DOCKETED	
Docket Number:	18-IEPR-04
Project Title:	Energy Demand Forecast Update
TN #:	226021
Document Title:	Hourly Load Model Results
Description:	Presentation by Chris Kavalec
Filer:	Raquel Kravitz
Organization:	California Energy Commission
Submitter Role:	Commission Staff
Submission Date:	12/5/2018 3:31:04 PM
Docketed Date:	12/5/2018

Hourly Load Model Results

IEPR Workshop

December 6, 2018

Chris Kavalec
Energy Assessments Division
Chris.Kavalec@energy.ca.gov / 916-654-5184

Purpose of Hourly Forecasts

- Annual peak forecast requires hourly analysis to measure peak shift coming from demand modifiers (PV, EV, AAEE, TOU)
- Staff also proposes to use hourly analysis for RA TAC monthly forecasts and flexibility analysis

Hourly Load Model Estimation

Estimate ratio of hourly load to annual average load for each hour (24 regressions for each TAC) as a function of weather, day of the week, weekend/holiday, month, using hourly data by TAC for 2011-2017

$$L_{i,d} / L_y = f(g(t), dow_d, wkhol_d, month_d, constant_i)$$

i=1,24 d=1,365-6, y=1,7, g(t)=weather (temperatures, dew point and cloud cover)

Implementing Hourly Load Model

- Apply estimated ratios to annual forecast "consumption" load (load served by utilities plus PV energy minus EV load)
  - Annual load forecast accounts for economic/demographic growth and other changes
- Adjust consumption load using climate change impacts, EV charging profiles, PV generation profiles, residential TOU hourly impacts, and hourly AAEE.

Weather-Normalized Loads

- Simulate 18 years using hourly weather and calendar effects assuming 7 different calendars (18 x 7 = 126 simulations of 8760 hourly load ratios)
- Take highest hourly ratio for each simulation, rank, and select median—this becomes weather-normalized peak ratio
  - Similarly for 2nd highest hourly load, etc., through 8760 hours
- Assign ratios to actual day and hour. For CED 2017, staff used "average" years for each TAC
  - 2009 for SCE and SDG&E, 2012 for PG&E

Assignment of Ratios Created Two Issues

1. Any peculiarities of the chosen “average” weather year get carried through to forecast

   Example: SCE and SDG&E had unusually low monthly peaks in May and June, 2009, leading to relatively low SCE, SDG&E, and CAISO peaks for these months

2. Using two different years (2009 and 2012) for assignment creates misalignment for CAISO coincident peaks

New Method for Assigning Hourly Loads

1. Assign to calendar based on historical average TAC load ratio by day type (1st Tuesday in March, 2nd Thursday in June, Christmas, etc.) and hour.
   - Keeps CAISO coincidence intact
   - However, understates peaks for shoulder months

New Method for Assigning Hourly Loads

2. Add a second step:
   - Calculate average peak load ratios for each month, average second highest load ratios, etc., all the way down to average of lowest hourly load ratios.
   - Assign highest peak load ratios in a given month to the day type/hour with the highest average load ratios, 2nd highest to 2nd highest average load ratios, etc.
   - Assign simulated load ratios to calendar based on adjusted average load ratios for each calendar year.

Hourly Profiles

- Consumption
- PV generation
- Residential TOU
- AAEE profiles as in CED 2017
- Climate Change
- Other adjustments

Testing Results

- Using 2018, estimate hourly sales loads
- Compare to weather normalized annual peak for 2018 from CEDU 2018 forecast
- Compare estimated monthly peak proportions to historical averages

Weather-Normalized Annual Peaks

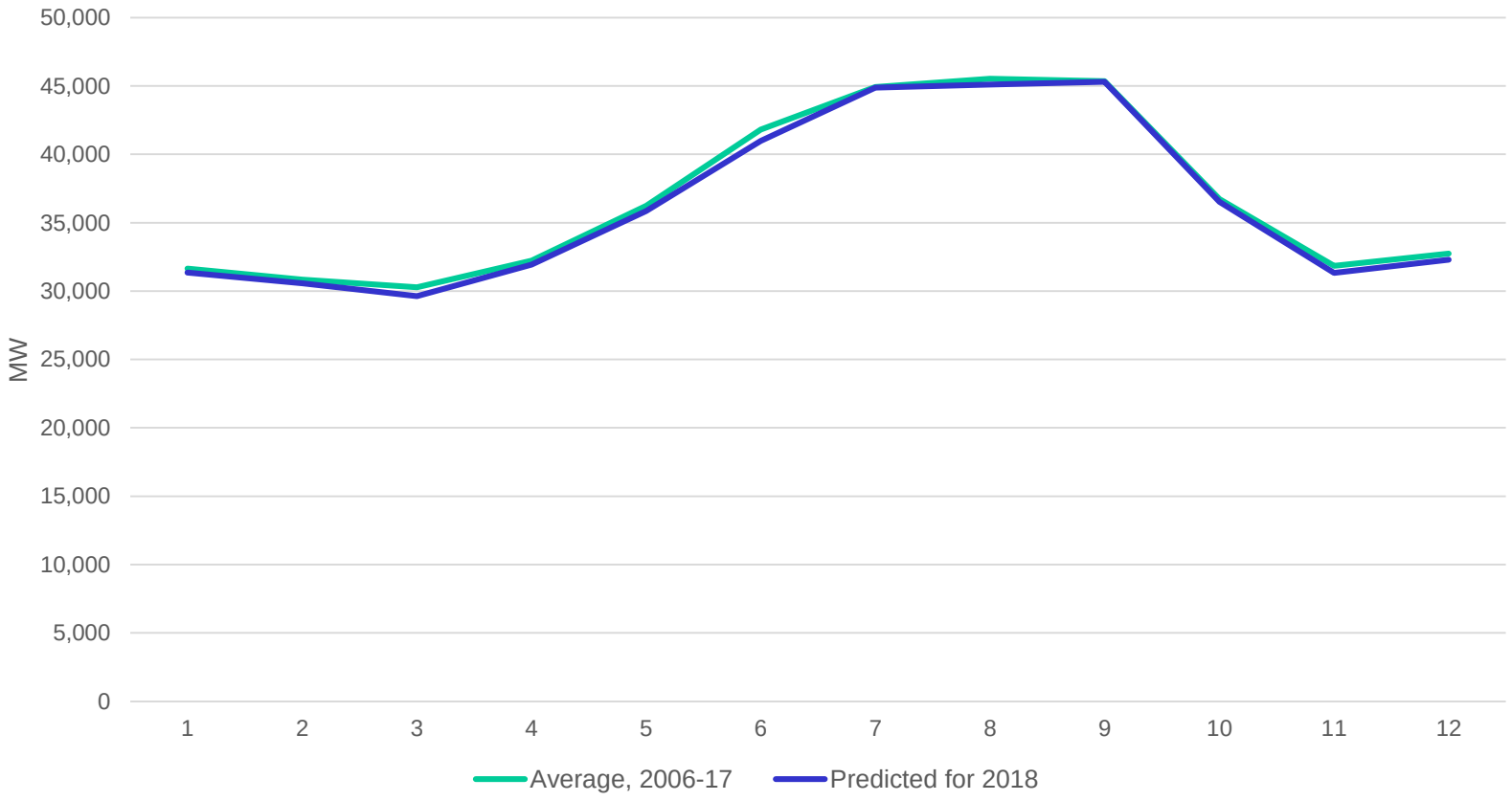
Geography	CEDU 2018 WN Peak*	HLM 2018 WN Peak*
PG&E TAC	20,600	20,340
SCE TAC	23,223	22,738
SDG&E TAC	4,173	4,498
CAISO System	46,321	45,303
Coincidence Factor	0.965	0.949

*Excludes LMDR.

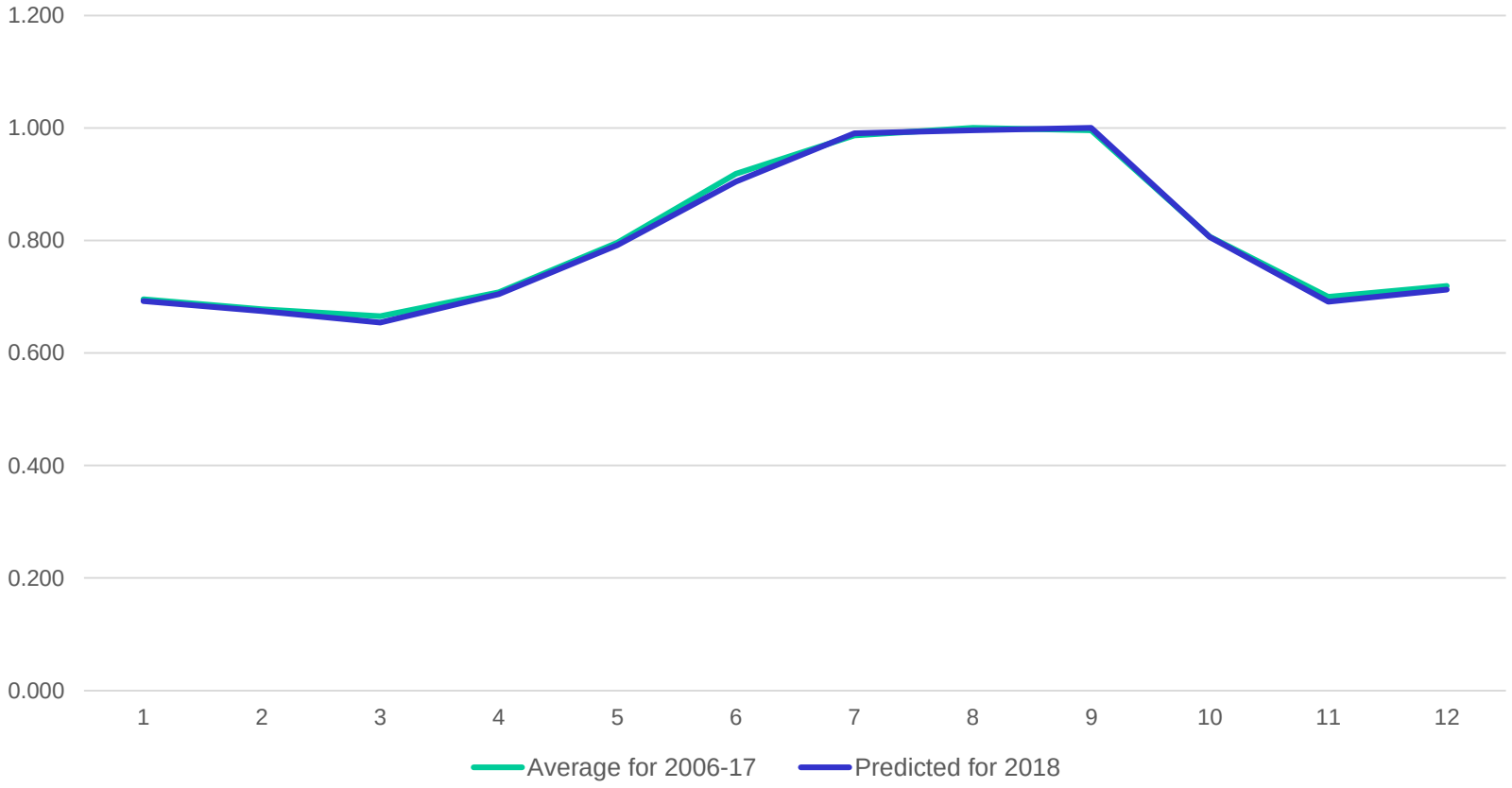
Comparing Monthly Peaks to Historical

- Common method: use the last 5 full historical years
- However, there is significant variation depending on time period chosen
- For example, using June (and EMS data):
  - Average peak 2013-17: 43,463 MW
  - Average peak 2011-17: 41,982 MW
  - Average peak 2015-17: 43,876 MW
  - Average peak 2014-18: 41,962 MW
  - Average peak 2006-17: 41,814 MW

Comparison of Monthly Peaks: CAISO History vs. HLM 2018



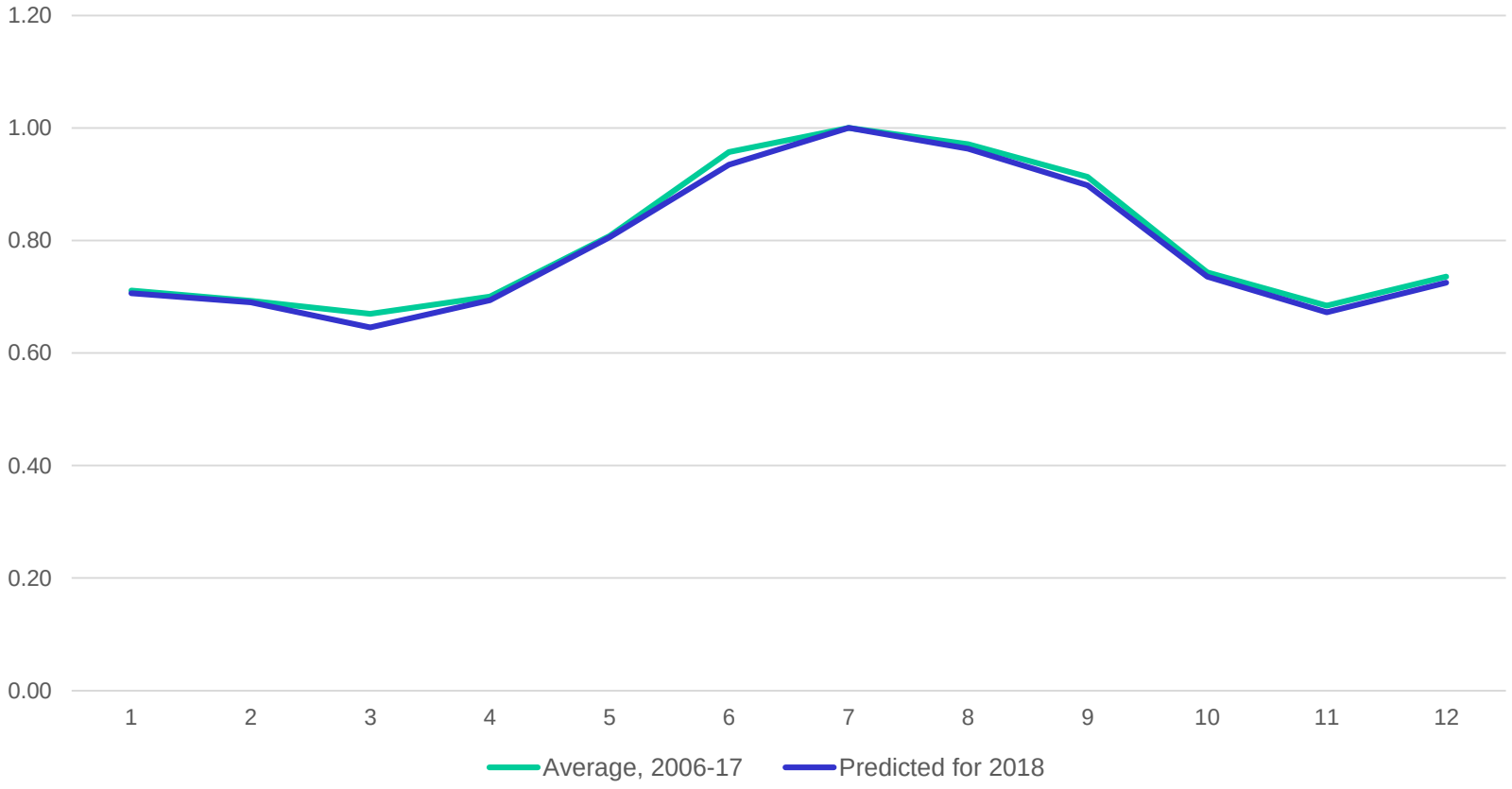
Comparison of Monthly Peak Ratios: CAISO History vs. HLM 2018



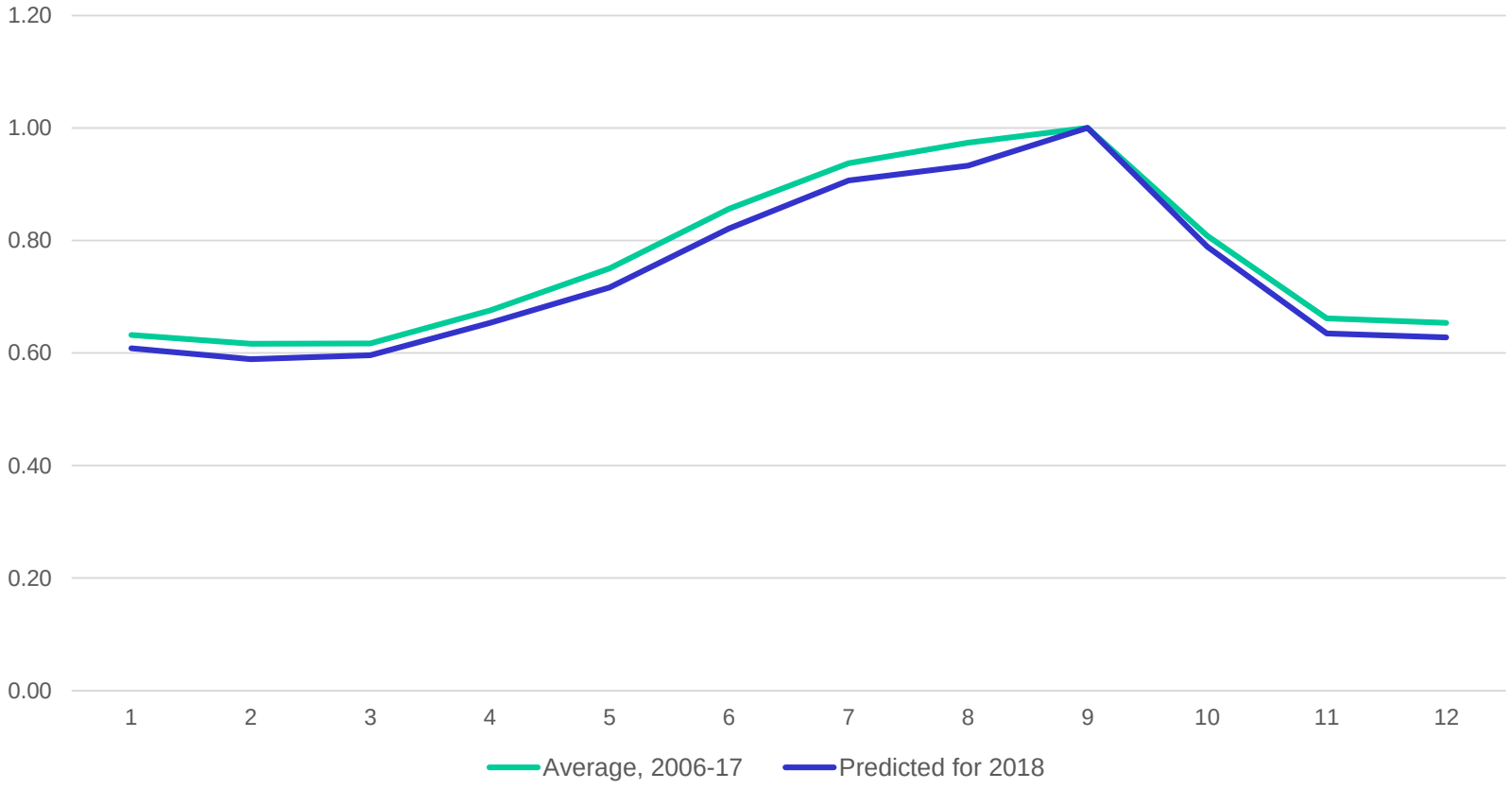
Monthly Peak Coincidence – HLM 2018

	Sum of TACs	CAISO Peak	Coincidence
January	31,426	31,353	0.998
February	30,920	30,557	0.988
March	30,190	29,635	0.982
April	32,153	31,933	0.993
May	36,124	35,862	0.993
June	41,365	40,983	0.991
July	45,031	44,866	0.996
August	46,160	45,107	0.977
September	45,972	45,303	0.985
October	37,410	36,513	0.976
November	31,629	31,320	0.990
December	32,337	32,292	0.999

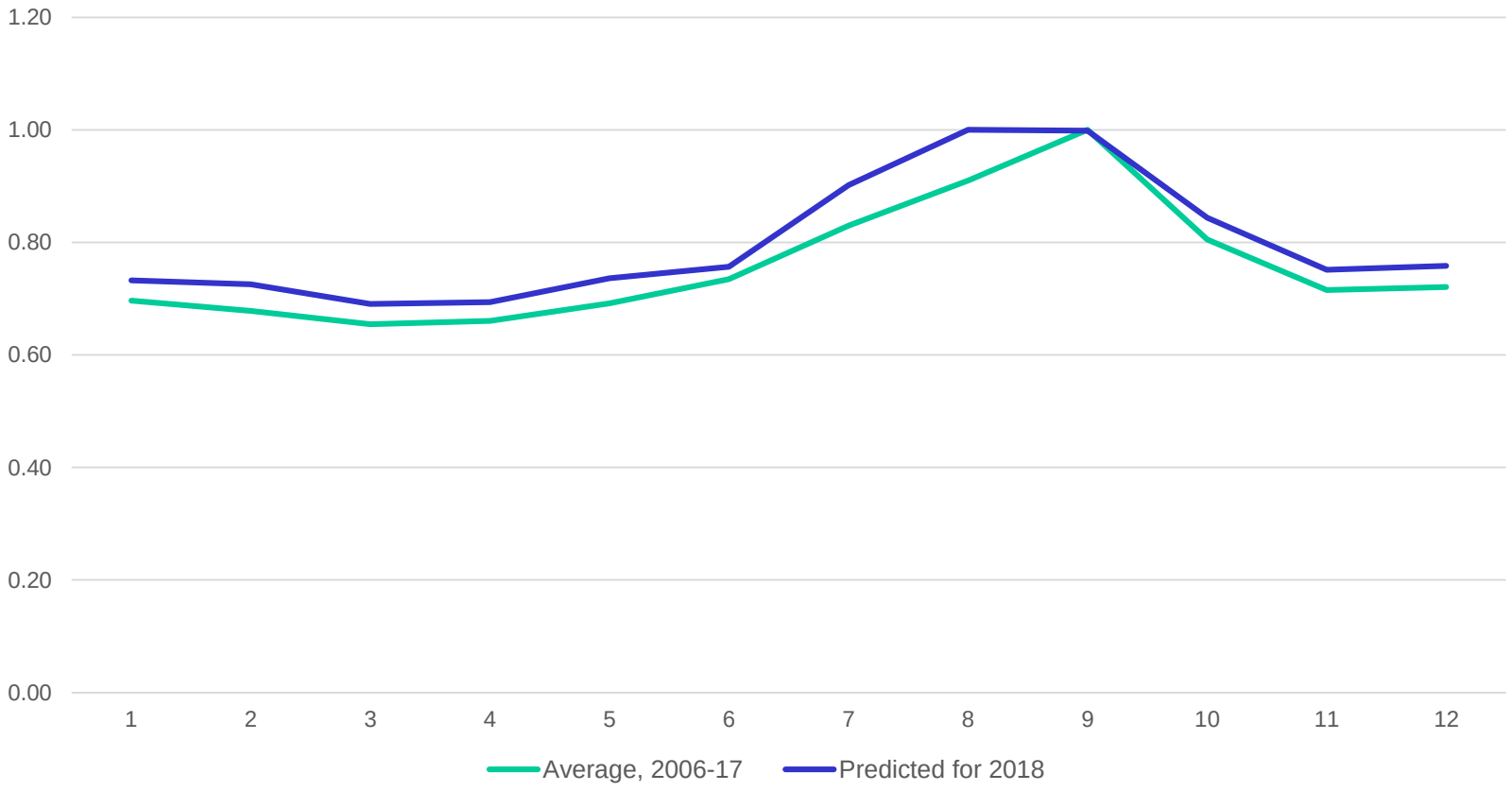
Comparison of Coincident Monthly Peak Ratios: PG&E History vs. HLM 2018



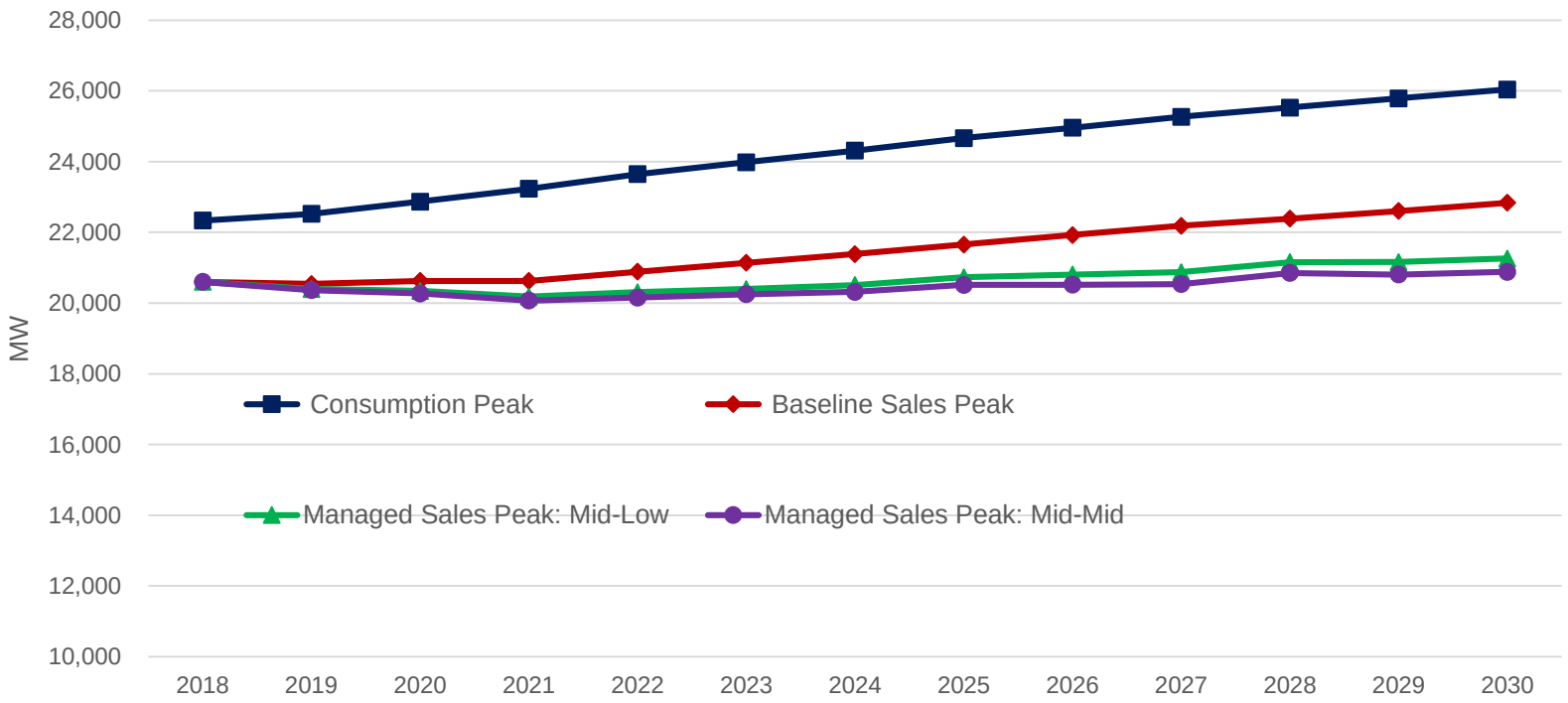
Comparison of Coincident Monthly Peak Ratios: SCE History vs. HLM 2018



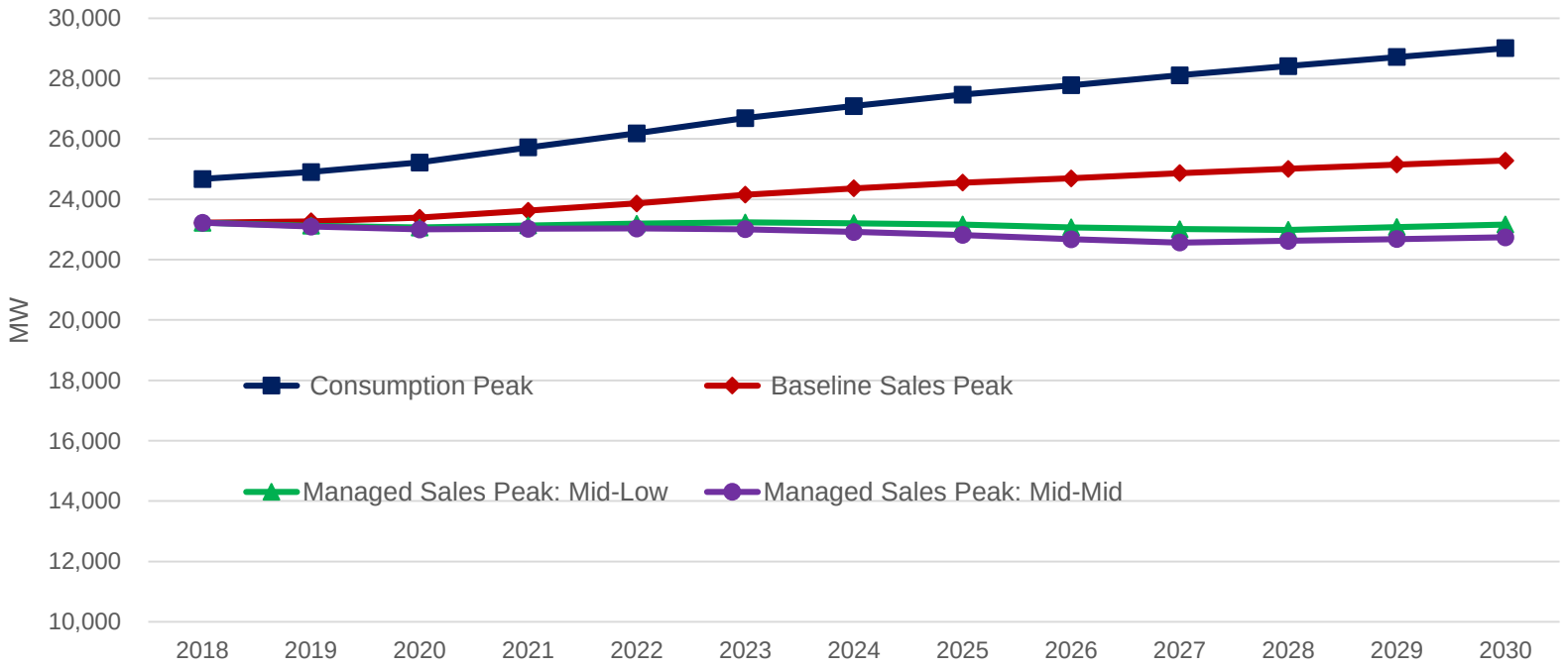
Comparison of Coincident Monthly Peak Ratios: SDG&E History vs. HLM 2018



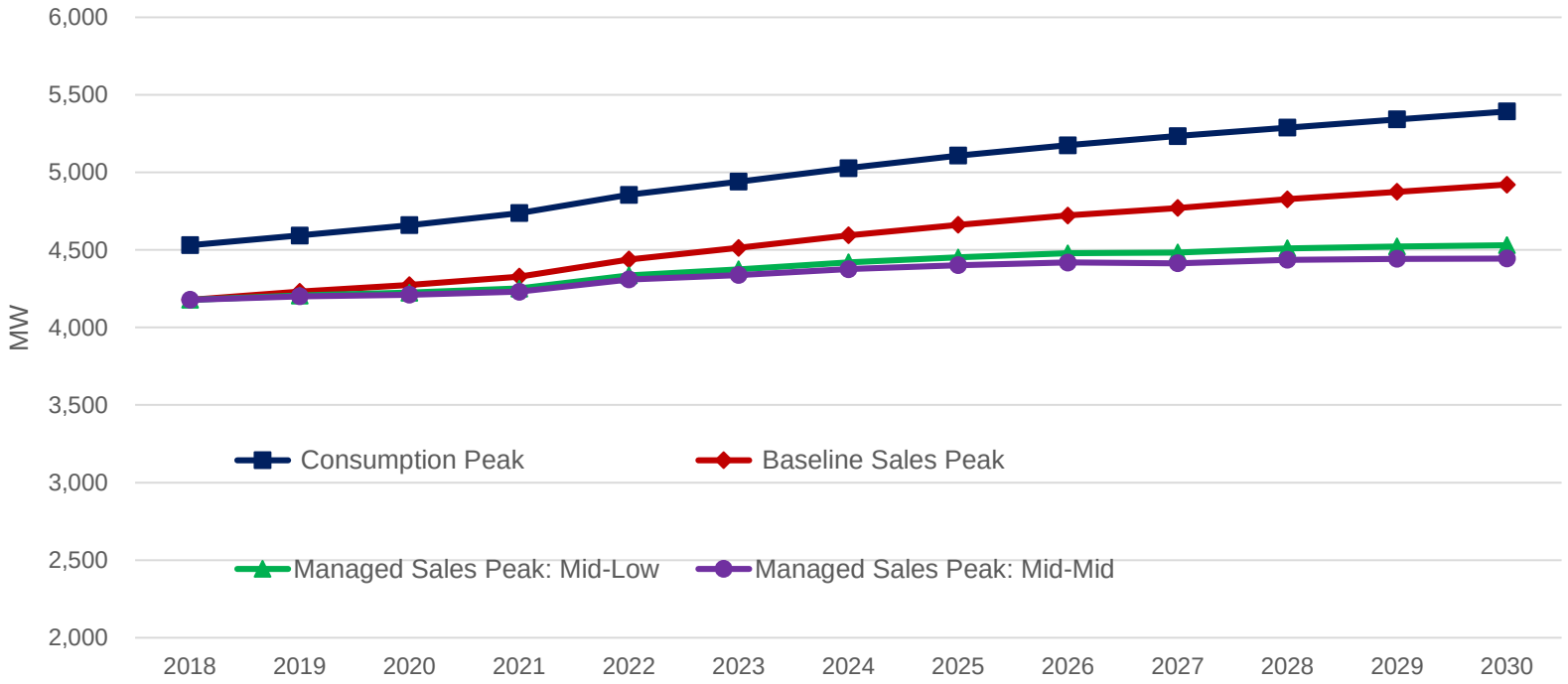
Mid Baseline and Planning Peak Forecasts: PG&E



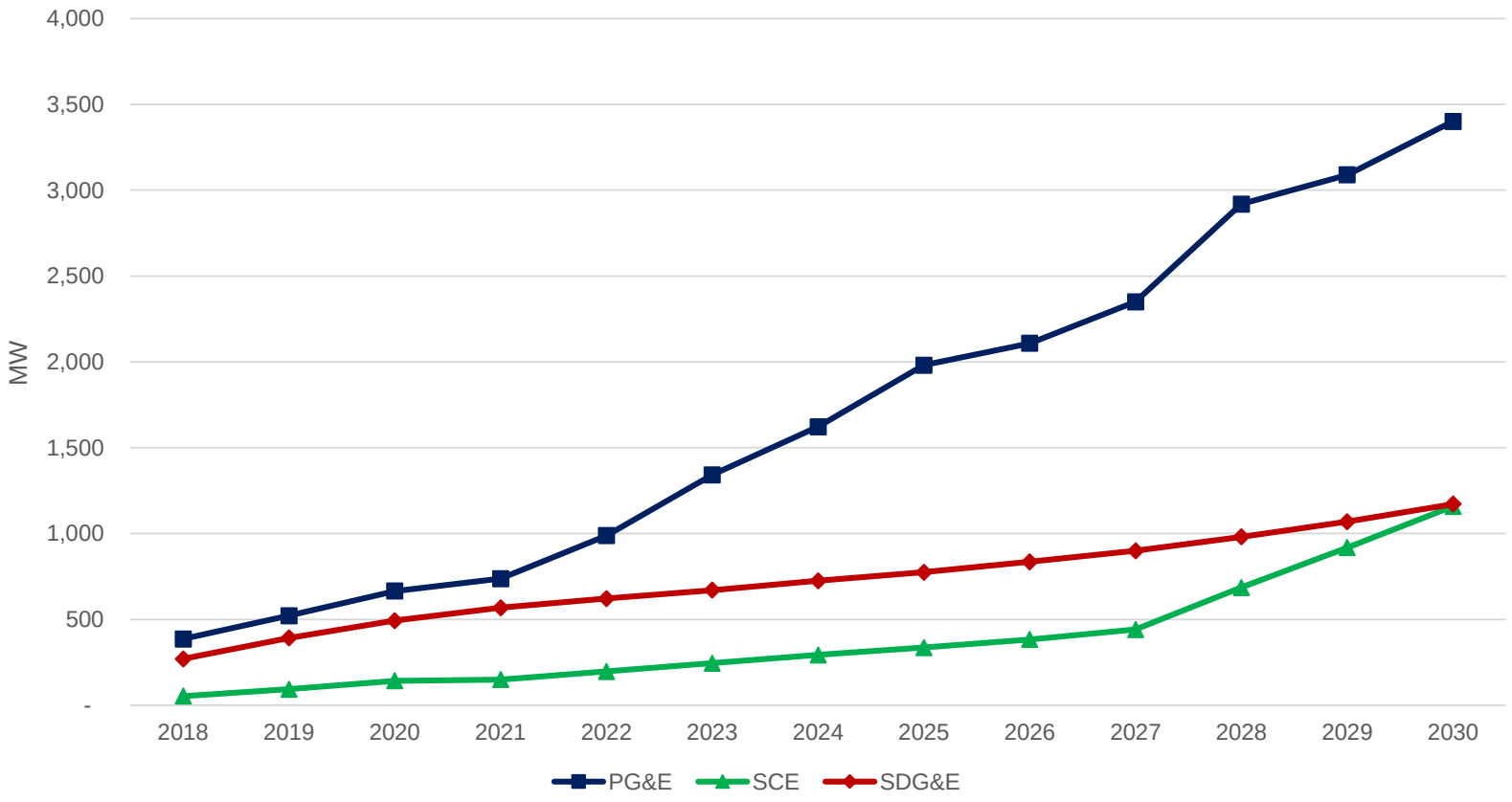
Mid Baseline and Planning Peak Forecasts: SCE



Mid Baseline and Planning Peak Forecasts: SDG&E



Peak Shift Impacts



Comparison to CED 2017 Peak Planning Forecasts: Average Annual Growth 2018-2030

IOU	CEDU 2018 Mid-Mid	CED 2017 Mid-Mid	CEDU 2018 Mid-Low	CED 2017 Mid-Low
PG&E	0.10%	0.37%	0.26%	0.54%
SCE	-0.20%	-0.44%	-0.04%	-0.27%
SDG&E	0.58%	0.26%	0.73%	0.43%

Questions/Comments?