13	14.85	
2016110976671	50	21.20	42%	-35.17	77.56	
2087822864086	25	2.49	10%	7.19	-2.20	
2087305762201	720	709.89	99%	914.74	505.04	

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2061578063052	25	44.27	177%	18.11	70.44	
0201517010446	400	311.94	78%	261.63	362.25	
2063441489165	25	19.67	79%	13.66	25.68	
2039569989846	50	30.16	60%	26.80	33.53	
2016361719026	75	30.98	41%	40.03	21.94	
2054884250306	53	32.23	61%	19.51	44.96	
2058105880837	75	54.76	73%	-9.07	118.58	
2060810896527	270	77.00	29%	-16.20	170.21	
2037400873292	175	187.59	107%	111.72	263.46	
2052963192814	700	412.66	59%	819.00	6.32	
2016738285599	150	68.48	46%	29.84	107.12	
2081736498768	55	9.61	17%	25.70	-6.48	
2085377810147	50	147.80	296%	130.32	165.27	
2035603139094	50	106.21	212%	100.78	111.65	
2068085080261	45	41.05	91%	41.11	41.00	
2049522229607	500	280.09	56%	156.74	403.43	
2025711111289	25	0.48	2%	-11.25	12.22	
2034631874286	540	503.40	93%	477.30	529.50	
2029505080593	700	546.57	78%	367.30	725.84	
2088180125319	75	75.61	101%	63.14	88.08	
2055449419001	55	-2.07	-4%	-3.85	-0.29	
2069329238838	10	39.59	396%	41.39	37.78	
2041330827731	45	1.52	3%	1.52	1.52	
2077800734651	55	-4.73	-9%	-7.45	-2.01	
0206295561426	20	-52.68	-263%	-37.32	-68.04	
2026642701439	150	87.73	58%	178.73	-3.26	
2035807284901	150	197.64	132%	219.67	175.61	
2022059696609	75	43.65	58%	13.73	73.58	
2067864752001	600	344.84	57%	285.77	403.92	
2059405094840	200	89.81	45%	167.88	11.73	

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2063030244489	30	-13.66	-46%	-47.55	20.22	
2030608408633	45	41.05	91%	41.11	41.00	
2079482398079	50	90.88	182%	-14.00	195.75	
2065141128737	650	1145.40	176%	874.80	1416.00	
2037402763731	500	137.06	27%	93.86	180.27	
2086628930978	50	45.61	91%	45.67	45.55	
2025306997540	250	5.47	2%	0.26	10.67	
2032519527383	150	95.68	64%	125.79	65.57	
2078431367025	75	63.95	85%	16.35	111.55	
2033008185057	75	104.50	139%	112.35	96.65	
0204315927891	175	183.84	105%	95.45	272.23	
2045627104552	25	1.37	5%	17.14	-14.40	
2089185219739	35	0.42	1%	-0.83	1.66	
2073355144047	75	75.89	101%	42.65	109.13	
2061285094330	30	53.29	178%	63.59	43.00	
2027222619210	73	24.27	33%	36.29	12.25	
2034077872172	50	238.00	476%	212.27	263.72	
2088039494145	75	96.09	128%	104.90	87.28	
0208336562261	150	176.45	118%	232.76	120.14	
2052710713608	30	59.46	198%	103.11	15.81	
2066506061193	75	65.31	87%	52.65	77.96	
2045385440494	40	7.70	19%	-0.11	15.51	
2052396508157	43	42.05	98%	-5.67	89.78	
2039915812190	100	0.77	1%	0.72	0.81	
2020118657997	800	170.10	21%	225.90	114.30	
2076234487024	200	5.41	3%	-19.27	30.10	
2057742189005	20	-4.29	-21%	-12.22	3.64	
2065101260299	75	4.62	6%	4.62	4.62	
2070235539099	1500	3585.75	239%	3660.00	3511.50	
2078932331809	75	54.74	73%	77.69	31.79	

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2065012738311	100	110.74	111%	113.14	108.33	
2032983275229	300	236.29	79%	159.84	312.74	
2080598887707	55	0.58	1%	-0.49	1.65	
2038371377735	250	157.18	63%	214.24	100.12	
2079814198771	100	108.80	109%	67.13	150.47	
2054243970153	80	40.15	50%	39.99	40.31	
2040836904500	115	64.92	56%	63.84	65.99	
0204550655634	50	91.88	184%	97.27	86.49	
2086908995532	75	25.81	34%	37.58	14.04	
2074723406113	50	171.37	343%	179.35	163.39	
2051324849089	100	56.02	56%	38.97	73.08	
2033636222013	70	84.58	121%	179.15	-9.99	
2082564517491	75	67.00	89%	75.40	58.61	
2013242080832	35	-9.56	-27%	-11.50	-7.61	
2064725694404	10	3.81	38%	-3.04	10.67	
2053525562636	150	187.96	125%	183.12	192.79	
2021529695842	140	0.72	1%	0.63	0.81	
2078791705705	25	43.22	173%	48.27	38.18	
0202015273597	1300	1806.26	139%	1623.60	1988.91	
2022910147563	100	18.74	19%	80.94	-43.45	
2027940388060	1100	806.40	73%	1711.60	-98.80	
2066207727686	160	5.28	3%	11.84	-1.28	
2010729979616	75	35.84	48%	37.94	33.75	
2045012600095	75	68.42	91%	68.51	68.33	
2082185423941	100	91.11	91%		91.11	
2054934767166	35	1.02	3%	-16.47	18.50	
2026310172860	300	17.91	6%	-12.00	47.82	
2053433378662	140	-12.94	-9%	1.61	-27.49	
2032397427828	500	58.24	12%	-1.06	117.55	
2082064298240	300	446.36	149%	378.68	514.04	

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2057796184528	55	-1.07	-2%	9.07	-11.21	
2029738442127	25	6.37	25%	3.85	8.90	
2016831520019	75	7.92	11%	12.57	3.26	
2062425409263	10	1.75	17%	2.20	1.30	
2016143176688	10	27.65	276%	28.27	27.03	
2053170496220	500	955.50	191%		955.50	
0204477086214	100	25.13	25%	42.24	8.03	
2078022786062	140	67.52	48%	5.45	129.59	
2028729742109	400	445.86	111%	411.80	479.93	
2044336385629	50	351.60	703%	164.40	538.80	
2029267597368	100	170.55	171%	160.19	180.92	
2056063649886	75	107.25	143%	115.35	99.15	
2071872619890	200	184.58	92%	151.95	217.20	
2057737913362	400	191.27	48%	23.11	359.43	
2056583893498	300	77.44	26%	110.79	44.10	
2012210190935	350	1017.90	291%	1137.02	898.78	
2044261317420	550	548.29	100%	538.00	558.58	
2022481369342	75	13.91	19%	6.66	21.15	
2017584394850	50	55.08	110%	9.94	100.22	
2076235949114	175	249.49	143%	318.90	180.08	
2087614638978	45	16.58	37%	-0.05	33.20	
2021682577375	100	93.72	94%	83.30	104.15	
2051812881872	900	851.64	95%	818.76	884.52	
2064361617255	1000	1067.70	107%	1104.60	1030.80	
2030609508802	1100	1102.43	100%	1112.38	1092.49	
0206539510268	20	-4.53	-23%	-15.93	6.87	
2025220949191	77	97.70	127%	91.71	103.68	
0203425343351	50	71.41	143%	71.02	71.80	
2065748522867	100	49.55	50%	56.75	42.34	
0204899211033	140	-1.22	-1%	-1.22	-1.22	

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2033675302547	55	4.27	8%	10.96	-2.43	
2031255879649	250	428.14	171%	428.14	428.14	
2013195576132	150	187.16	125%	153.36	220.97	
2076635856206	100	44.42	44%	36.05	52.79	
2019030851505	1000	68.25	7%		68.25	
0202963240297	750	732.92	98%	730.04	735.80	
2072231311552	56	71.06	127%	97.28	44.85	
2071123729364	250	146.12	58%	173.48	118.76	
2031245748796	150	205.01	137%	252.49	157.53	
2046576881962	200	397.74	199%	72.36	723.12	
2081358648625	250	45.22	18%	107.10	-16.65	
0209442887025	55	15.55	28%	23.54	7.56	
2042724303801	86	2.40	3%	-2.90	7.70	
2067620894446	1000	787.50	79%	625.80	949.20	
2013644238951	300	383.59	128%	408.38	358.80	
0207625597577	100	117.79	118%	147.75	87.83	
2030970621749	150	74.28	50%	85.31	63.25	
2038430795466	53	93.15	176%	107.97	78.33	
2080181683001	200	192.96	96%	244.92	140.99	
2075578735908	50	121.12	242%	120.58	121.65	
2019317463590	200	120.98	60%	34.05	207.90	
0209583655810	50	113.57	227%	125.01	102.13	
2087976470312	250	300.02	120%	409.37	190.66	
2054217888880	600	298.87	50%	351.55	246.20	
2069870962751	280	216.09	77%	199.39	232.80	
0002073721823	55	4.75	9%	7.56	1.94	
0205159877927	75	35.63	48%	35.96	35.30	
2017015925519	570	961.50	169%	1146.50	776.50	
0206349209002	300	522.05	174%	382.59	661.50	
2024204968345	100	10.16	10%	-18.77	39.08	

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2076913369163	50	36.09	72%	23.37	48.81	
2048266996420	200	147.75	74%	188.25	107.25	
2085474324259	25	17.55	70%	6.45	28.64	
2034609772981	400	110.90	28%	97.80	124.00	
2027786525364	43	183.92	428%	180.27	187.56	
2010336618636	200	200.10	100%	37.99	362.21	
2045880243611	75	117.11	156%	105.44	128.79	
0206580994024	500	27.95	6%	-40.50	96.39	
2084602660182	175	31.64	18%	-15.00	78.29	
2055523243982	260	62.48	24%	33.15	91.80	
2025472026008	185	-248.25	-134%	-501.75	5.25	
2062536531441	150	222.26	148%	216.43	228.10	
2080788777168	25	25.33	101%	23.30	27.35	
0204932103249	100	-14.83	-15%	-19.09	-10.58	
2027766010594	25	27.52	110%	29.57	25.47	
0204876219484	55	-9.79	-18%	-12.58	-6.99	
2044985311227	75	271.30	362%	239.54	303.05	
2080325170110	150	227.77	152%	184.81	270.73	
2089850014098	20	-4.25	-21%	-16.81	8.30	
2070821211476	75	0.70	1%	1.97	-0.57	
2049428341020	19	19.99	105%	24.51	15.48	
2044712211382	600	217.97	36%	142.72	293.22	
2066156487505	150	125.82	84%	128.74	122.90	
2052589377811	85	103.55	122%	94.70	112.40	
2031472121288	100	2.21	2%	1.61	2.80	
2049859293068	25	17.75	71%	13.89	21.60	
2014116518776	200	42.30	21%	8.40	76.20	
2013359728252	73	9.51	13%	8.11	10.92	
2026311663050	75	22.62	30%	16.74	28.49	
2058950248499	10	-0.13	-1%	-10.12	9.86	

ODCID	Nomination (kW)	Average Event Performance (kW)	Performance Rate*	August 20, 2020 Event Performance (kW)	September 17, 2020 Event Performance (kW)	December 8 & 17, 2020 Test Events Performance (kW)
2058380572543	400	214.87	54%	210.51	219.23	
2085717967053	500	1069.71	214%	1310.47	828.96	
2015055422491	2600	2949.15	113%	2684.10	3214.20	
0204406228283	50	74.88	150%	79.95	69.81	
2086648247781	75	93.94	125%	89.78	98.10	
2032492966041	200	116.99	58%	72.59	161.40	
2052953504743	10	-2.98	-30%	-3.70	-2.27	
2068031415643	200	-2.49	-1%	65.68	-70.67	
2063540249101	66	50.95	77%	14.76	87.14	
2076832331709	700	524.10	75%	1092.60	-44.40	
2089965866770	630	746.25	118%	829.20	663.30	
2035942583814	2200	2293.86	104%	2690.58	1897.15	
2034645921357	360	169.59	47%	262.11	77.07	
2038965006613	20	7.51	38%	-11.34	26.35	
0020612200165	50	76.01	152%	109.69	42.34	
2050821801787	55	5.09	9%	6.93	3.24	
0206758611034	100	115.05	115%	170.33	59.78	
2045714525304	25	18.03	72%	5.99	30.07	
2032004713414	40	4.03	10%	-0.34	8.40	
0208214183309	450	1001.40	223%	1043.40	959.40	
2033100525121	240	7.77	3%	15.92	-0.39	
2077579596526	60	75.95	127%	16.07	135.82	
2069531413959	10	27.52	275%	-5.10	60.13	
2060736983545	1690	2275.03	135%	2988.45	1561.60	
2073706757870	37	19.81	54%	9.98	29.65	
2026112253061	75	35.20	47%	34.16	36.24	
2079053143497	75	104.16	139%	97.63	110.69	
2049854256261	10	13.76	138%	-13.71	41.23	
2025813925630	75	-6.23	-8%	13.75	-26.21	
2062986864958	75	29.84	40%	27.41	32.27	

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2064277822194	50	128.74	257%	100.22	157.25	
2042726276681	25	9.38	38%	10.98	7.79	
2046283072962	350	466.31	133%	518.31	414.32	
2034525466541	45	17.23	38%	74.43	-39.97	
2063477935792	64	12.96	20%	7.83	18.09	
2034247143844	355	305.25	86%	53.70	556.80	
2033731106136	120	267.60	223%	214.20	321.00	
2065923841138	350	1008.22	288%	954.96	1061.48	
2044554509441	40	117.64	294%	122.26	113.02	
2089313986629	500	3.06	1%	0.88	5.25	
2018080965614	300	188.40	63%	28.80	348.00	
2021687917710	20	-0.30	-2%	-8.30	7.69	
0201236151850	55	8.12	15%	8.60	7.64	
2042383031680	1000	899.55	90%			899.55
2059176280351	750	330.60	44%			330.60
2025526942946	100	52.83	53%			52.83
2032492966041	100	35.64	36%			35.64
2018343965104	100	1.44	1%			1.44
2028910332023	100	40.05	40%			40.05

*Performance rate is calculated by dividing average performance by nominated capacity.

For more information, please contact:

Antje Flanders
Vice President

617-301-4643 tel
617-497-7944 Fax
aflanders@opiniondynamics.com

1000 Winter Street
Waltham, MA 02451