STAFF PAPER

Weather-Induced Ranges for Incremental Uncommitted Energy Efficiency Peak Savings

Supplement to the Energy Commission Committee Report: *Incremental Impacts of Energy Efficiency Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast*

Chris Kavalec, Mitch Tian, and Mike Jaske
Demand Analysis Office
Electricity Supply Analysis Division
California Energy Commission

AUGUST 2010

CEC-200-2010-005

ABSTRACT

This supplement to the Energy Commission Committee Report *Incremental Impacts Of Energy Efficiency Policy Initiatives Relative To The 2009 Integrated Energy Policy Report Adopted Demand Forecast* provides new analysis related to incremental uncommitted peak efficiency savings. Daily average temperatures for 1990-2007 were used to develop a range around the peak savings presented in the report, which were based on an "average" weather year. Temperatures from a relatively cool year during this period reduced projected peak efficiency savings in 2020 for the three major investor-owned utilities combined by around 15 percent in all three scenarios (low, mid, and high) examined in the report. A relatively hot year increased projected 2020 peak savings for the three investor-owned utilities combined by around 13 percent in all three scenarios. Ranges were also developed for the three investor-owned utilities individually for each scenario.

Keywords: Efficiency, incremental, uncommitted, savings, peak, temperatures, peak-to-energy ratios, investor-owned utilities

Kavalec, Chris. Mitch Tian. Mike Jaske. 2010. *Weather-Induced Ranges for Incremental Uncommitted Energy Efficiency Peak Savings, Supplement to the Energy Commission Committee Report: Incremental Impacts of Energy Efficiency Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast*. California Energy Commission. 200-2010-005.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

Introduction and Method

This supplement presents additional analysis to that described in the *Incremental Impacts Of Energy Efficiency Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast*[1] (*Incremental Uncommitted Efficiency Report*). In Chapter 5 of that report, Energy Commission staff and Itron provided incremental uncommitted efficiency peak savings assuming a series of peak to energy factors based upon "average" weather. Conversion of energy to peak efficiency savings relied on historical average temperatures over a 30-year period. These peak savings are referred to in this supplement as *base* results.

A warmer year than average generally results in higher ratios between peak demand and energy use at the end-use level and, therefore, higher peak savings, while a cooler-than-average year would tend to yield lower peak savings. Over the lifetime of an efficiency measure, both warmer and cooler-than-average conditions will occur, but unless there is substantial change in average weather conditions over the life of the measure, the average should be in the middle of a distribution of occurrences. The *Incremental Uncommitted Efficiency Report* also presented results based on peak-to-energy ratios for 2004 developed by Itron , the same ratios that were used in the *2008 Energy Efficiency Goals Update Report*[2] and underlie the current California Public Utilities Commission (CPUC) peak efficiency electricity savings goals for the three investor-owned utilities (IOUs). Because 2004 was a relatively cool year, and because the Itron ratios are not entirely consistent with those developed by Energy Commission staff, use of the Itron version of 2004 ratios resulted in significantly lower peak savings than those derived from Energy Commission average weather conditions.[3]

Since peak savings are very sensitive to weather in a given year, and to be consistent with the *base* peak results given in the *Incremental Uncommitted Efficiency Report*, Energy Commission staff conducted new analysis for incremental uncommitted peak savings.[4] This involved developing potential ranges around the "average" weather results using Energy Commission peak-to-energy ratios for cooler and hotter years. These ratios were developed by running the Energy Commission's peak demand model (HELM), converting 2009[5]

1. Electricity and Natural Gas Committee. *Incremental Impacts of Energy Policy Initiatives Relative to the 2009 Integrated Energy Policy Report Adopted Demand Forecast*. CEC-200-2010-001-CTF. http://www.energy.ca.gov/2010publications/CEC-200-2010-001/index.html.

2. http://www.cpuc.ca.gov/NR/rdonlyres/8944D910-ECA2-4E19-B1F3-96956FB6E643/0/Itron2008CAEnergyEfficiencyStudy.pdf.

3. *Incremental Uncommitted Efficiency Report*, Chapter 5, pp. 50-51.

4. Note that in this supplement, as in the *Incremental Uncommitted Efficiency Report*, efficiency savings represent customer side of the meter impacts and do not incorporate transmission and distribution losses.

5. The year 2009 was the first forecast year in the *2009 IEPR* demand forecast and therefore assumed "average" weather for the peak calculations.

energy consumption by weather-sensitive end use for each IOU estimated for the *2009 IEPR* demand forecast into peak demand, assuming actual daily average temperatures in each year from 1990-2007. Peak ranges were then developed by examining the variation in weather-sensitive demand (air conditioning) for the residential and commercial sectors over these 18 years for each IOU. Model limitations precluded using additional, earlier years as inputs.

Ranges were developed at both the aggregate (sum of the three IOUs) and individual IOU level. For the aggregate range, weather years and associated temperatures were chosen for each end of the range that maximized the difference in simulated weather-sensitive demand between a "cool" and "warm" year for the three IOUs combined. At the individual IOU level, weather years were chosen to maximize the difference for each IOU. The peak-to-energy ratios developed for these years were then input into Itron's SESAT model to generate new incremental uncommitted peak savings results for each IOU.

Results

Table 1 shows the resulting range of incremental uncommitted peak efficiency savings for the three IOUs combined[6], using 2004 and 1999 as the "cool" and "warm" years, respectively. By 2020, the cool year reduces projected incremental uncommitted peak savings by 544 megawatts (MW) (13 percent) in the low case, 795 MW (15 percent) in the mid case, and 1,009 MW (16 percent) in the high case. For the warm year, peak savings increase by 483 MW (12 percent), 682 MW (13 percent), and 839 MW (13 percent) in the low, mid, and high cases, respectively.[7]

Table 2 shows the estimated range of incremental uncommitted peak savings for the PG&E service territory, using 1992 and 1999[8] as the "cool" and "warm" years respectively. In 2020, the cool year impact reduces projected peak savings by 285 MW (16 percent) in the low case,

---

6. Note that **Table 1**, as in results presented in the *Incremental Uncommitted Efficiency Report* for the three IOUs combined, does not reflect coincident peak savings, but rather the simple sum of the three individual savings estimates. The Energy Commission estimates that, in an average year, this sum can be converted to coincident savings by multiplying by a factor of 0.976.

7. For reference, the sum of the IOU service territory projected peaks in the *2009 IEPR* forecast for 2020 is around 52,000 MW (PG&E approximately 23,000 MW, SCE 24,000, and SDG&E 5,000).

8. The PG&E service territory projected peak in the *2009 IEPR* forecast for 2020 is around 23,000 MW. The year 2006 produced a hotter summer on average for PG&E than 1999. However, in this analysis, the HELM model assigned the same amount of energy (2009 projected) to produce a different peak for each historical weather year. The same amount of cooling energy distributed to fewer very hot days can mean a higher peak estimated by HELM. Had staff the time to do a more complete analysis, the Energy Commission energy forecasting models could have been rerun so that 2009 projected energy by end use varied according to weather in each year, giving a slightly improved estimate of resulting peak-to-energy ratios.

404 MW (18 percent) in the mid case, and 506 MW (19 percent) in the high case. For the warm year, peak savings increase by 392 MW (23 percent), 558 MW (25 percent), and 684 MW (25 percent) in the low, mid, and high cases, respectively.

Table 1: Range of Peak Incremental Uncommitted Savings for Three IOUs Combined (MW)

	Low Scenario			Mid Scenario			High Scenario		
Year	Cool (2004)	Base	Warm (1999)	Cool (2004)	Base	Warm (1999)	Cool (2004)	Base	Warm (1999)
2013	397	439	481	482	544	603	563	640	710
2014	703	788	874	913	1,039	1,158	1,060	1,217	1,360
2015	1,028	1,168	1,306	1,395	1,604	1,798	1,626	1,887	2,121
2016	1,492	1,705	1,907	1,984	2,298	2,582	2,339	2,735	3,079
2017	2,023	2,312	2,579	2,622	3,045	3,420	3,116	3,651	4,108
2018	2,578	2,949	3,287	3,295	3,839	4,313	3,941	4,629	5,209
2019	3,062	3,518	3,928	3,937	4,605	5,182	4,724	5,570	6,278
2020	3,490	4,034	4,517	4,557	5,352	6,034	5,475	6,484	7,323

Source: Itron and California Energy Commission, 2010.

Table 2: Range of Peak Incremental Uncommitted Savings for PG&E (MW)

	Low Scenario			Mid Scenario			High Scenario		
Year	Cool (1992)	Base	Warm (1999)	Cool (1992)	Base	Warm (1999)	Cool (1992)	Base	Warm (1999)
2013	168	192	226	198	231	280	233	273	331
2014	295	343	413	371	438	537	433	516	633
2015	428	506	618	563	674	834	659	795	987
2016	620	736	900	801	965	1,198	948	1,151	1,433
2017	843	997	1,214	1,062	1,280	1,588	1,266	1,538	1,912
2018	1,074	1,271	1,545	1,337	1,615	2,004	1,603	1,951	2,425
2019	1,273	1,514	1,846	1,596	1,935	2,408	1,918	2,344	2,922
2020	1,446	1,731	2,123	1,841	2,245	2,803	2,216	2,722	3,406

Source: Itron and California Energy Commission, 2010.

Table 3 shows the estimated range of incremental uncommitted peak savings for the SCE service territory, using 2004 and 1999 as the "cool" and "warm" years respectively. In 2020, the cool year impact reduces projected peak savings by 286 MW (15 percent) in the low case, 413 MW (16 percent) in the mid case, and 530 MW (17 percent) in the high case. For the warm year, peak savings increase by 117 MW (6 percent), 172 MW (7 percent), and 212 MW (7 percent) in the low, mid, and high cases, respectively.

Table 3: Range of Peak Incremental Uncommitted Savings for SCE (MW)

	Low Scenario			Mid Scenario			High Scenario		
Year	Cool (2004)	Base	Warm (1999)	Cool (2004)	Base	Warm (1999)	Cool (2004)	Base	Warm (1999)
2013	184	205	215	225	256	271	264	303	320
2014	328	372	392	430	493	523	501	581	616
2015	484	556	589	662	767	816	774	908	966
2016	704	815	863	944	1,104	1,175	1,117	1,322	1,408
2017	953	1,104	1,168	1,247	1,465	1,559	1,488	1,766	1,881
2018	1,214	1,409	1,490	1,568	1,849	1,969	1,882	2,242	2,388
2019	1,446	1,686	1,785	1,878	2,224	2,370	2,262	2,706	2,884
2020	1,655	1,941	2,058	2,180	2,593	2,765	2,630	3,160	3,372

Source: Itron and California Energy Commission, 2010.

Table 4 shows the estimated range of incremental uncommitted peak savings for the SDG&E service territory, using 1990 and 1998 as the "cool" and "warm" years respectively. In 2020, the cool year impact reduces projected peak savings by 64 MW (18 percent) in the low case, 109 MW (21 percent) in the mid case, and 129 MW (21 percent) in the high case. For the warm year, peak savings increase by 24 MW (7 percent), 42 MW (8 percent), and 49 MW (8 percent) in the low, mid, and high cases, respectively.

Table 4: Range of Peak Incremental Uncommitted Savings for SDG&E (MW)

	Low Scenario			Mid Scenario			High Scenario		
Year	Cool (1990)	Base	Warm (1998)	Cool (1990)	Base	Warm (1998)	Cool (1990)	Base	Warm (1998)
2013	37	42	44	46	56	60	52	64	68
2014	63	74	78	87	107	115	98	121	129
2015	89	107	113	131	163	175	148	184	198
2016	129	155	165	183	229	247	209	263	283
2017	177	211	225	239	300	323	276	347	374
2018	226	270	287	297	374	404	345	436	470
2019	266	320	341	352	446	481	411	520	562
2020	299	363	387	405	514	556	473	602	651

Source: Itron and California Energy Commission, 2010.

Finally, **Table 5** shows the percentage changes in projected incremental uncommitted peak savings corresponding to the results given in **Table 1** through **Table 4** for the mid scenario. Percentage changes increase between 2013 and 2020 as the CPUC's Big Bold Initiatives, which target air conditioning efficiency, increase in relative impact. The percentage differences are noticeably higher in the warm year for PG&E compared to the other IOUs, reflecting the lack of a historically extreme heat event during the 1990–2007 period in the SCE and SDG&E service territories. In addition, very hot years in the PG&E service territory as a whole (such as 1999) typically mean that more weather-moderate, densely populated parts of the territory, such as the Bay Area, experience much higher temperatures than usual and air conditioning use rises quickly.

Table 5: Weather-Induced Percentage Changes in Incremental Uncommitted Peak Savings, Mid Scenario by IOU and Three IOUs Combined

	3 IOUs Combined		PG&E		SCE		SDG&E	
Year	Cool (2004)	Warm (1999)	Cool (1992)	Warm (1999)	Cool (2004)	Warm (1999)	Cool (1990)	Warm (1998)
2013	-11%	11%	-14%	21%	-12%	6%	-18%	7%
2014	-12%	11%	-15%	23%	-13%	6%	-19%	7%
2015	-13%	12%	-16%	24%	-14%	6%	-20%	7%
2016	-14%	12%	-17%	24%	-14%	6%	-20%	8%
2017	-14%	12%	-17%	24%	-15%	6%	-20%	8%
2018	-14%	12%	-17%	24%	-15%	6%	-21%	8%
2019	-15%	13%	-18%	24%	-16%	7%	-21%	8%
2020	-15%	13%	-18%	25%	-16%	7%	-21%	8%

Source: Itron and California Energy Commission, 2010.

Two limitations in this analysis are noted. First, the 1990–2007 period does not represent a full spectrum of weather possibilities. Energy Commission staff explored the potential variation of incremental uncommitted peak savings using readily available data rather than conducting a more complete, probabilistic analysis incorporating a full range of possible temperatures. Second, the changes in peak savings in cool and hot years overstate the change in a final "managed" forecast for procurement purposes, since any underlying base forecast (that is, without incremental uncommitted savings) would also change. Hotter or cooler average temperatures would mean higher or lower starting points for projected peaks before any adjustment for incremental uncommitted savings. For example, it would be inappropriate to subtract hot weather-induced incremental impacts of energy efficiency programs from a 1:2 (average weather) baseline peak demand forecast used for California Independent System Operator capacity planning.