

Codes and Standards Program Savings Estimate – Updated V3b Savings Estimate Spreadsheet

For 2005 Building Standards and 2006/2007 Appliance Standards

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TABLE OF CONTENTS

0. EXECUTIVE SUMMARY	5
1. CODES & STANDARDS SAVINGS ESTIMATE SPREADSHEET REVISION.....	7
1.1 Introduction.....	7
1.2 Title 20 Standards (std 18) Update	7
1.3 Non-compliance Rate Update	7
1.4 Naturally Occurring Market Adoption Update	8
1.5 First-Year Energy Saving Update	9
2. RESULTS – ESTIMATED SAVINGS	11
2.1 Estimated Savings Compared to Goals.....	11
2.2 Breakdowns between Appliance and Building Standards	12
2.3 Breakdowns by Utility Territory.....	12
3. REFERENCES	14

LIST OF TABLES

Table 1 - Total IOU-Attributable C&S Program Net Savings - Exec Summ	5
Table 2 – Changes of C&S Program Net Savings from the V3 Spreadsheet.....	6
Table 3 – Quantec Study Results of Non-Compliance Rates for Title 20/24 Measures	8
Table 4– Quantec Study Results of NOMA for Title 20/24 Measures	9
Table 5 – Measures Updated with New First-year Energy savings	10
Table 6 - Total IOU-Attributable C&S Program Net Savings	11
Table 7 – Changes of Total IOU-Attributable C&S Program Net Savings from the V3 Spreadsheet	11
Table 8 - Appliance Standards – IOU-Attributable C&S Program Net Savings	12
Table 9 - Building Standards Savings – IOU-Attributable C&S Program Net Savings	12
Table 10 - PG&E Service Territory – IOU-Attributable C&S Program Net Savings	12
Table 11 - SCE Service Territory – IOU-Attributable C&S Program Net Savings.....	13
Table 12 - SDG&E Service Territory – IOU-Attributable C&S Program Net Savings.....	13
Table 13 - SCG Service Territory – IOU-Attributable C&S Program Net Savings	13

0. EXECUTIVE SUMMARY

The white paper entitled *Codes and Standards Program Savings Estimate* (HMG 2005a) provided detailed documentation of the methodology for estimating energy savings generated by the utilities’ Statewide Codes and Standards Program (hereinafter C&S Program). HMG developed an Excel spreadsheet to estimate C&S Program savings based on the methodology described in the white paper. The C&S savings estimate spreadsheet went through several revisions to incorporate better program information and to correct formula errors. The savings estimate spreadsheet associated with the above white paper is Total C&S Savings HMG - Posted V3.xls (HMG 2005b) (hereinafter V3 Spreadsheet). This document describes the revisions made since the V3 Spreadsheet was posted to the CALMAC website. The title of the latest C&S Program savings estimate spreadsheet is Total C&S Savings HMG - V3b.xls (hereinafter V3b Spreadsheet). This document also provides updated C&S programs savings estimates attributable to each of the California investor owned utilities (IOUs).

Revisions in the V3b Spreadsheet incorporate results of the recent Quantec study (Quantec 2007) on naturally occurring market adoption (NOMA) and non-compliance rates for selected Title 20 and Title 24 measures. In summary, these revisions include:

1. Split the Title 20 standard “Std18” into “Std18a TV” and “Std18b DVD”, to accommodate different NOMA and non-compliance rates for these two appliance categories;
2. Incorporated Quantec study results of non-compliance rates for selected Title 20 and Title 24 measures;
3. Incorporated Quantec study results of NOMA rates for selected Title 20 and Title 24 measures;
4. Adjusted the first-year energy savings for selected Title 20 measures in response to the updated NOMA model;

These revisions were also documented in the revision notes section of the V3b Spreadsheet, in the worksheet “Totals-Goals” column A row 7 through 9.

These revisions led to a slight change in overall C&S Program savings estimates. Table 1 lists the updated estimates of total IOU C&S Program savings during the 2006 to 2008 cycle as compared to the CPUC statewide savings goals (ED 2005). The C&S values are the Program Net Savings and are adjusted to remove the measures that will be installed in non-IOU service territories. The C&S percentages indicate what percent of the statewide goals could be met through the C&S savings.

Table 1 - Total IOU-Attributable C&S Program Net Savings - Exec Summ (V3b revision)

IOU Totals	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	2,032	195	10%	2,275	194	9%	2,504	247	10%
Demand (MW/yr)	442	55	12%	478	53	11%	528	64	12%
Gas (Mtherm/yr)	30.0	4.6	15%	37.3	4.4	12%	44.4	4.2	9%

Table 2 lists the changes in total IOU savings from the V3 Spreadsheet to the V3b Spreadsheet. The updated savings estimates show slightly increased energy and demand savings, but slightly decreased gas savings. Note that the Goal values are unchanged.

Table 2 – Changes in C&S Program Net Savings from the V3 to V3b Spreadsheets

IOU Totals	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	2,032	23	1.1%	2,275	16	0.7%	2,504	10	0.4%
Demand (MW/yr)	442	5	1.0%	478	-0.41	-0.1%	528	0.87	0.2%
Gas (Mtherm/yr)	30.0	-0.45	-1.5%	37.3	-0.10	-0.3%	44.4	0.24	0.5%

1. C&S SAVINGS ESTIMATE SPREADSHEET REVISIONS

1.1 INTRODUCTION

The white paper entitled *Codes and Standards Program Savings Estimate* (HMG 2005a) provided detailed documentation of the methodology for estimating energy savings generated by the utilities' Statewide Codes and Standards Program (hereinafter C&S Program). HMG developed an Excel spreadsheet to estimate C&S Program savings based on the methodology described in the white paper. The C&S savings estimate spreadsheet went through several revisions to incorporate better program information and to correct formula errors. The savings estimate spreadsheet associated with the above white paper is Total C&S Savings HMG - Posted V3.xls (HMG 2005b) (hereinafter V3 Spreadsheet). This document describes the revisions made since the V3 Spreadsheet was posted to the CALMAC website. The title of the latest C&S Program savings estimate spreadsheet is Total C&S Savings HMG - V3b.xls (hereinafter V3b Spreadsheet). This document also provides updated C&S programs savings estimates attributable to each of the California investor owned utilities (IOUs).

Revisions in the V3b Spreadsheet incorporate results of the recent Quantec study (Quantec 2007) on naturally occurring market adoption (NOMA) and non-compliance rates for selected Title 20 and Title 24 measures. In summary, these revisions include:

1. Split the Title 20 standard “Std18” into “Std18a TV” and “Std18b DVD”, to accommodate different NOMA and non-compliance rates for these two appliance categories;
2. Incorporated Quantec study results of non-compliance rates for selected Title 20 and Title 24 measures;
3. Incorporated Quantec study results of NOMA for selected Title 20 and Title 24 measures;
4. Adjusted the first-year energy savings for selected Title 20 measures in response to the updated NOMA model;

These revisions were also documented in the revision notes section of the V3b Spreadsheet, in the worksheet “Totals-Goals” column A row 7 through 9.

Reviewers of this documents can refer to the White Paper for a more complete explanation of the attribution parameters discussed in this revision. The following sections provide detailed descriptions of each revision item listed above.

1.2 TITLE 20 STANDARDS (STD 18) UPDATE

In the V3 spreadsheet, the Title 20 standard (Std 18) had same attribution parameters for both TVs and DVDs. The Quantec study (Quantec 2007) developed different NOMA and non-compliance results for these two subcategories. Therefore, it makes sense to separate them into two standards, Std 18a for TVs and Std 18b for DVDs, to incorporate their individual attribution parameters. The first-year energy and demand savings estimates were separated accordingly.

1.3 NON-COMPLIANCE RATE UPDATE

The V3 spreadsheet used the 30% default non-compliance rate for all Title 20 and Title 24 standards. The Quantec study (Quantec 2007) provided the following estimates of non-compliance rates for selected measures. These evaluation results were incorporated in the V3b Spreadsheet. It should be noted that the averaged non-compliance rate of all Title 20 / 24 standards in the V3b Spreadsheet, weighted by the first-year energy savings, is 31%. The averaged non-compliance rate weighted by demand or gas savings is

33%. They are very close to the original assumption of 30%, indicating that the original assumption of the overall new code compliance is close to the Quantec evaluation result.

Table 3 – Quantec Study Results of Non-Compliance Rates for Title 20/24 Measures

Index	Title 20 / 24 Standards	Non-compliance Rate
Title 20 Standards		
Std 4	Walk-in Refrigerators/ Freezers	0%
Std 5	Refrigerated Canned/Bottled Beverage Vending Machines	63%
Std 8	Residential Pool Pumps, Tier 1	15%
Std 11	General Service Incandescents, Tier 1	27%
Std 12	Metal Halide Luminaires	37%
Std 18a	Televisions	41%
Std 18b	DVD Players	57%
Std 21	Pre-rinse Spray Valves	4.2%
Std 20	Unit Heaters and Duct Furnaces	44%
Title 24 Standards		
Std B3	Residential hardwired lighting	28%
Std B4	Duct improvement	73%
Std B5	Window replacement	68%
Std B6	Lighting controls under skylights	44%
Std B7	Ducts in existing buildings	100%
Std B8	Cool roofs	50%
Std B11	Duct testing/sealing in new buildings	100%

1.4 NATURALLY OCCURRING MARKET ADOPTION UPDATE

The V3 spreadsheet followed the NOMA assumption as defined in the White Paper (HMG 2005a). For each Title 20/24 measure, NOMA was assumed to increase from 0% at the measure starting year to 100% several years later in linear pattern. The Quantec study assumed that the NOMA for Title 20 / 24 measures followed the Bass diffusion model:

$$F(t) = \frac{(1 - e^{-(p+q)t})}{(1 + (q/p)e^{-(p+q)t})} \times Max$$

where

F(t) = the market penetration in year t (%),
 p = coefficient of leading behavior (innovation),

q = coefficient of following behavior (imitation),
 Max = maximum penetration rate (%)
 t = elapsed time from initial market presence.

Bass model parameters were evaluated for selected Title 20 / 24 measures, as shown in Table 4. The V3b Spreadsheet changed the formula from linear equations to Bass curves for all affected measures, based on Quantec study.

Table 4– Quantec Study Results of NOMA for Title 20/24 Measures

Index	Title 20 / 24 Standards	Max	Starting Year	p	q
Title 20 Standards					
Std 9	Residential Pool Pumps, Tier 2	33%	1995	0.00	0.23
Std 11	General Service Incandescents, Tier 1	53%	1970	0.06	0.01
Std 12	Metal Halide Luminaires	58%	1992	0.02	0.14
Std 17	Consumer Electronics – audio players	50%	2000	0.08	0.16
Std 18a	Televisions	83%	2000	0.07	0.17
Std 18b	DVD Players	61%	2000	0.03	0.33
Std 21	Pre-rinse Spray Valves	69%	1965	0.01	0.06
Std 20	Unit Heaters and Duct Furnaces	53%	1985	0.01	0.13
Title 24 Standards					
Std B3	Hardwired lighting	57%	2000	0.0122	0.2131
Std B4	Duct improvement	19%	1990	0.0105	0.1819
Std B6	Lighting controls under skylights	51%	2000	0.0086	0.3026
Std B7	Ducts in existing buildings	23%	1990	0.0013	0.1571

1.5 FIRST-YEAR ENERGY SAVING UPDATE

The White Paper (HMG 2005a) NOMA model assumed 0% initial market penetration at the measure starting year (date of Standards adoption). The first-year energy savings estimate should have included the effects of non-zero initial market penetration. Quantec’s approach (Quantec 2007) included initial market penetration rates in the Bass models. Therefore, any assumptions of normal market penetration assumed in original first-year energy savings should be removed, to avoid double counting by the Bass models. The corresponding first-year energy savings should be based on zero initial market penetration. Upon examination of original first-year savings estimates, we identified the following measures which require such adjustment, and changed the savings spreadsheet accordingly.

Table 5 – Measures Updated with New First-year Energy savings

Index	Title 20 / 24 Standards
Title 20 Standards	
Std 9	Residential Pool Pumps, Tier 2
Std 12	Metal Halide Luminaires
Std 17	Consumer Electronics – audio players
Std 20	Unit Heaters and Duct Furnaces
Title 24 Standards	
None	

2. RESULTS – ESTIMATED SAVINGS

This section presents the updated savings estimates provided by the revised V3b Spreadsheet, and compares them to the savings goals established by the CPUC for the utility portfolios of programs.

2.1 ESTIMATED SAVINGS COMPARED TO GOALS

Table 6 shows the updated annual C&S Program savings attributable to each of the four IOUs during the 2006 to 2008 program cycle. The statewide savings goals are the same as those in the V3 Spreadsheet and they are taken from the CPUC review of the IOU 2006 - 2008 energy efficiency program portfolio planning (ED 2005). The C&S values are net program savings, adjusted to remove the measures that will be installed in non-IOU service territories. The C&S percentages indicate what percent of the total savings goals could be met through the C&S savings. Table 7 presents the changes in savings estimates from the V3 Spreadsheet to the V3b Spreadsheet. The V3b Spreadsheet provides higher energy and demand savings estimates but lower gas savings estimates.

Table 6 - Total IOU-Attributable C&S Program Net Savings (V3b revision)

IOU Totals Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	2,032	195	10%	2,275	194	9%	2,504	247	10%
Demand (MW/yr)	442	55	12%	478	53	11%	528	64	12%
Gas (Mtherm/yr)	30.0	4.6	15%	37.3	4.4	12%	44.4	4.2	9%

Table 7 – Changes of Total IOU-Attributable C&S Program Net Savings from the V3 Spreadsheet

IOU Totals	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	2,032	23	1.1%	2,275	16	0.7%	2,504	10	0.4%
Demand (MW/yr)	442	5	1.0%	478	-0.41	-0.1%	528	0.87	0.2%
Gas (Mtherm/yr)	30.0	-0.45	-1.5%	37.3	-0.10	-0.3%	44.4	0.24	0.5%

The tables in the following sections provide greater detail and resolution of the annual savings numbers.

2.2 BREAKDOWNS BETWEEN APPLIANCE AND BUILDING STANDARDS

Table 8 and Table 9 present the updated savings from Title 20 appliance standards and Title 24 building standards, respectively.

Table 8 - Appliance Standards – IOU-Attributable C&S Program Net Savings (V3b revision)

IOU Totals Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	2,032	108	5%	2,275	113	5%	2,504	173	7%
Demand (MW/yr)	442	17	4%	478	18	4%	528	32	6%
Gas (Mtherm/yr)	30.0	2.9	10%	37.3	2.9	8%	44.4	2.8	6%

Table 9 - Building Standards Savings – IOU-Attributable C&S Program Net Savings (V3b revision)

IOU Totals Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	2,032	87	4%	2,275	81	4%	2,504	75	3%
Demand (MW/yr)	442	38	9%	478	35	7%	528	32	6%
Gas (Mtherm/yr)	30.0	1.7	6%	37.3	1.5	4%	44.4	1.4	3%

2.3 BREAKDOWNS BY UTILITY TERRITORY

The following tables show updated savings and goals for each of the four IOU service territories. These breakdowns are done on the basis of statewide energy sales.

Table 10 - PG&E Service Territory – IOU-Attributable C&S Program Net Savings (V3b revision)

PG&E Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	829	85.9	10%	944	85	9%	1,053	109	10%
Demand (MW/yr)	180	24	13%	205	24	12%	228	28	12%
Gas (Mtherm/yr)	13	1.7	14%	15	1.6	11%	17	1.5	9%

Table 11 - SCE Service Territory – IOU-Attributable C&S Program Net Savings (V3b revision)

SCE Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	922	89	10%	1,046	88	8%	1,167	113	10%
Demand (MW/yr)	207	25	12%	219	24	11%	246	29	12%
Gas (Mtherm/yr)	-	-	-	-	-	-	-	-	-

Table 12 - SDG&E Service Territory – IOU-Attributable C&S Program Net Savings (V3b revision)

SDG&E Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	281	20	7%	285	20	7%	284	26	9%
Demand (MW/yr)	55	6	10%	54	6	10%	54	7	12%
Gas (Mtherm/yr)	3	0.2	7%	3	0.2	6%	4	0.2	5%

Table 13 - SCG Service Territory – IOU-Attributable C&S Program Net Savings (V3b revision)

SCG Annual	2006			2007			2008		
	Goal	C&S	C&S %	Goal	C&S	C&S %	Goal	C&S	C&S %
Energy (GWh/yr)	-	-	-	-	-	-	-	-	-
Demand (MW/yr)	-	-	-	-	-	-	-	-	-
Gas (Mtherm/yr)	15	2.7	19%	19	2.6	13%	23	2.5	11%

3. REFERENCES

CPUC Energy Division, (ED 2005). *The California 2006-2008 Energy Efficiency Portfolio - A Review of Early IOU Planning Documents*, May 27, 2005, prepared by TecMarket Works.

Heschong Mahone Group Inc., (HMG 2005a). *Codes and Standards Program Savings Estimate - For 2005 Building Standards and 2006/2007 Appliance Standards*. Prepared for SCE and the Joint Utilities. Available at <http://calmac.org>, Study ID SCE0241.01.

Heschong Mahone Group Inc., (HMG 2005b). *Codes and Standards Program Savings Estimate - For 2005 Building Standards and 2006/2007 Appliance Standards - Estimation Spreadsheet*. Prepared for SCE and the Joint Utilities. Available at <http://calmac.org>, Study ID SCE0241.02.

Quantec, LLC and The Benningfield Group (Quantec 2007). *Statewide Codes and Standards Market Adoption and Noncompliance Rates*. Prepared for SCE. Available at <http://calmac.org>, Study ID SCE0224.01; 1134-04.