SOUTHERN CALIFORNIA EDISON®
Energy for What's Ahead℠

SCE's Weather Normalization Analysis and Recommendations

For Presentation at CEC DAWG Workshop

March 17, 2017

Purpose and Agenda

- Purpose: To be able to better reconcile weather normalized historical annual peak data and reduce CEC's and SCE's peak demand forecast differences

- Agenda
  - Highlight of the issues
  - Historical load data reconciliation
  - Peak weather representation
  - Weather normalization methodology
  - Recent SCE annual peak weather conditions
  - Recommendations

Major Sources of Differences

- Historical load data differences
  - CAISO EMS data versus SCE system records
- Weather data and definitions
  - CEC's Max631 versus SCE's max effective temperatures
  - Weather stations and weights
- Weather Normalization methodologies
  - Simulation compared to analytical approach
- Unique annual peak weather conditions
  - Typical versus abnormal

2016 Monthly Peak Data Reconciliation

EMS data was made available to stakeholders by CAISO on March 08, 2017. The comparisons below reflect discrepancies between CAISO and SCE system recorded data in 2016.

SCE annual Peak w/o DR

Month	SCE TAC	Peak Date	Peak Hour	SCE system	Delta	MWD**	CDWR*	Pasadena*	SCESys+MWD+CDWR+Pasadena	Delta between CAISO EMS and calculated "TAC)
6	**24,030**	**6/20/2016**	**17**	**23,106**	**924**	**253**	**160**	**254**	**23,773**	**257**

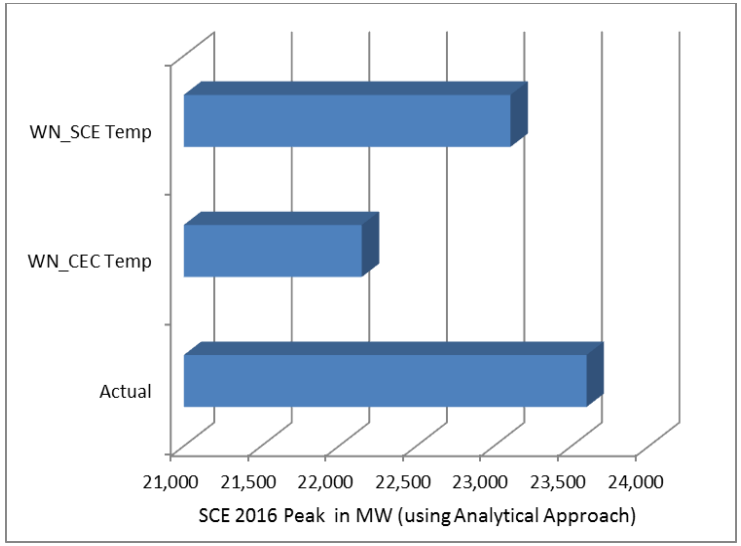
Month	SCE TAC	Peak Date	Peak Hour	SCE system	Delta	MWD**	CDWR*	Pasadena*	SCESys+MWD+CDWR+ Pasadena	Delta between CAISO EMS and calculated "TAC)
1	13,746	1/6/2016	18	13,626	120					
2	13,674	2/16/2016	19	13,832	-158					
3	13,255	3/16/2016	20	13,007	248					
4	15,056	4/19/2016	17	14,275	781					
5	14,491	5/12/2016	17	13,907	584					
6	**23,597**	**6/20/2016**	**16**	**22,709**	**888**	**253**	**160**	**254**	**23,376**	**221**
7	22,202	7/22/2016	16	21,897	305					
8	22,256	8/15/2016	17	21,464	792					
9	20,324	9/26/2016	16	19,710	614					
10	16,747	10/20/2016	17	15,935	812					
11	15,642	11/9/2016	16	15,258	384					
12	13,694	12/21/2016	19	13,329	365					

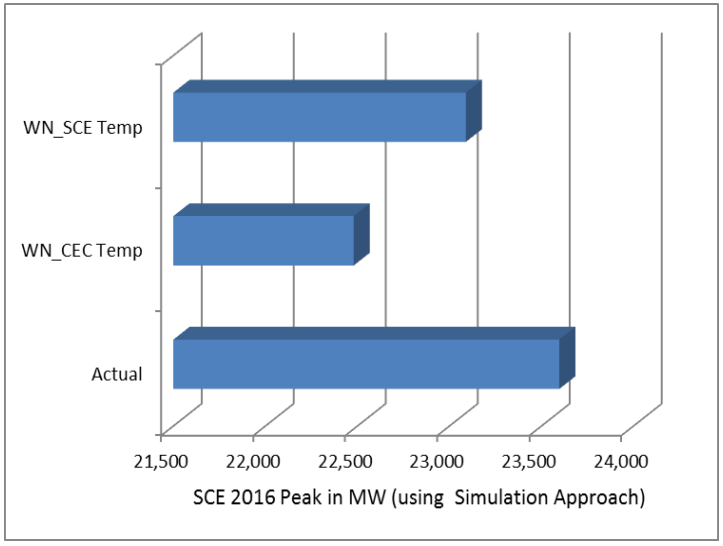
*from CEC 2016 December California Energy Demand Update Forecast 2015 - 2027, Mid Demand Baseline Case, Mid AAEE Savings.TN214927_20161219T151005_CEDU2016_LSE_and_BA_Tables_Mid_Baseline__Mid_AAEE.xlsx
**MWD value is from record MWD load

Impacts from Weather Representation

CEC uses “Max631” to represent daily weather for modeling purpose. SCE uses its own “Maximum Effective Temperature” instead. In addition, CEC uses different weather stations and weights compared to what SCE uses.

Findings: The weather normalized results could be significantly impacted by the use of the different weather representations holding everything else being the same.

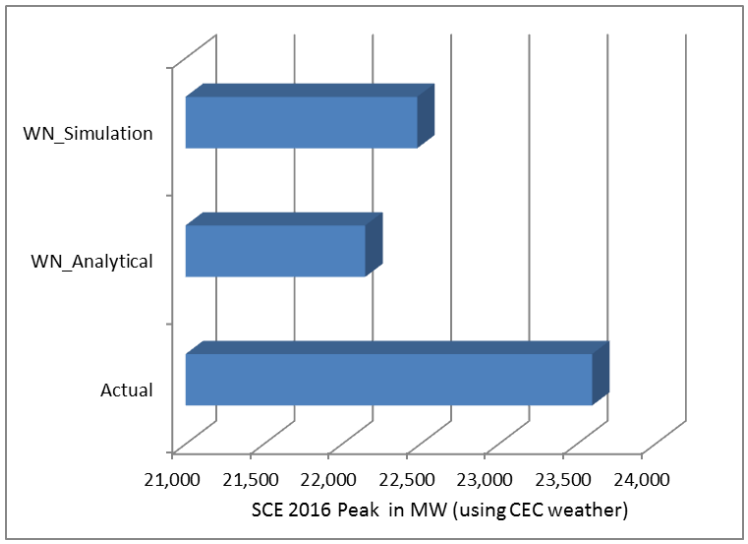


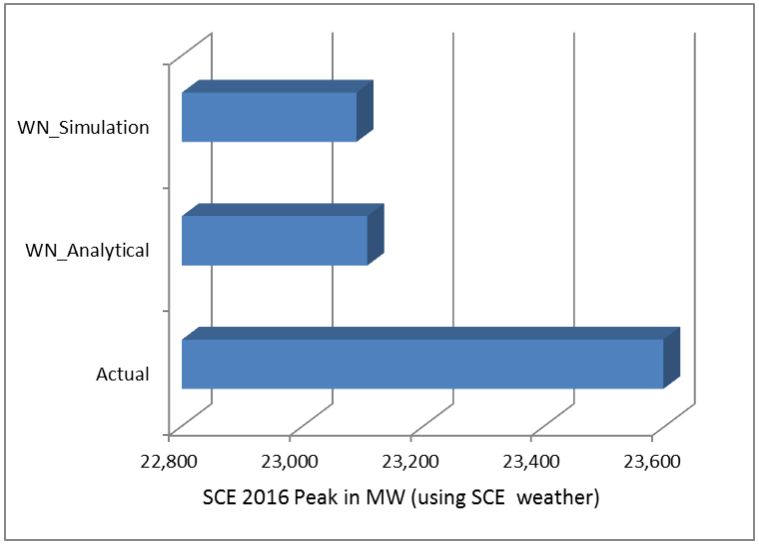


Impacts from Weather Normalization Methodologies

CEC uses simulation approach to derive the weather normalized annual peak estimate while SCE utilizes analytical approach to obtain the estimate.

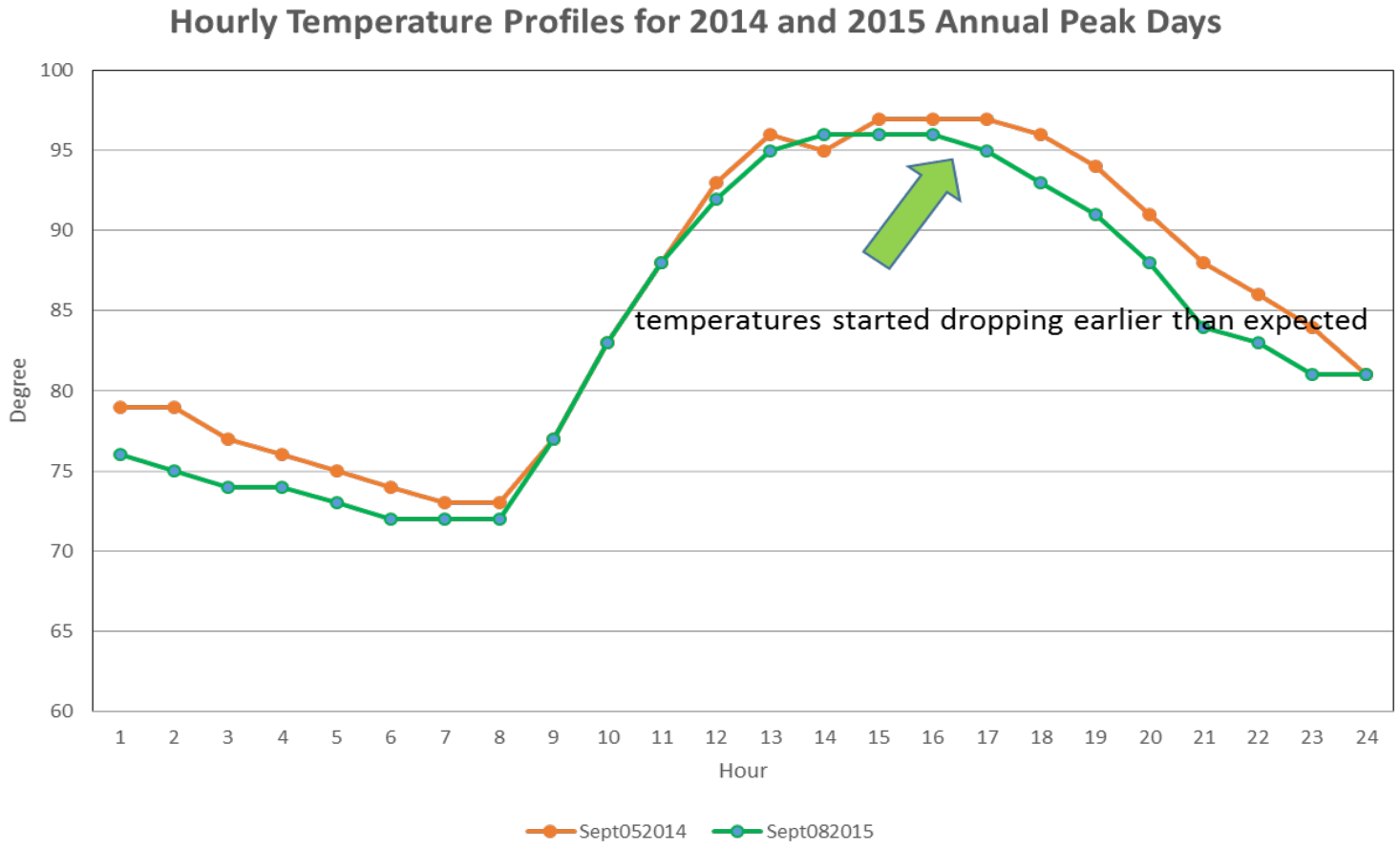
Findings: The different weather normalization methodologies yield similar results holding everything else being the same.





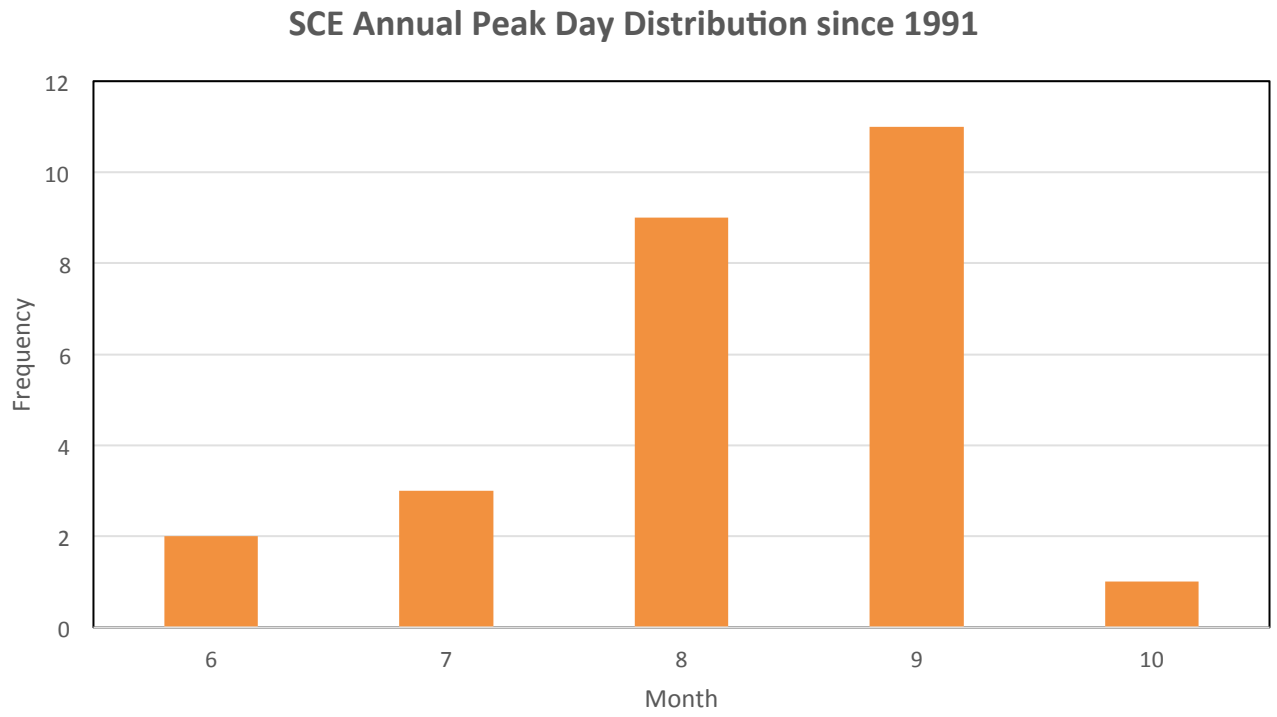
SCE 2015 Annual Peak Day Weather

SCE 2015 annual peak demand could have reached higher if hourly temperatures remained high through late afternoon hours which is usually expected for typical SCE annual peak day weather.



SCE Annual Peak Monthly Distribution

SCE's annual peak days occur in August and September majority of the time. Peak day occurrences in June or October are unusual. 2016 SCE peak day happened in June which is not typical for SCE.



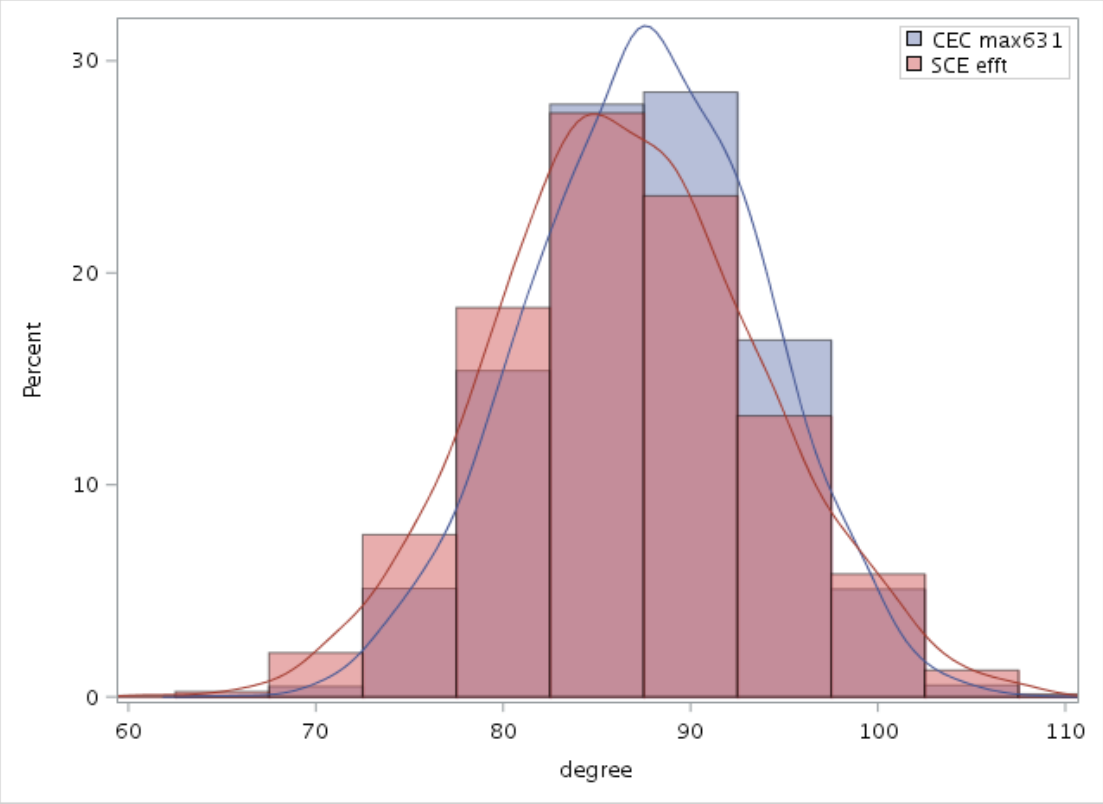
SCE Recommendations

- Make CAISO EMS data available to stakeholders when CAISO provides it to CEC
- Investigate the potential historical load data discrepancy to mitigate the forecast impact
- Evaluate the impacts from using alternative weather representations
- Consider unique annual peak day weather conditions to ensure reasonableness
  - conduct post modeling discussions
  - assess the unique weather conditions
  - determine any necessary adjustments
  - examine other weather impact including humidity

Back Up

Summer 2016 Weather Representation

CEC's summer 2016 weather distribution is different from SCE's.



	CEC_Max631	SCE_Max_Eff
Avg	87.60	86.56
Min	65.15	60.90
max	107.88	109.20
99%	101.23	103.70
95%	97.86	99.00
Skewness	-0.08	0.08
Kurtosis	-0.19	-0.04

Monthly Peak Comparison between CAISO EMS and SCE System Data for 2014 to 2016

	2014					2015					2016				
Month	Peak Day	Peak HE	CAISO EMS_SCE	SCE System	Delta	Peak Day	Peak HE	CAISO EMS_SCE	SCE System	Delta	Peak Day	Peak HE	CAISO EMS_SCE	SCE System	Delta
1/8/2014	19		13,789	13,262	527	1/20/2015	19	13,324	12,911	413	1/6/2016	18	13,746	13,626	120
2/4/2014	19		13,258	12,938	320	2/11/2015	19	13,503	13,063	440	2/16/2016	19	13,674	13,832	-158
3/17/2014	20		13,085	12,730	355	3/27/2015	16	15,088	14,774	314	3/16/2016	20	13,255	13,007	248
4/30/2014	17		15,107	14,739	368	4/30/2015	17	16,122	15,836	286	4/19/2016	17	15,056	14,275	781
5/15/2014	17		20,336	20,006	330	5/1/2015	17	15,603	15,203	400	5/12/2016	17	14,491	13,907	584
6/30/2014	17		17,787	17,390	397	6/30/2015	15	19,250	19,070	180	**6/20/2016**	**16**	**23,597**	**22,709**	**888**
7/24/2014	17		21,514	21,126	388	7/31/2015	17	19,487	19,313	174	7/22/2016	16	22,202	21,897	305
8/1/2014	16		20,426	20,255	171	8/28/2015	16	22,527	22,064	463	8/15/2016	17	22,256	21,464	792
9/15/2014	**18**		**22,947**	**22,482**	**465**	**9/8/2015**	**16**	**22,863**	**22,557**	**306**	9/26/2016	16	20,324	19,710	614
10/3/2014	17		17,907	17,635	272	10/9/2015	17	20,549	20,404	145	10/20/2016	17	16,747	15,935	812
11/6/2014	18		14,419	13,972	447	11/2/2015	18	13,413	13,235	178	11/9/2016	16	15,642	15,258	384
12/30/2014	19		14,060	13,569	491	12/15/2015	19	14,243	14,050	193	12/21/2016	19	13,694	13,329	365