WHEN TRUST MATTERS

Estimating COVID Impacts using SDG&E Dynamic Load Profiling

SDG&E has not reviewed or endorsed this presentation

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Objective and Data

Objective

- To estimate the pandemic's first year impact using public data sources

Data Sources

- SDG&E dynamic load profiling
- NOAA weather data
- Normalized weather data ("CALMAC 2019")

Why SDG&E

- Compact service territory is easier to associate with a specific weather station

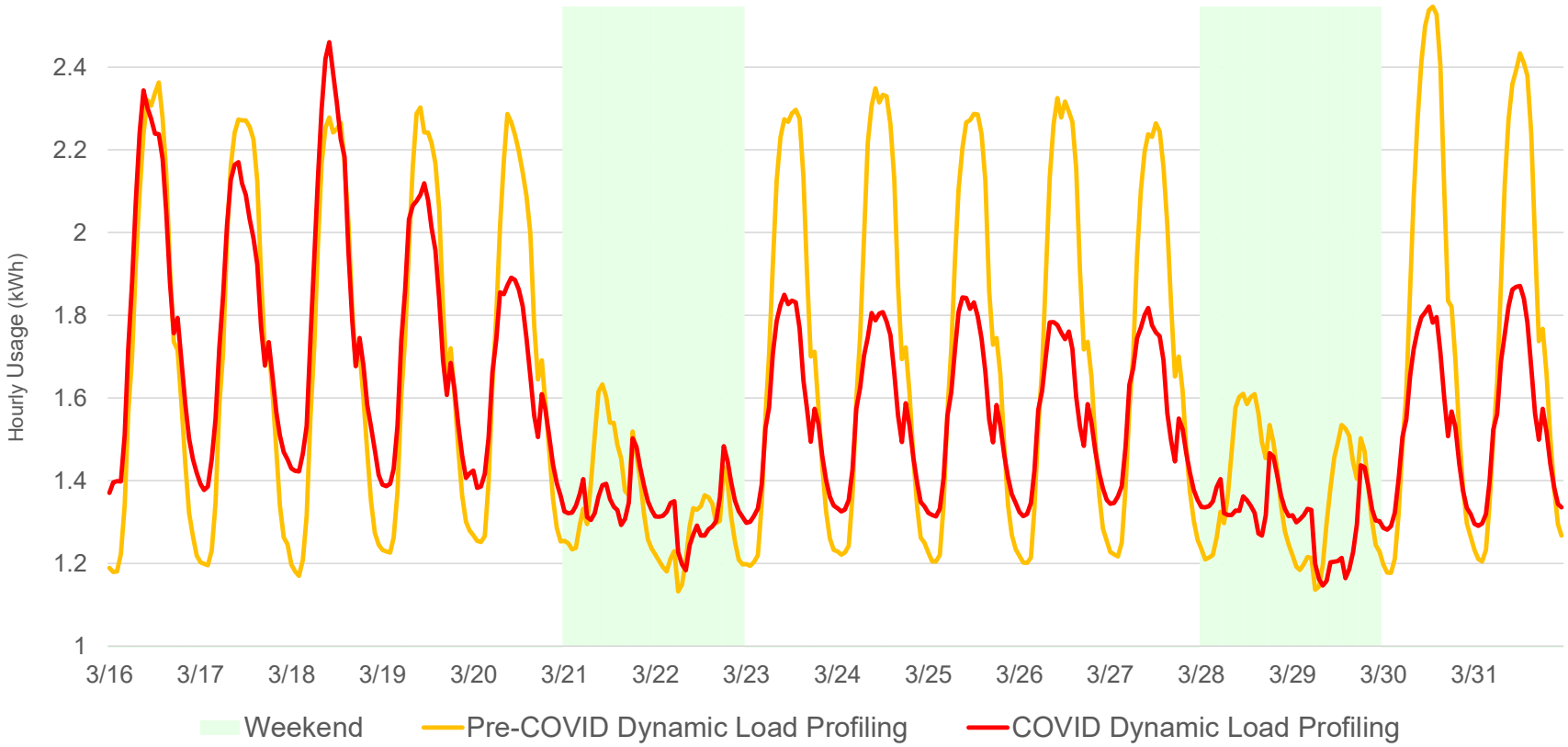
A note about Dynamic Load Profiles (DLP)

- Dynamic Load Profiles are hourly class profiles that have been mandated by the CPUC since 1997. DLP were originally designed for Settlements, but they eventually found their way to a number of uses, such as forecasting, procurement, and third party solar calculators, to name a few.

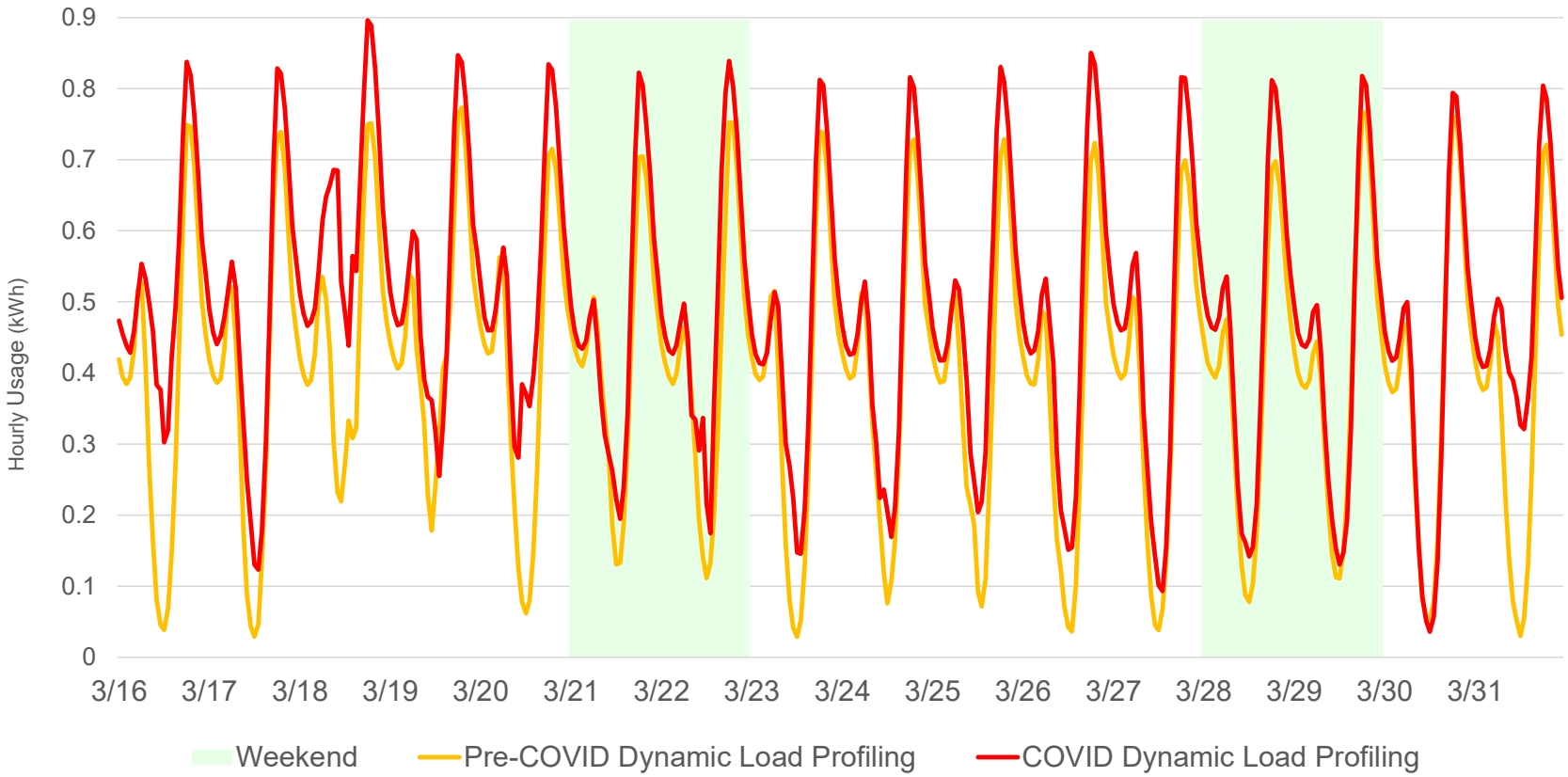
- SDG&E's dynamic load profiles reflect net usage. SDG&E has a very high penetration of solar customers. For these, the load entered into DLP is net load, not total energy use. This means that DLP is not entirely reflective of actual energy use.

- SDG&E's DLP is posted at https://www2.sdge.com/eic/dlp/dynamic.cfm

Small Commercial Dynamic Load Profile Comparison



Residential Dynamic Load Profile Comparison



Weather Station Selection

We looked for a weather station that:

- Is representative of SDG&E customers
- Has weather normalization posted in CALMAC

We considered:

- Three of the six weather stations that were assigned to SDG&E residential customers in the CEC's RASS
- These three have the highest number of customer matches
- Montgomery-Gibbs airport was selected based on model fit

San Diego Gas & Electric Service Territory

Figure source: https://www.sdge.com/more-information/our-company/about-us

Heating and Cooling Reference Temperatures

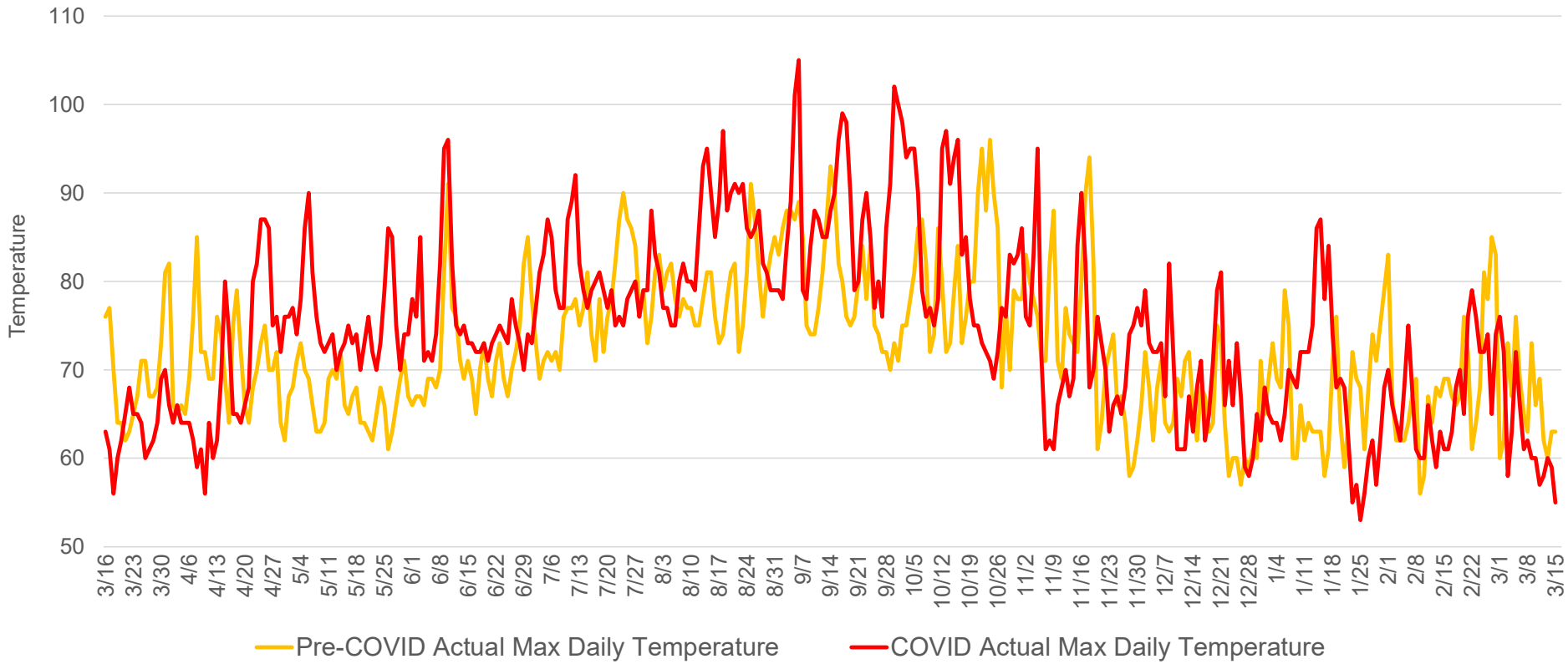
HDD and CDD were calculated with different bases

- Heating base was varied from 45 degrees to 70 degrees
- Cooling base was varied from 60 degrees to 90 degrees

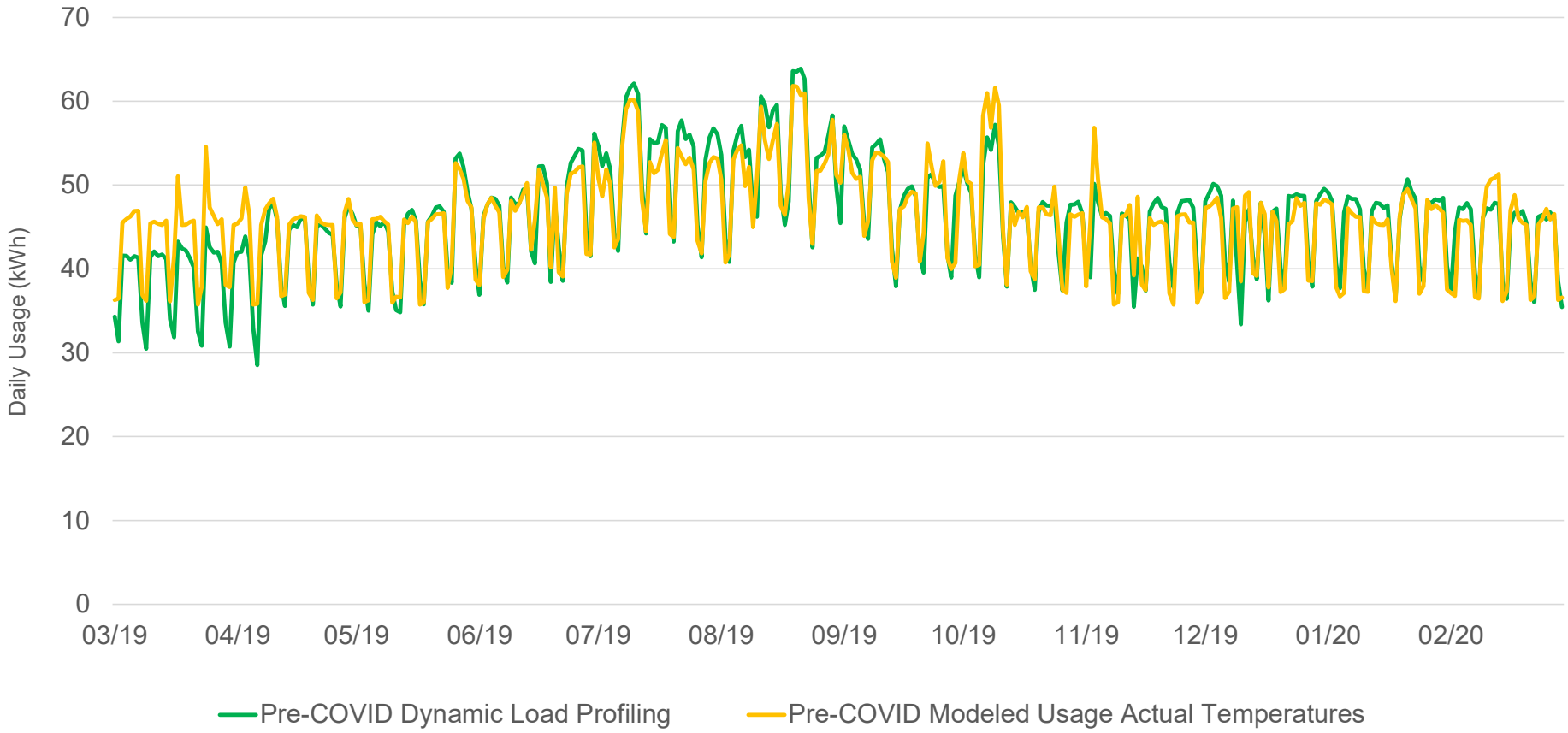
All combinations were tested. Pairs of CDD and HDD were selected based on model fit (R-Squared)

Rate Class	Period	Heating Base	Cooling Base
Residential	Pre-COVID	61 degrees	65 degrees
	COVID	63 degrees	67 degrees
Small Commercial	Pre-COVID	60 degrees	61 degrees
	COVID	59 degrees	64 degrees

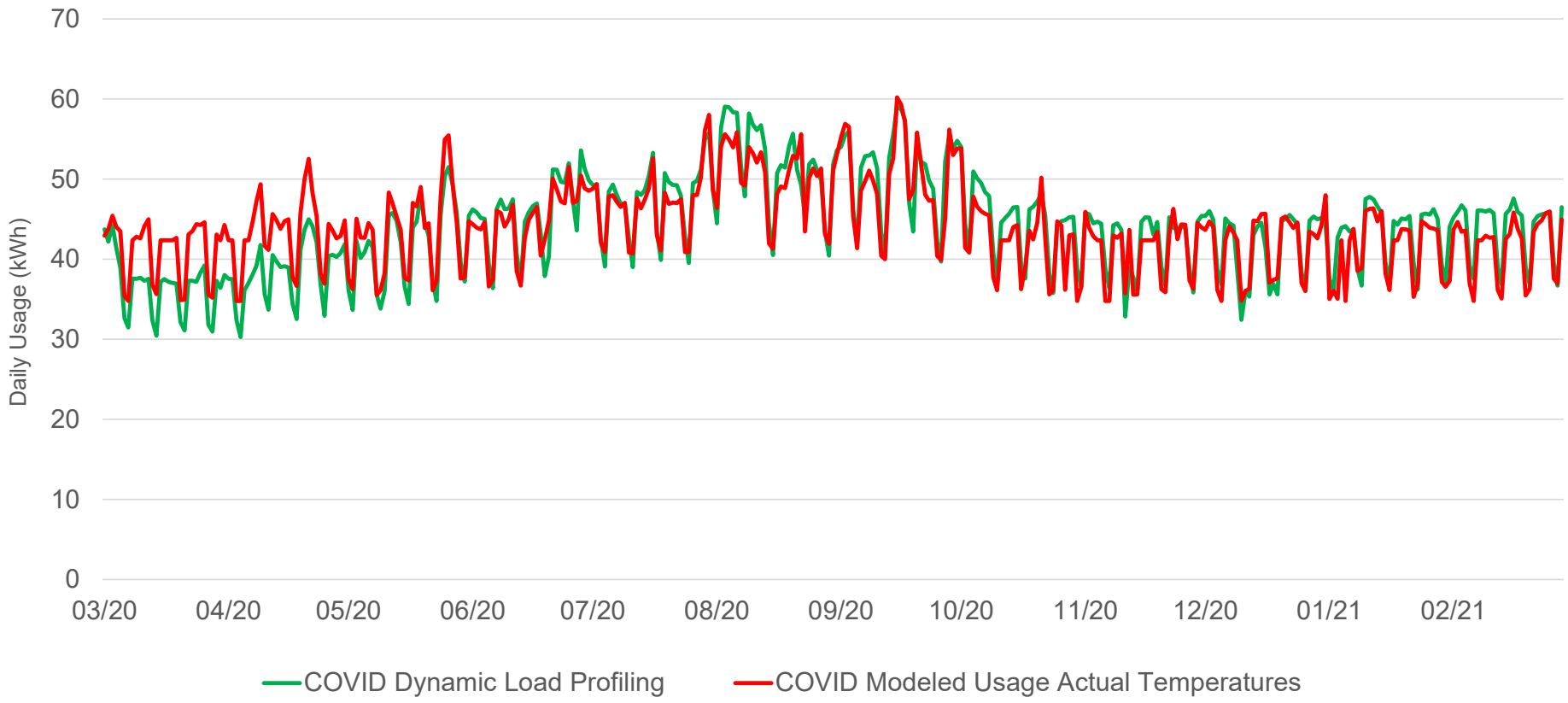
Weather Data



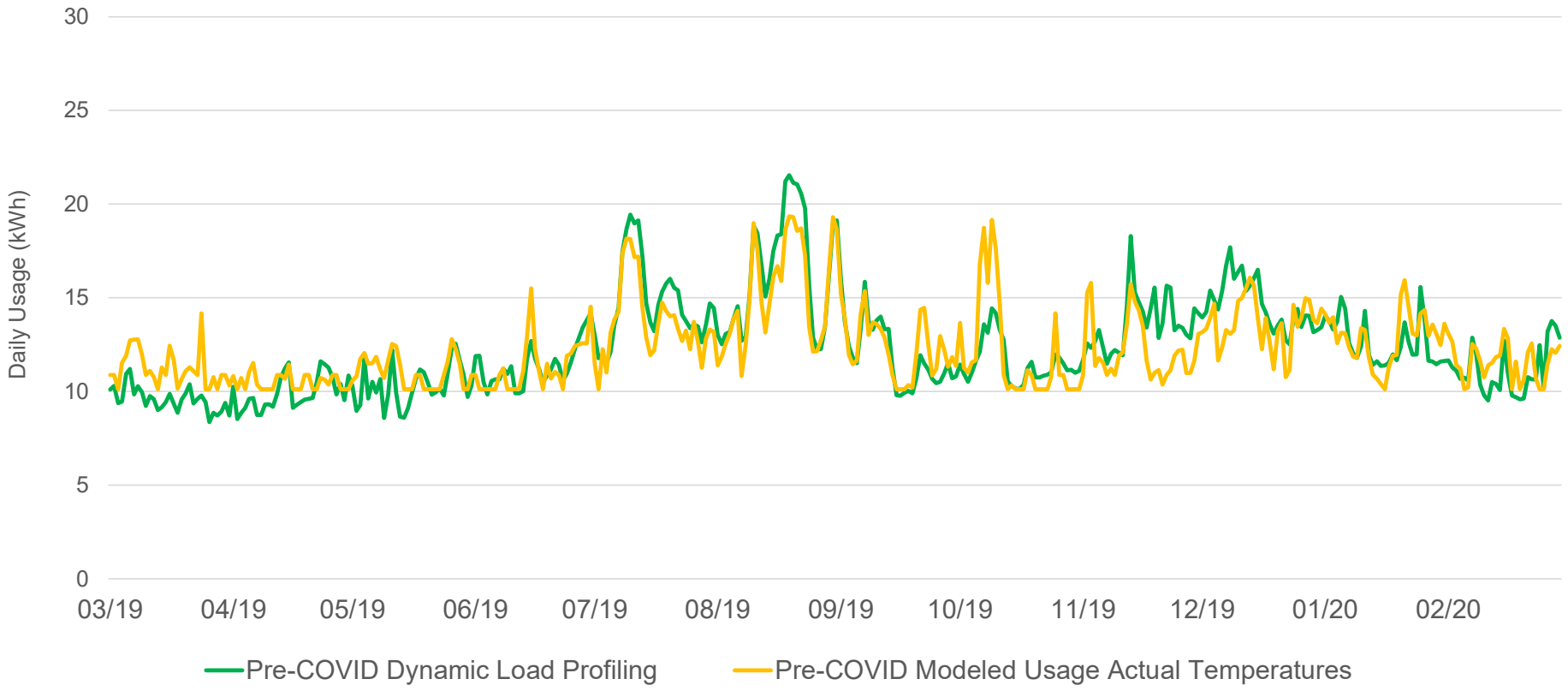
Small Commercial – Pre-COVID DLP vs. Modeled DLP



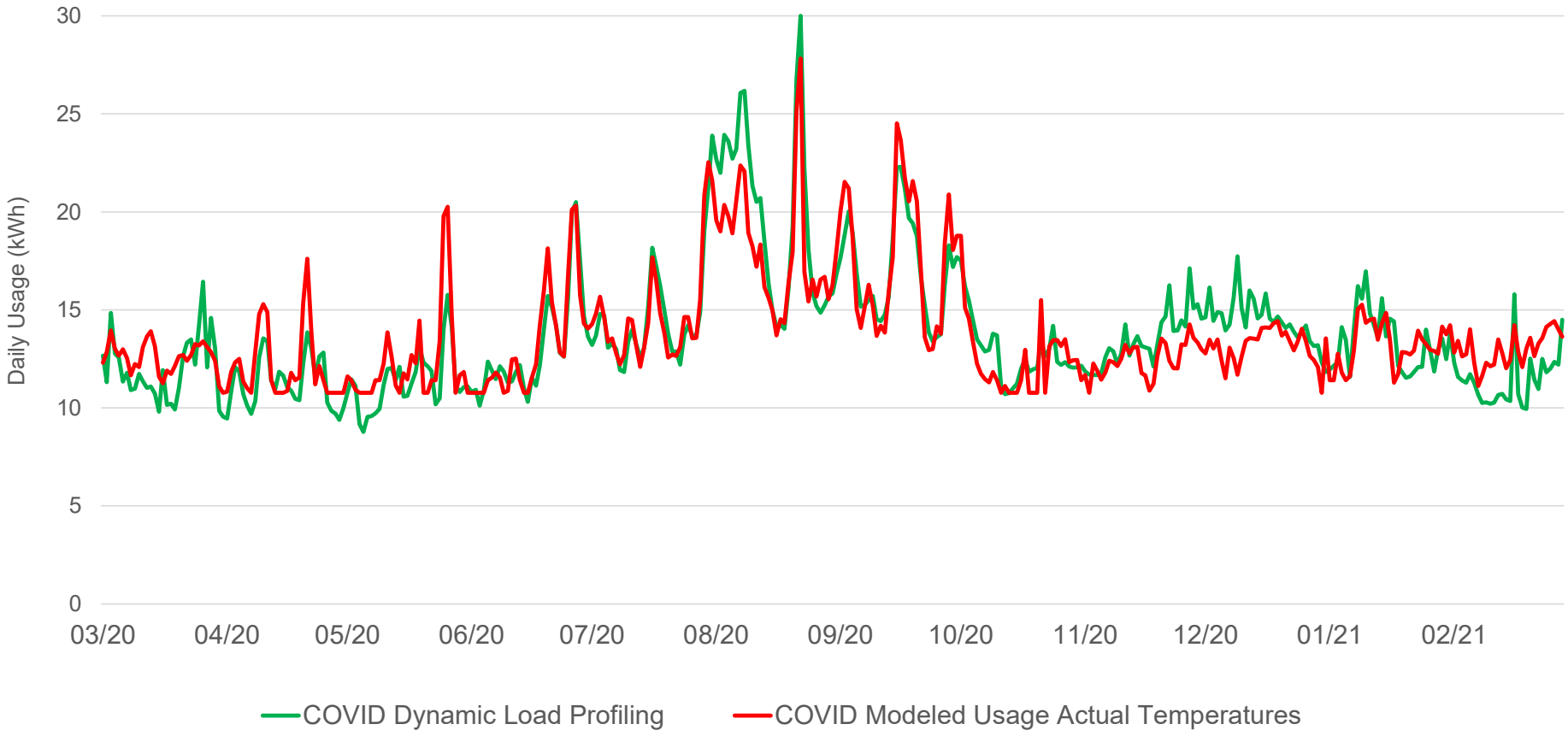
Small Commercial – COVID DLP vs. Modeled DLP



Residential – Pre-COVID DLP vs. Modeled



Residential – COVID DLP vs. Modeled



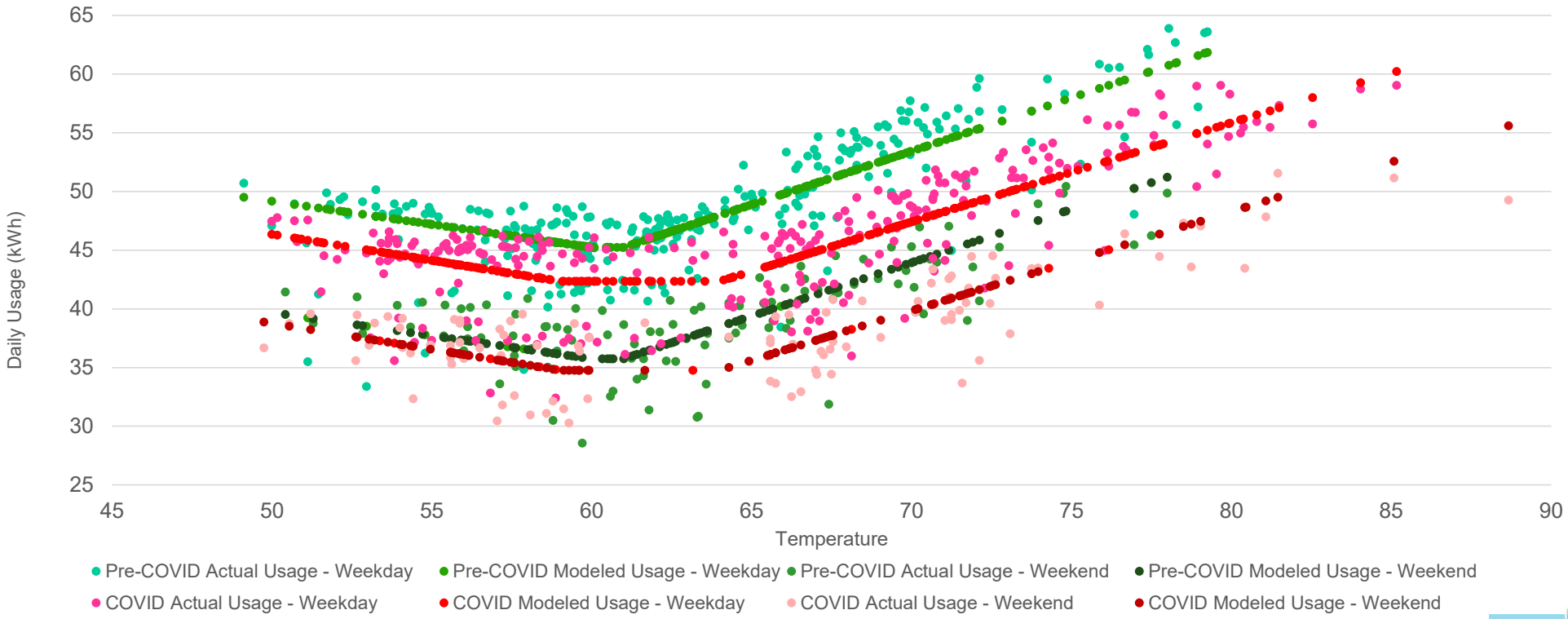
The Small Commercial Models

Variable	Period	Estimate	Standard Error	Pr > |t|
Intercept	Pre-COVID	45.23	0.247	< 0.0001
	COVID	42.34	0.277	< 0.0001
HDD	Pre-COVID Base 60 Degrees	0.39	0.069	< 0.0001
	COVID Base 59 Degrees	0.44	0.081	< 0.0001
CDD	Pre-COVID Base 61 Degrees	0.91	0.034	< 0.0001
	COVID Base 64 Degrees	0.84	0.034	< 0.0001
Holiday/Weekend	Pre-COVID	-9.49	0.305	< 0.0001
	COVID	-7.58	0.337	< 0.0001

Small Commercial Scatterplots

Pre-COVID: Usage = 45.23 + 0.39*HDD + 0.91*CDD – 9.49*(Holiday/Weekend) [F:582.71 R-Squared:0.83]

COVID: Usage = 42.34 + 0.44*HDD + 0.84*CDD – 7.58*(Holiday/Weekend) [F:390.47 R-Squared:0.76]



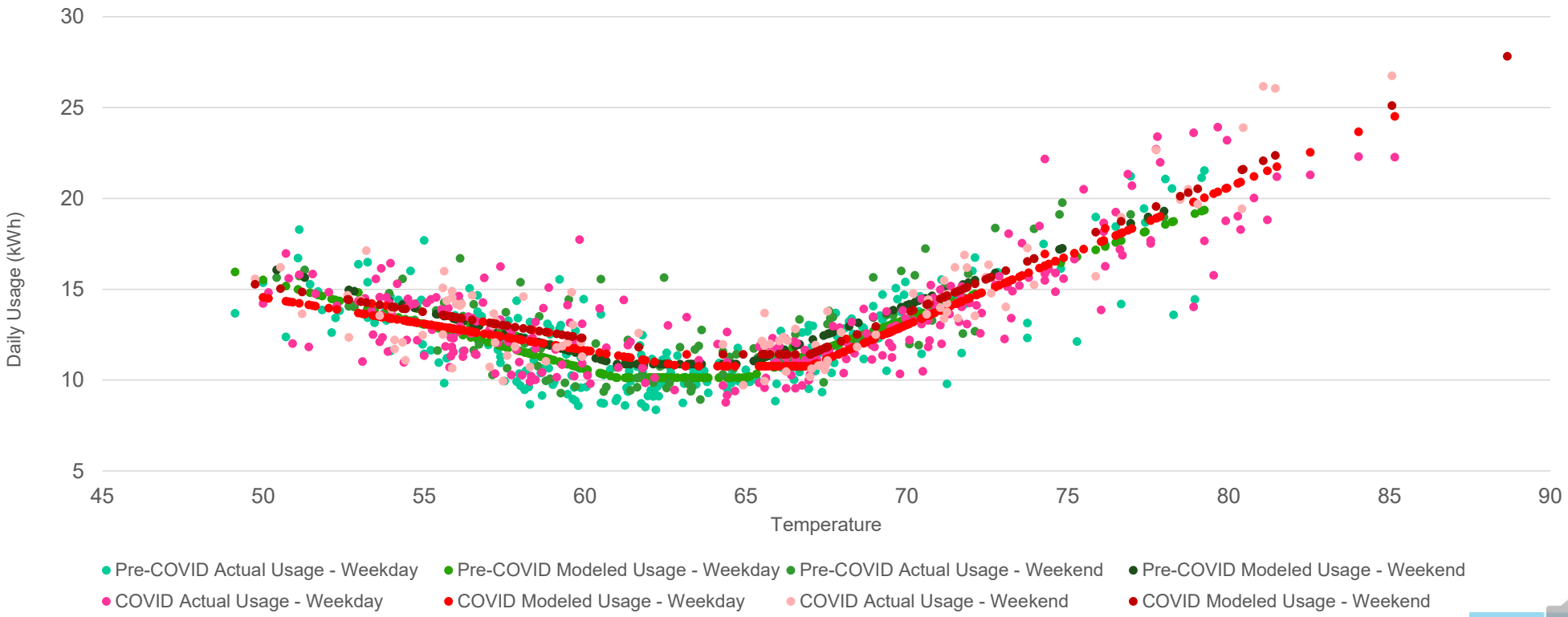
The Residential Models

Variable	Period	Estimate	Standard Error	Pr > |t|
Intercept	Pre-COVID	10.12	0.123	< 0.0001
	COVID	10.77	0.145	< 0.0001
HDD	Pre-COVID Base 61 Degrees	0.49	0.031	< 0.0001
	COVID Base 63 Degrees	0.29	0.024	< 0.0001
CDD	Pre-COVID Base 65 Degrees	0.65	0.026	< 0.0001
	COVID Base 67 Degrees	0.76	0.022	< 0.0001
Holiday/Weekend	Pre-COVID	0.76	0.168	< 0.0001
	COVID	0.65	0.176	0.0003

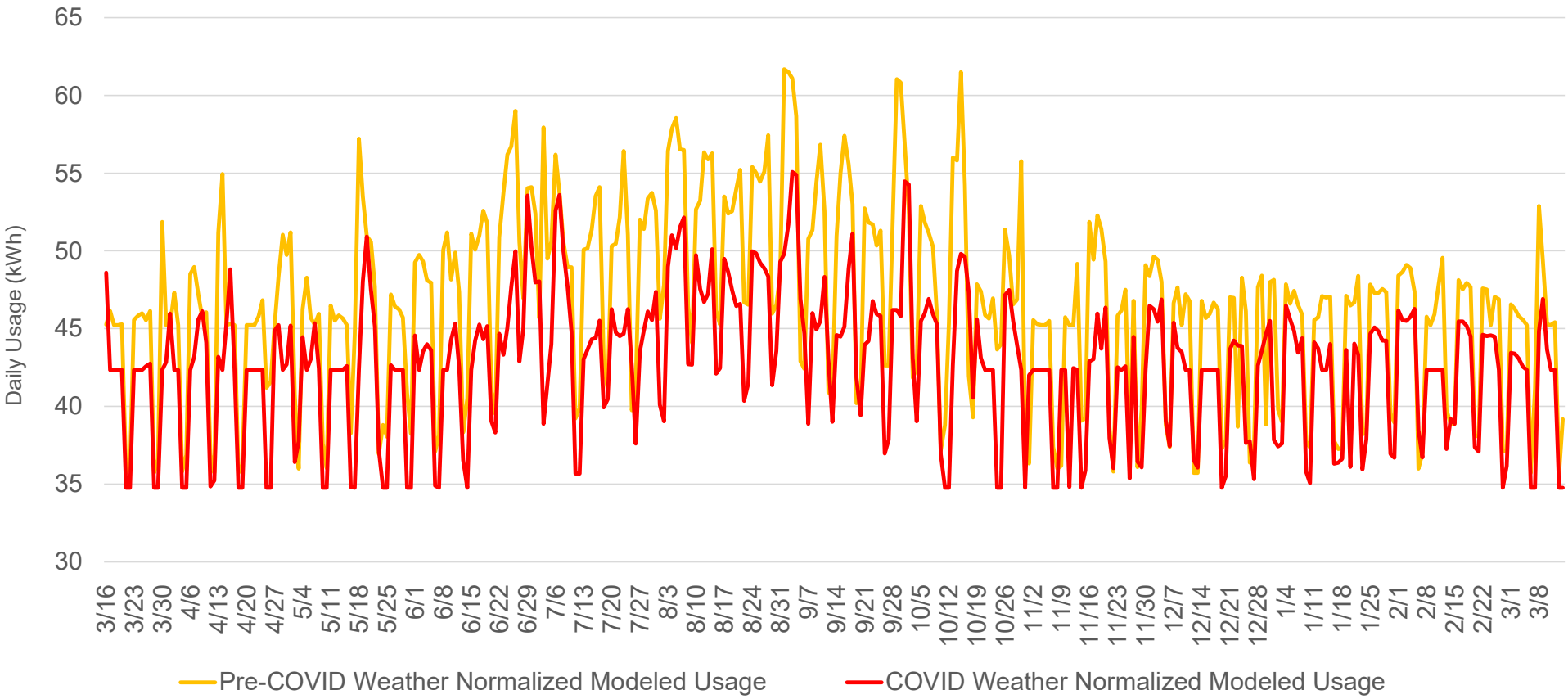
Residential Scatterplots

Pre-COVID: Usage = 10.12 + 0.49*HDD + 0.65*CDD – 0.76*(Holiday/Weekend) [F:239.47 R-Squared:0.665]

COVID: Usage = 10.77 + 0.29*HDD + 0.76*CDD – 0.65*(Holiday/Weekend) [F:399.51 R-Squared:0.769]



Small Commercial comparison of normalized daily usage before and during COVID



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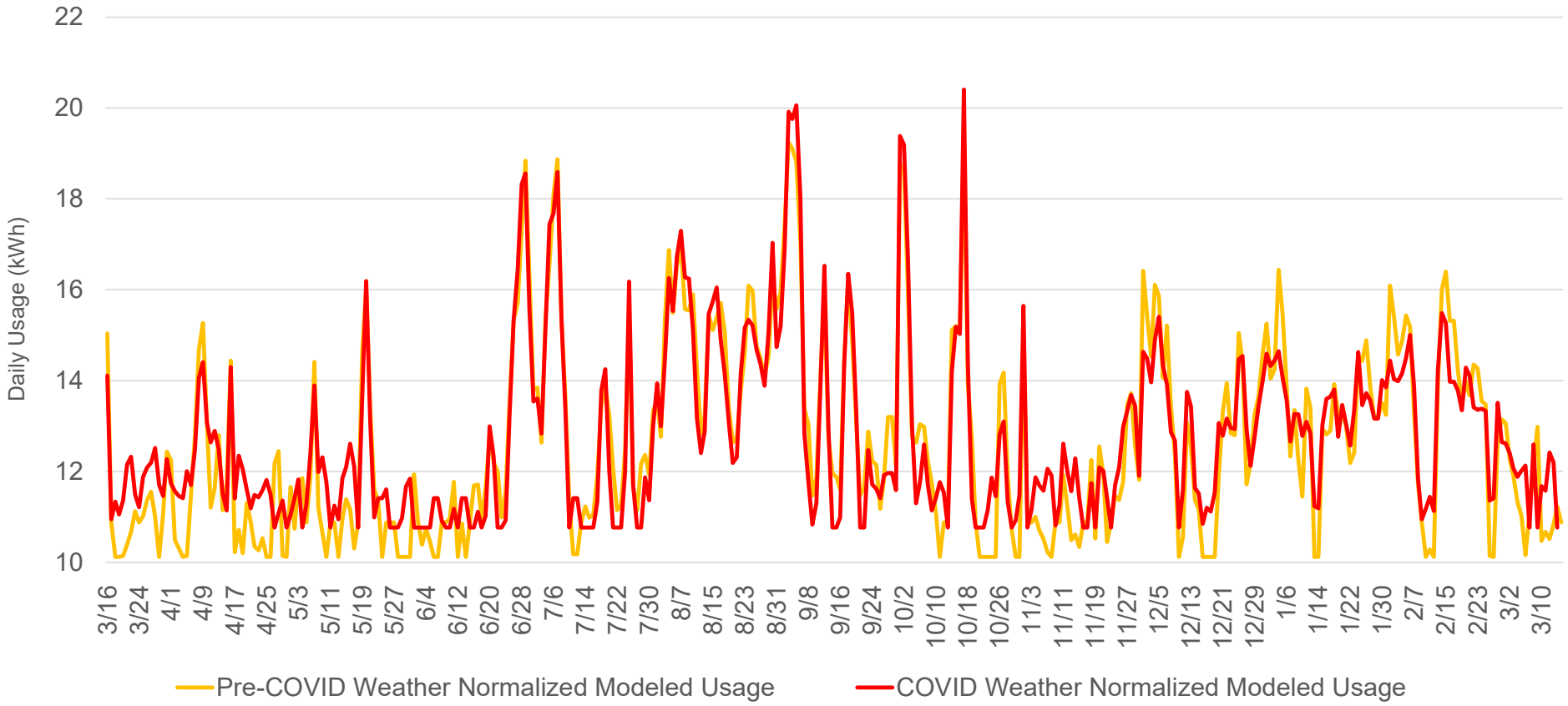
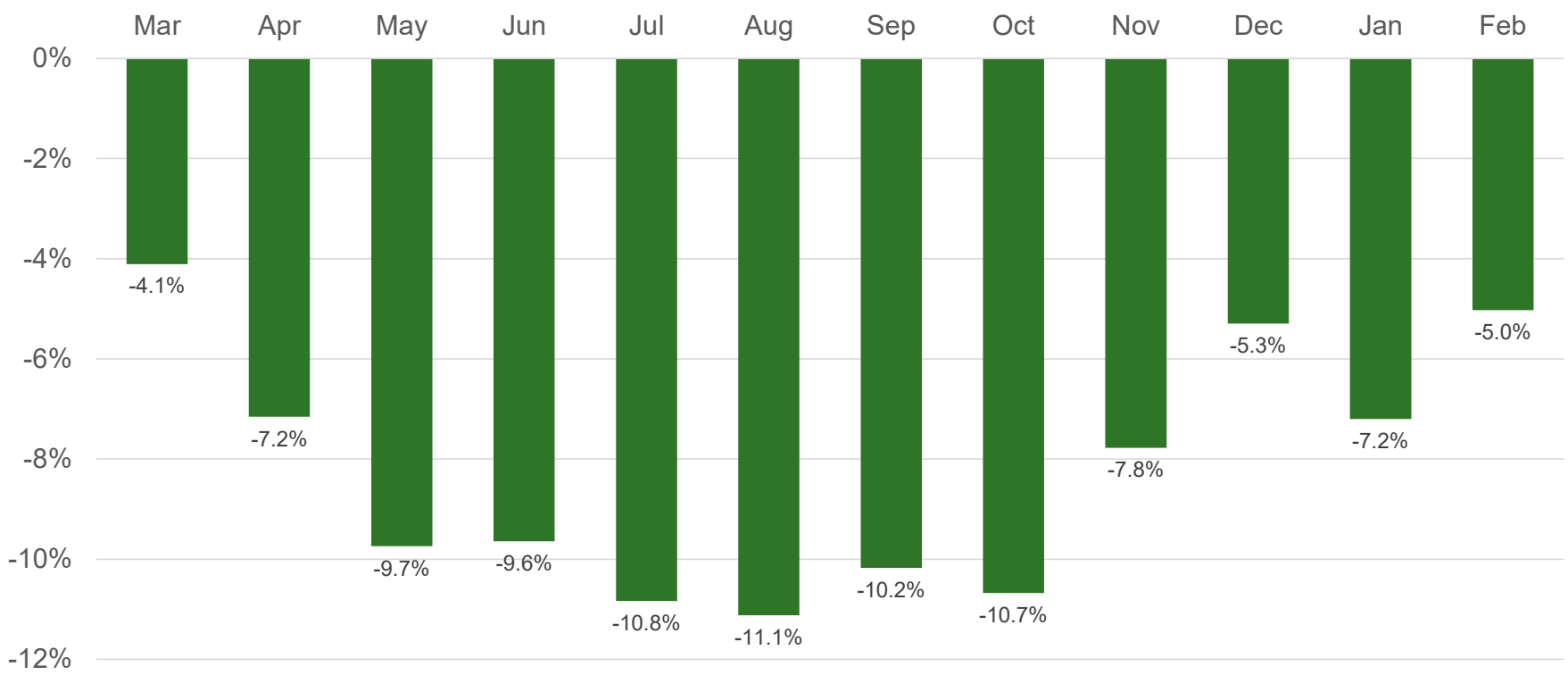
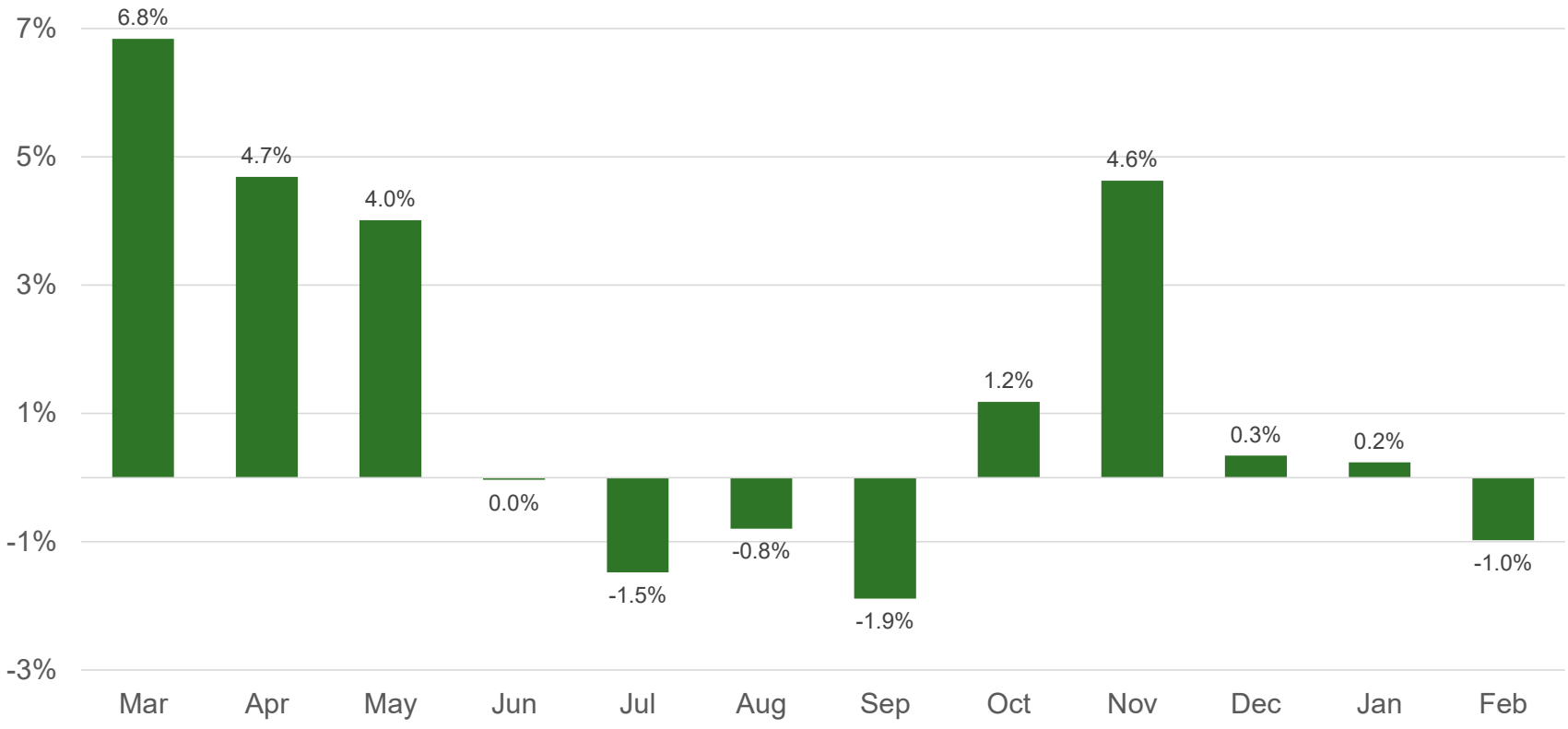


Small Commercial Weather Normalized Usage Change



Residential Weather Normalized Usage Change



Findings and Next Steps

- COVID impacts vary substantially from month to month
- COVID significantly reduced usage in the small commercial rate classes
- COVID slightly reduced usage in the residential rate classes
  - Largest impact was during the first several months of the shelter in place order
- SDG&E high penetration of solar had effects that were not considered in this analysis.
  - Dynamic load profiling reflects net usage
- We will test this approach on other rate classes

Questions?

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Appendix

Small Commercial

NO_COVID coolref=61 heatref=60 Weather Station: 722903

heatref=60 coolref=61

The REG Procedure
Model: model1
Dependent Variable: usage

Number of Observations Read	366
Number of Observations Used	366

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	12860	4286.50308	582.71	<.0001
Error	362	2662.91296	7.35611		
Corrected Total	365	15522			

Root MSE	2.71222	R-Square	0.8284
Dependent Mean	46.06123	Adj R-Sq	0.8270
Coeff Var	5.88828		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	45.23004	0.24655	183.45	<.0001
hdd	1	0.39335	0.06882	5.72	<.0001
cdd	1	0.91009	0.03385	26.88	<.0001
holi_weekend	1	-9.49247	0.30479	-31.14	<.0001

COVID coolref=64 heatref=59 Weather Station: 722903

heatref=59 coolref=64

The REG Procedure
Model: model1
Dependent Variable: usage

Number of Observations Read	365
Number of Observations Used	365

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	10461	3487.13716	390.47	<.0001
Error	361	3223.97355	8.93067		
Corrected Total	364	13685			

Root MSE	2.98842	R-Square	0.7644
Dependent Mean	43.95462	Adj R-Sq	0.7625
Coeff Var	6.79888		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	42.34246	0.27748	152.60	<.0001
hdd	1	0.44422	0.08094	5.49	<.0001
cdd	1	0.84405	0.03387	24.92	<.0001
holi_weekend	1	-7.57667	0.33679	-22.50	<.0001

Appendix

Residential

NO_COVID coolref=65 heatref=61 Weather Station: 722903

heatref=61 coolref=65

The REG Procedure
Model: model1
Dependent Variable: usage

Number of Observations Read	366
Number of Observations Used	366

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	1602.29227	534.09742	239.47	<.0001
Error	362	807.36347	2.23029		
Corrected Total	365	2409.65574			

Root MSE	1.49341	R-Square	0.6649
Dependent Mean	12.31092	Adj R-Sq	0.6622
Coeff Var	12.13081		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	10.12344	0.12280	82.44	<.0001
hdd	1	0.49014	0.03145	15.59	<.0001
cdd	1	0.64750	0.02553	25.36	<.0001
holi_weekend	1	0.75773	0.16783	4.51	<.0001

COVID coolref=67 heatref=63 Weather Station: 722903

heatref=63 coolref=67

The REG Procedure
Model: model1
Dependent Variable: usage

Number of Observations Read	365
Number of Observations Used	365

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	3	2926.62098	975.54033	399.51	<.0001
Error	361	881.49751	2.44182		
Corrected Total	364	3808.11849			

Root MSE	1.56263	R-Square	0.7685
Dependent Mean	13.72748	Adj R-Sq	0.7666
Coeff Var	11.38325		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	t Value	Pr > |t|
Intercept	1	10.76659	0.14491	74.30	<.0001
hdd	1	0.29081	0.02441	11.91	<.0001
cdd	1	0.75710	0.02220	34.11	<.0001
holi_weekend	1	0.64842	0.17619	3.68	0.0003