

California Energy Demand 2019 Revised Forecast, 2020-2030

DAWG: Weather Normalized Peaks



Cary.Garcia@energy.ca.gov

11/21/2019

California Energy Commission



CED 2019 Weather Normalized Peaks

- TAC Annual Peak
 - Estimated using regression models defined during CEDU 2018
 - HLM annual peak scaled to WN values for each TAC
 - Compared model fit as well error during peak events



CED 2019 Weather Normalized Peaks

- TAC Annual Peak
 - Linear regression estimated using last 3 years of load data
 - Simulate through 30 years of summer days (Jun.-Sept.)
 - Median of 30 annual peaks = 1-in-2 normalized peak

- Basic Equation for TACs:

$$\text{Daily MW} = \text{Max} + \text{Max } t-1 + \text{Max } t-2 + \text{Min} + \text{DOW} + \text{monthly dummies} + \text{yearly dummies}$$



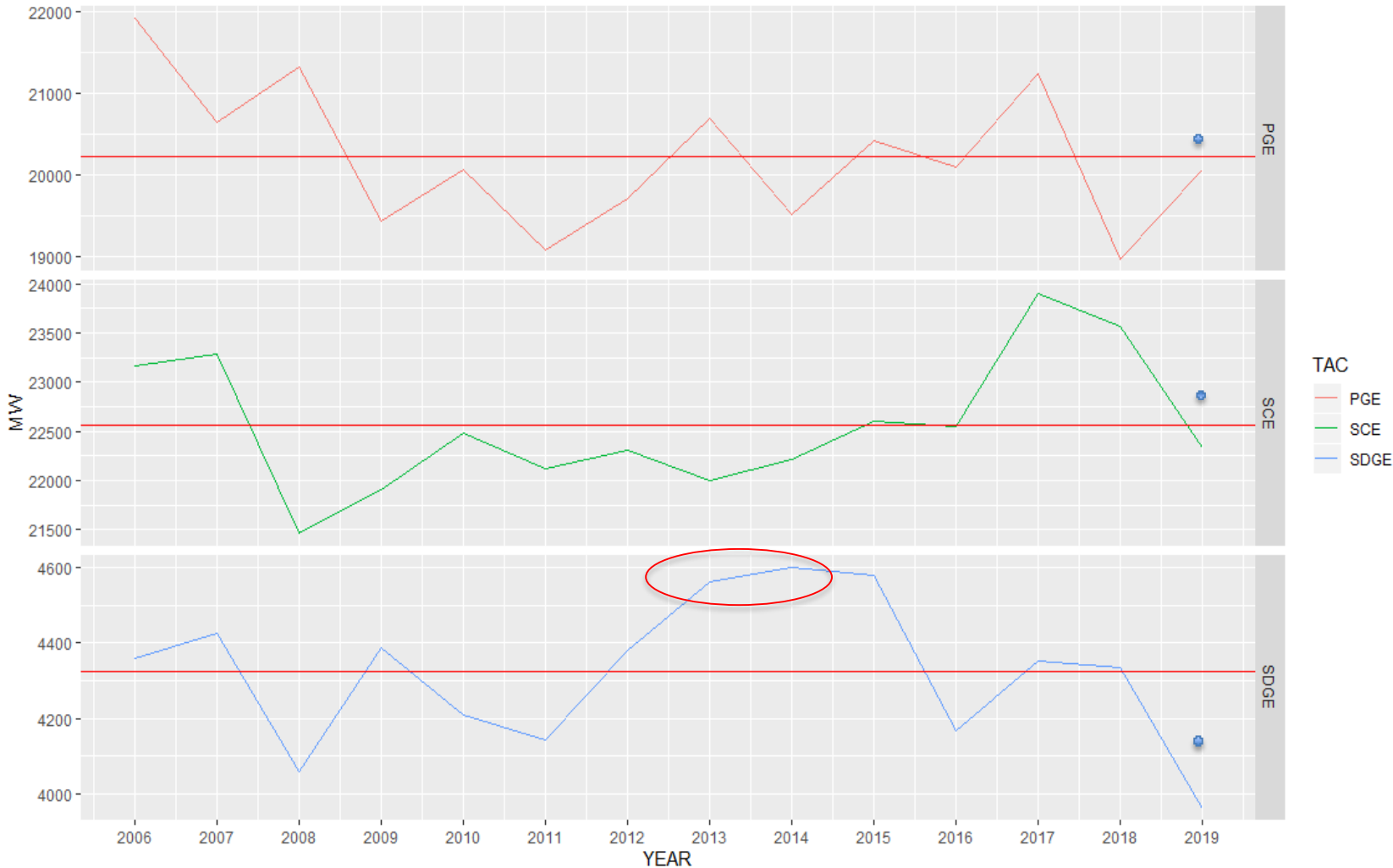
Annual Normalized Peaks

Weather Variant	Forecast	PG&E	SCE	SDG&E
1-in-2	CED 2019 Revised	20,468	22,708	4,126
	CEDU 2018	20,600	23,183	4,160
		-0.6% / -132 MW	-2% / -475 MW	-0.8% / -34 MW



Comparing Historic Peaks

Average of Top 5 Annual Peaks by TAC



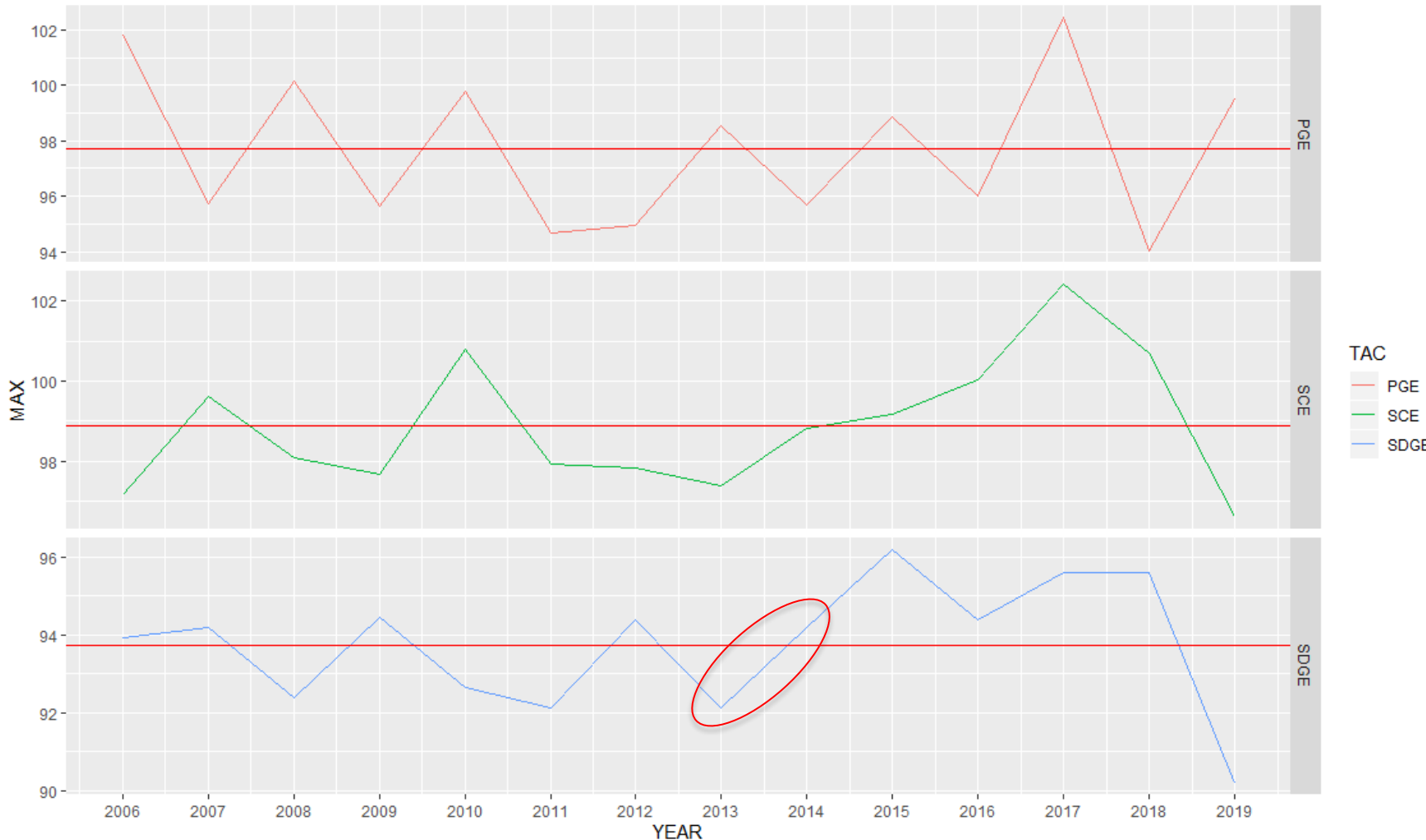
Red line = Average

- SDG&E initially appears lower than “normal”
- But 2013-2014 peaks do not appear to be weather related



Historic Max Temps

Average MAX Temp for Top 5 Annual Peaks by TAC



- 2013- 2014 temps appear closer to “normal”
- Income growth from 2011 – 2014 was 3.5% CAGR
- Slowed to 2%, 2015 to 2018



Monthly Peaks

- Compared monthly historical peak demand to HLM monthly peaks
- Also compared monthly peak demand model simulated peak demand
 - Temperature and load modeling and weather simulation for each month May-September



Appendix: CED 2019 Normalized Peaks

Weather Variant	PG&E	SCE	SDG&E
1-in-2	20,468	22,708	4,126
1-in-5	20,952	23,734	4,399
1-in-10	21,223	23,864	4,453
1-in-20	21,758	24,802	4,472



Appendix: Annual Model Fit

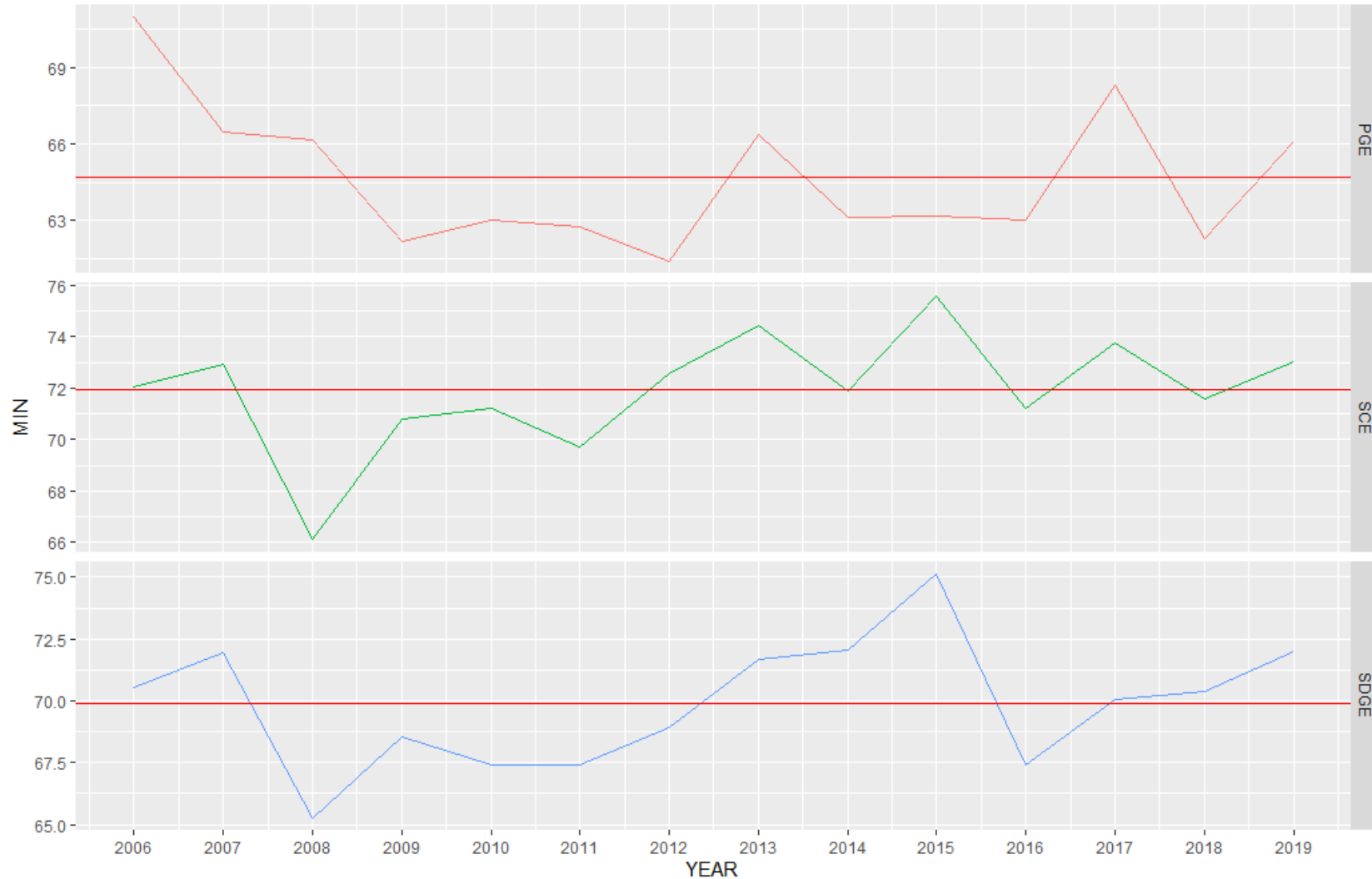
TAC	R-squared	MAPE	RMSE	Top 5 – MAPE *	Top 5 – RMSE *
PG&E	0.95	0.02	443	0.01	280
SCE	0.95	0.03	642	0.04	924
SDG&E	0.92	0.03	129	0.03	160

* Top 5 error is calculated based upon the predicted values from each TAC area model for the top 5 annual peak values for each of the years (2017-2019) used to estimate the model coefficients.



Appendix: Historic Min Temps

Average MIN Temp for Top 5 Annual Peaks by TAC



- Red line = average(min)

TAC
— PGE
— SCE
— SDGE



Appendix: Monthly Model Fit

TAC Monthly Peaks

- Derived from HLM results
- Compared historic and model simulated data to HLM monthly peaks
- Weather simulation similar to annual model but individual models run for each month (May-Sept) by TAC area



Appendix: Monthly Model Fit

PGE						
Data	Load: 2015-2019 May-September Daily Peaks Weather: MAX631, Average temperature <ul style="list-style-type: none"> • Include only days that average temperature > 65 • Exclude weekends and holidays 					
Variables	MAX631, MAX631_Sq, AVG, Dummies(Y2015, Y2016, Y2017, Y2018, Y2019)					
Fitness	Month	Root_MSE	Dependent_Mean	Coeff_Var	R_Square	Adj_R_Sq
	5	342.2681	14630.6948	2.3394	0.9557	0.9394
	6	425.1981	16349.9330	2.6006	0.9567	0.9532
	7	336.9571	17359.5722	1.9410	0.9526	0.9491
	8	355.7436	17056.4639	2.0857	0.9457	0.9420
	9	395.4532	15969.6220	2.4763	0.9579	0.9539

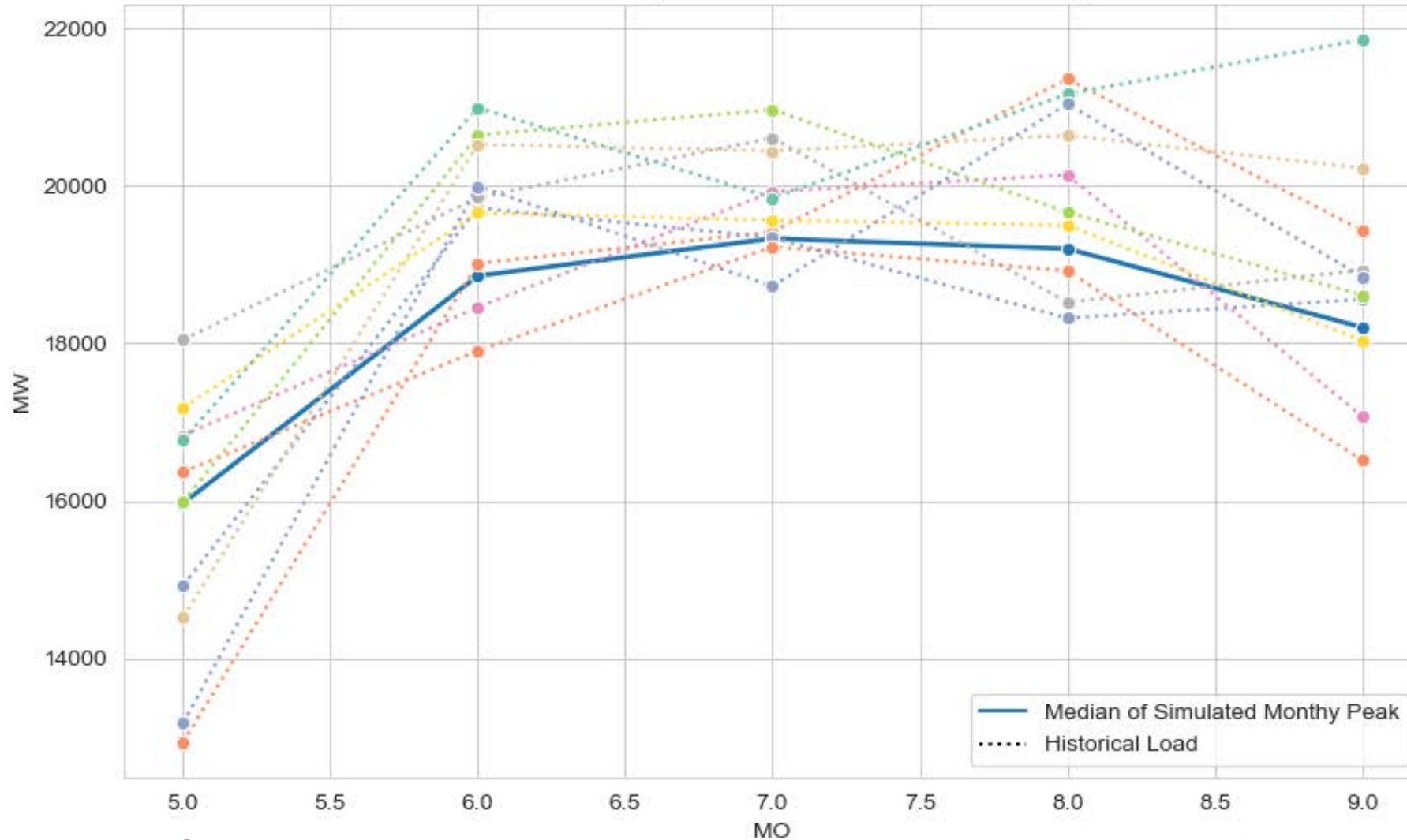
SCE						
Data	Load: 2015-2019 May-September Daily Peaks Weather: MAX631, Average temperature <ul style="list-style-type: none"> • Include only days that average temperature > 65 					
Variables	MAX631, MAX631_Sq, AVG, Workday (1 for True, 0 for False) Dummies (Y2015, Y2016, Y2017, Y2018, Y2019)					
Fitness	Month	Root_MSE	Dependent_Mean	Coeff_Var	R_Square	Adj_R_Sq
	5	478.6661	13712.0522	3.4908	0.8705	0.8425
	6	607.3241	15641.9344	3.8827	0.9413	0.9377
	7	595.6632	18287.9649	3.2571	0.9463	0.9434
	8	468.9131	18967.5575	2.4722	0.9527	0.9501
	9	701.8199	17028.7156	4.1214	0.9271	0.9229



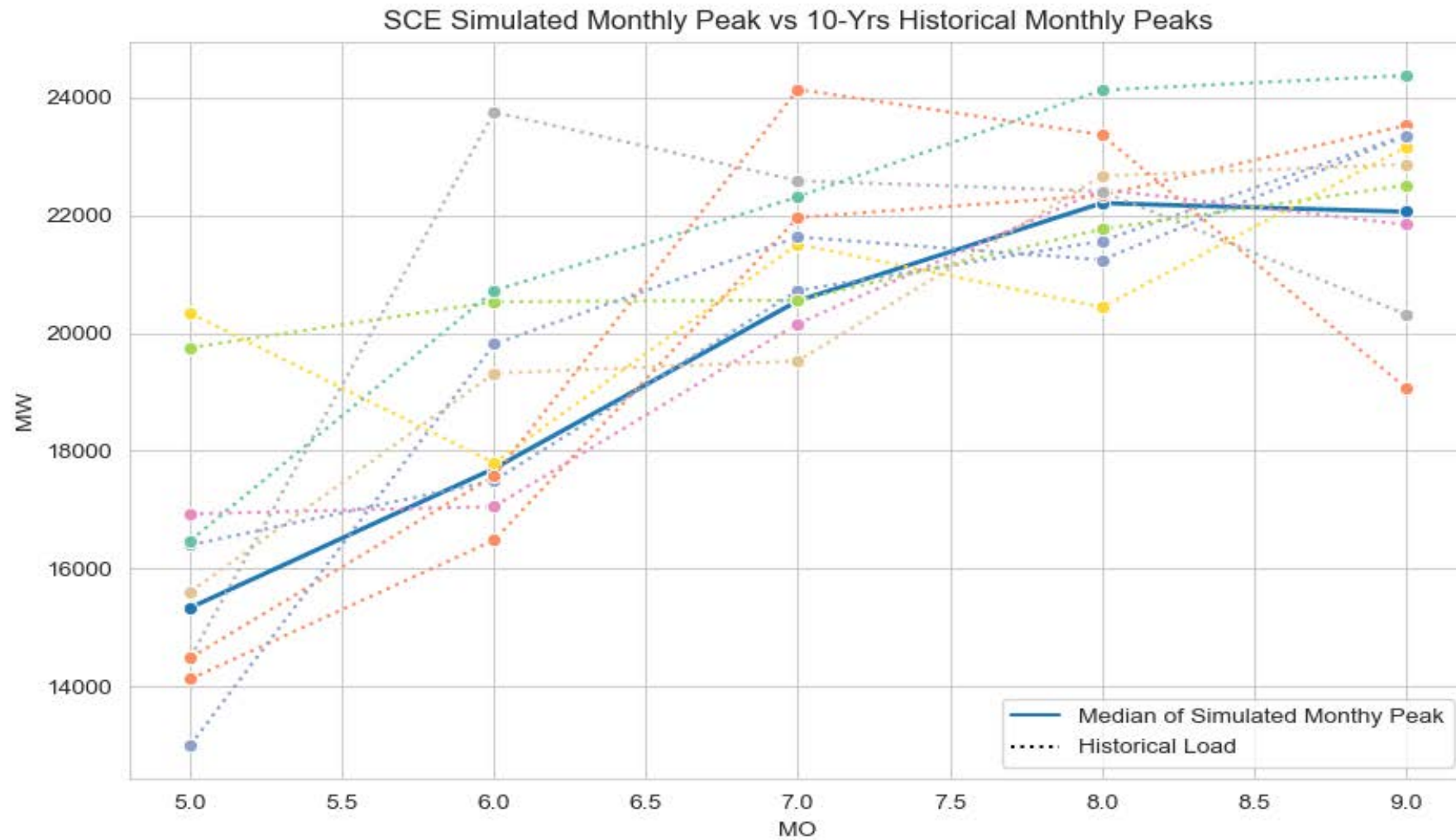
Appendix: Monthly Model Fit

SDGE						
Data	Load: 2015-2019 May-September Daily Peaks Weather: MAX631, Average temperature <ul style="list-style-type: none"> • Include only days that average temperature > 65 					
Variables	MAX631, MAX631_Sq, AVG, Workday (1 for True, 0 for False) Dummies (Y2015, Y2016, Y2017, Y2018, Y2019)					
Fitness	Month	Root_MSE	Dependent_Mean	Coeff_Var	R_Square	Adj_R_Sq
	5	49.2433	2662.4697	1.8495	0.8741	0.8369
	6	91.5772	2811.9779	3.2567	0.9097	0.9040
	7	111.0237	3215.3001	3.4530	0.9340	0.9304
	8	90.1495	3416.9237	2.6383	0.9600	0.9578
	9	124.6789	3252.5580	3.8333	0.9333	0.9295

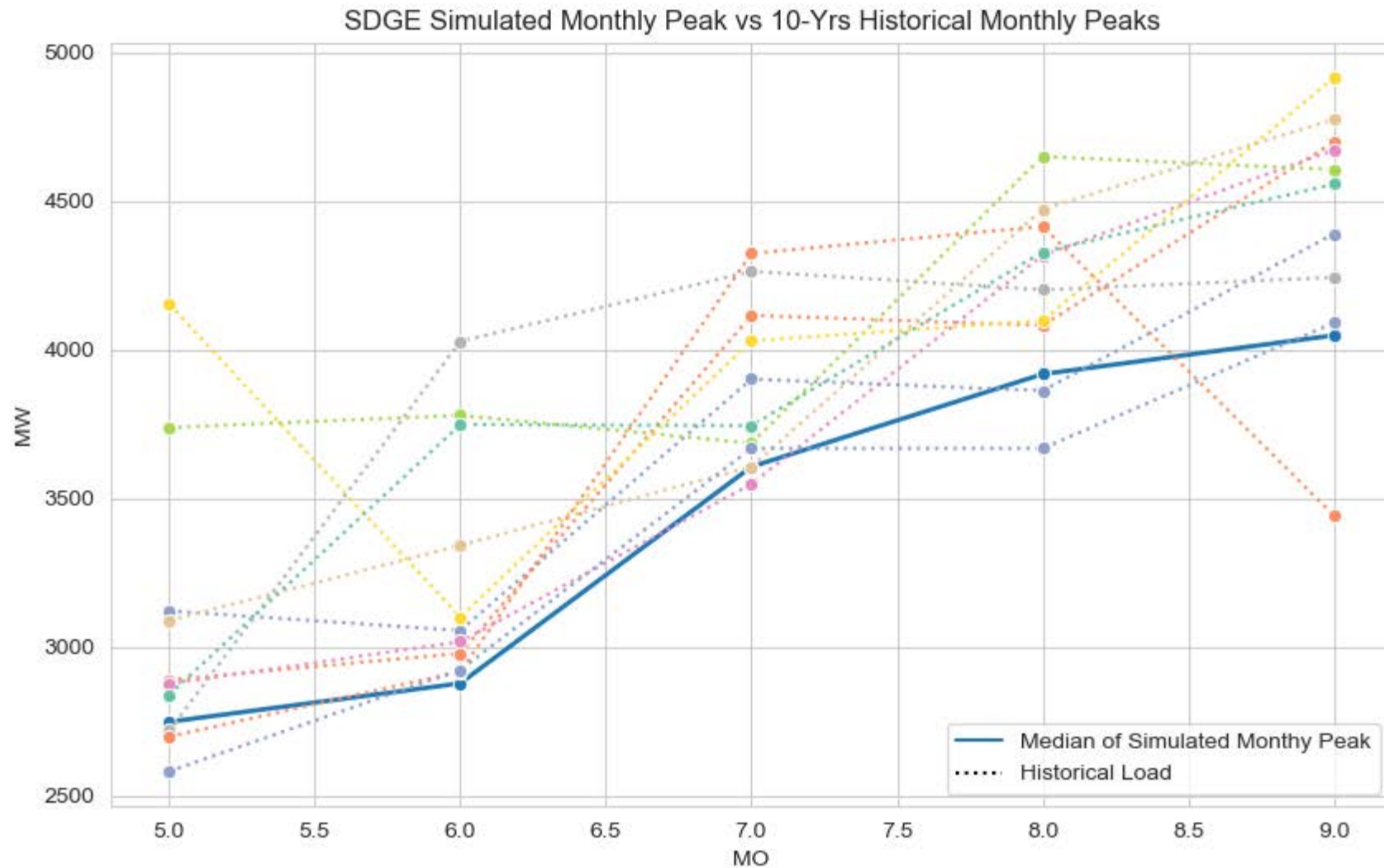
PGE Simulated Monthly Peak vs 10-Yrs Historical Monthly Peaks



- Compares simulated monthly model results to 10-years of historical monthly peak demand
- For comparison only not used in HLM



- Compares simulated monthly model results to 10-years of historical monthly peak demand
- For comparison only not used in HLM



- Compares simulated monthly model results to 10-years of historical monthly peak demand
- For comparison only not used in HLM