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DEER Database:

2011 Update Documentation

Appendices

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Appendix A-1

DEER Measure Database Updates

Measure content, modeling method, model input parameter, and database format changes

(Version 4.00 first release in November 2011)

This document last updated 8 November 2011

Version 4.00 of the DEER measure database is the update to the mid-December DEER 2008 release for 2009-2011 Energy Efficiency Planning/Reporting (DEER v2.05). It was created with a new version of the DEER measure analysis software (MAS). The new MAS tool includes a number of changes and additions to the previous version that results in an improved and expanded DEER measure database. The database structure and the database viewing tool, MISer, have also been updated for this database release.

Changes to the MAS tool were made to either fix simulation errors or to improve the processing of hourly simulation data for the determination of demand impacts. In addition, the MAS tool was expanded to include additional measures and additional measure base cases that were requested by the utilities.

Outline of Contents:

Changes to the MAS tool

The changes described here are typically due to errors discovered in the previous MAS tool. Some of the errors were simply incorrect building prototype specifications, such as an incorrect schedule or an inappropriate equipment size. Other fixes were made in order to make the calculation of demand impacts more robust.

Large Office primary lighting schedule

The primary lighting schedule associated with linear fluorescent fixtures had been (incorrectly) set to the secondary schedule associated with CFL fixtures. The result was that the linear fluorescent fixtures were “on” more hours than intended, but with a decreased coincident demand. The end-use demand impacts increased by 14% due to this change while the annual electric end-use impacts decreased by 10%. The table under the next heading provides the complete listing of lighting operating hours by building type and lighting technology type.

Nonresidential indoor lighting operating hours and coincident demand factors

All lighting UES values are now based on a consistent set of lighting operating hours and coincident demand factors (CDFs) for the entire building. Whole building operating hours and CDFs had previously been provided by activity area within each DEER building type. The operating hours and CDFs provided in the tables below are exact values, calculated from the energy simulation results using the following relationship:

$$\text{Operating Hours} = \frac{\text{Whole Building kWH Lighting Savings}}{\text{Whole Building Connected Lighting kW Reduction}}$$

The 2008 DEER update documentation included a table of operating hours by activity area within each DEER building type. These values were an approximation of operating hours based on hand calculations of each daily profile to an entire year and were not accurate for some building types. Additionally the table in the 2008 DEER update documentation did not include operating hours for the entire building. DEER v4.00 requires the following tables as well as the complete tables of CDFs included in the appendix to be used for calculating lighting UES values for DEER building types.

DEER v4.00 Linear Fluorescent and High Bay Opereating Hours

LINEAR FLUORESCENT AND HIGH BAY FIXTURES		
Building Type	**Operating Hours**	**CDF (range)***
Assembly	2610	0.53
Primary School	2140	0.02 - 0.62
Secondary School	2280	0.02 - 0.71
Community College	2420	0.02 - 0.81
University	2350	0.03 - 0.72
Relocatable Classroom	2480	0.02 - 0.7
Grocery	4910	0.69
Hospital	5260	0.83
Nursing Home	4160	0.68
Hotel	1950	0.24
Motel	1550	0.17
Bio/Tech Manuf.	3530	0.85
Light Industrial Manuf.	3220	0.92
Large Office	2640	0.71
Small Office	2590	0.69
Sit-Down Restaurant	4830	0.80
Fast-Food Restaurant	4840	0.81
Department Store	3380	0.76
Big Box Retail	4270	0.85
Small Retail	3380	0.88
Conditioned Storage	3420	0.70
Unconditioned Storage	3420	0.70
Refrigerated Warehouse	4770	0.56

* CDF values presented in ranges have different CDFs by climate zone.
Refer to the appendix for complete list of CDFs

DEER v4.00 Compact Fluorescent Lamp Operating Hours

COMPACT FLUORESCENT LAMPS		
Building Type	Operating Hours	CDF (range)*
Assembly	2300	0.41
Primary School	2240	0.02 - 0.63
Secondary School	2330	0.02 - 0.72
Community College	2420	0.02 - 0.81
University	2370	0.03 - 0.72
Relocatable Classroom	2600	0.02 - 0.73
Grocery	3890	0.49
Hospital	4200	0.72
Nursing Home	3570	0.56
Hotel	1670	0.20
Motel	1370	0.15
Bio/Tech Manuf.	3090	0.78
Light Industrial Manuf.	2580	0.78
Large Office	3000	0.63
Small Office	2980	0.68
Sit-Down Restaurant	4830	0.80
Fast-Food Restaurant	4810	0.81
Department Store	3710	0.63
Big Box Retail	4350	0.69
Small Retail	4010	0.70
Conditioned Storage	2760	0.57
Unconditioned Storage	2760	0.57
Refrigerated Warehouse	4730	0.55

* CDF values presented in ranges have different CDFs by climate zone.
Refer to the appendix for complete list of CDFs

Boiler Sizing

The sizing method used for the HVAC boilers resulted in boilers over-sized by 50 - 100% in the older vintage buildings. The performance of these boilers operating at low part-load caused an over-statement of the heating energy required to compensate for reduced internal loads (such as associated with indoor lighting measures).

Hot Water Storage Heater Sizing

The size of the commercial hot water storage heaters was increased by 25% to account for lower mains water temperature in the winter months. In some building types and in some climate zones, the demand for water heating exceeded the specified capacity for long periods of time.

Packaged HVAC specifications

The single-phase and three-phase distinction for SEER-rated packaged HVAC equipment (SEER 12, 13 and 14) has been eliminated. There are still entries in the database for three-phase units, but their performance and energy impact results are the same as for the units that do not specify the phase distinction.

Revisions to the CEE tier 1, 2 and 3 efficiency levels have affected the EER rating of three packaged HVAC measures. The 10 EER unit in the size range from 240 – 760 kBTU/hr was changed to a 9.8 EER rated unit. In the size range greater than 760 kBTU/hr, the 9.7 and 10 EER units were changed to 9.5 and 9.7 EER, respectively.

Oldest building vintage HVAC system performance

Analysis of CEUS data indicates that many older vintage building have updated HVAC systems and that these older buildings are not well represented by a constant volume HVAC system, as was assumed for the oldest vintage DEER prototypes. Built-up HVAC system in the oldest vintage buildings are now modeled as a combination of constant volume and variable volume systems, represented by an variable air volume HVAC system with a high minimum flow rate (60% minimum flow).

Economizer set point

The controls for the economizer have been changed in climate zones CZ01, CZ03 and CZ05. In these climate zones, standard control settings allowed the economizer to be used during the peak cooling period, causing a large peak latent cooling load. Though compliant with the Title-24 ACM specifications, it is unlikely that an economizer would be utilized in a way that increases the peak demand. The economizer set point temperature, above which the outside air is forced to its minimum flow rate, was lowered to 70 °F from 75 °F in these climate zones. This change results in more appropriate (i.e. smaller) design chiller size in these climate zones, especially in the older vintage buildings.

DOE2.2 bug fixes

These changes to the measure analysis software tool were prompted by an update to the DOE2.2 simulation engine that is used in the DEER MAS tool. The following fixes were identified as having some impact on the DEER measure results; there may be other bug fixes included in the update of the DOE2.2 simulation engine that do not affect the DEER results.

- Fix that affects the outside air volume associated with duct leakage: this mainly impacts the mobile home duct measures but has a small effect on the single-family and multi-family prototypes as well. DOE2.2 was previously over accounting for outside make-up air associated with duct losses to unconditioned spaces (in both base and measure cases). Non-commercial buildings were not impacted by this fix.
- Fix regarding default minimum heating flow rates. In some cases, the default zone minimum heating flow rate did not default to the system minimum heating flow rate as was intended. The impact of this fix on the DEER results is minor.
- Fix that corrects an error with the calculation of the heat load due to lighting fixtures under specific circumstances of zoning and lighting system configuration. All of the results in the “Lighting Workbook” are based on simulations that include this DOE2.2 source code correction.

T12 linear fluorescent baseline fixtures

Input power for T12 linear fluorescent baseline fixtures were updated to reflect USDOE ballast efficacy requirements enacted in 1990.

Minimum efficiency requirements for magnetic ballasts were adopted as part of EPACT in 1990. Ballasts covered by these standards are often called “Energy Efficient” or “ES” magnetic ballasts. These minimum efficiency requirements were updated again in 2005. The new requirements essentially prohibited the inclusion of ES magnetic ballasts in any new fixtures. However, the standard did allow the shipment of ES magnetic ballasts for repair or replacement purposes.

In 2010 EPACT prohibited the manufacture or import for sale of any T12 magnetic ballasts. Most importantly, EPACT 1990 required ES magnetic ballasts for all nonresidential applications. Pre-EPACT (pre-1990) fixtures that were installed with standard magnetic ballasts would need to have survived without any ballast replacements for twenty three years by 2013. Ballast replacements would have utilized either an ES ballast in the 1990’s or a hybrid or electronic ballast in the 2000-2010 period and since 2010 an electronic ballast.

During this same time period (especially post 1990’s) the standard lamp/ballast and fixture retrofits have become T8 lamps with electronic ballasts and the prices and availability of electronic ballasts compatible with the T12 lamps has allowed them to become the normal repair choice. For these reasons, baseline wattages of fixtures in the DEER lighting fixture table that include pre-EPACT magnetic ballasts have been revised to assume ES magnetic ballasts. The table provides a sample of these fixture power revisions for 4 and 8 foot 2-lamp fixtures.

Changes to DEER T12 Linear Fluorescent Fixture Watts for STD to ES Magnetic Ballasts

Fixture Code	Lamp Type	Lamp Size	Lamps per Fixture	Lamp Code	Ballast Type	Ballasts per Fixture	DEER Watts Per Fixture	
							2008	2011
F41EIS	T12	48 inch	1	F48T12/ES	Mag-STD	1	51	43
F41SIS/T2	T12	48 inch	1	F40T12	Mag-STD	2	52	44
F41SIS	T12	48 inch	1	F40T12	Mag-STD	1	60	48
F42EIS	T12	48 inch	2	F34T12/ES	Mag-STD	2	82	72
F42SIS	T12	48 inch	2	F40T12	Mag-STD	2	84	74
F43EIS	T12	48 inch	3	F48T12/ES	Mag-STD	1	133	109
F43SIS	T12	48 inch	3	F40T12	Mag-STD	1	136	112
F81ES/T2	T12	96 inch	1	F96T12/ES	Mag-STD	2	64	62
F81ES	T12	96 inch	1	F96T12/ES	Mag-STD	1	75	64
F81EHS	T12	96 inch	1	F96T12/HO/ES	Mag-STD	1	112	105
F82ES	T12	96 inch	2	F96T12/ES	Mag-STD	2	128	123
F82EHS	T12	96 inch	2	F96T12/HO/ES	Mag-STD	2	227	207
F83ES	T12	96 inch	3	F96T12/ES	Mag-STD	1 + 2	203	185
F83EHE	T12	96 inch	3	F96T12/HO/ES	Mag-ES/STD	1 + 2	319	312
F83EHS	T12	96 inch	3	F96T12/HO/ES	Mag-STD	1 + 2	380	312
F84ES	T12	96 inch	4	F96T12/ES	Mag-STD	2	256	246
F84EHS	T12	96 inch	4	F96T12/HO/ES	Mag-STD	2	454	414
F86EHS	T12	96 inch	6	F96T12/HO/ES	Mag-STD	2	721	621

The table below provides show how the above described changes to the baseline fixture wattages for typical early retirement retrofit measures will reduce the per fixture wattage change pre-retrofit versus post-retrofit. This value can be similar to the reduction in measure savings from this baseline change.

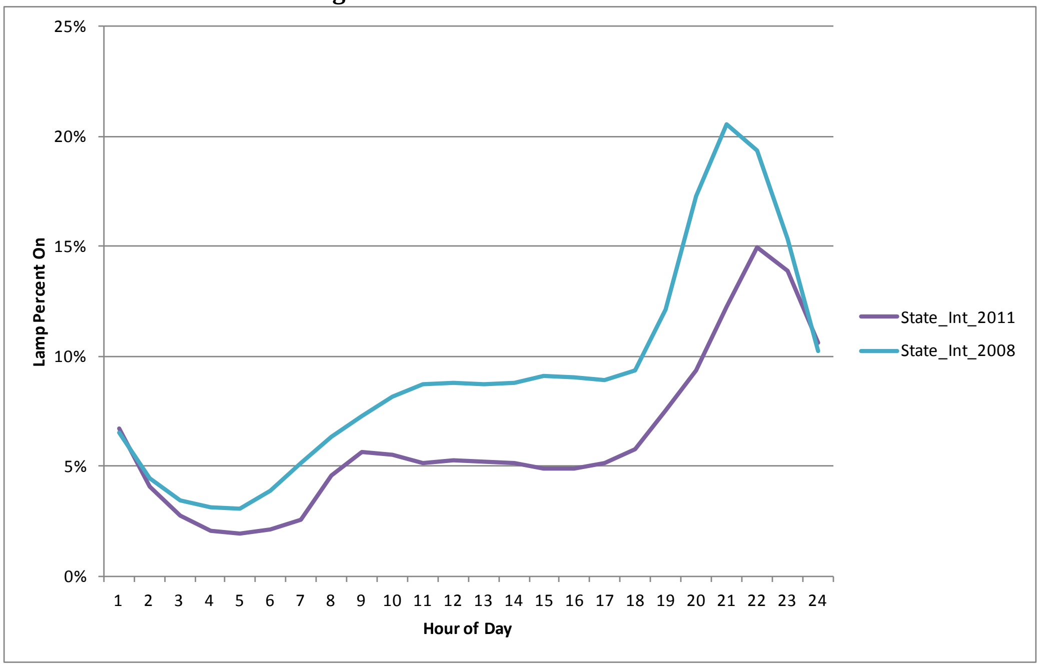
Reduction in DEER 2008 Measure Wattage Change Due to ES-Magnetic Ballast Baseline

Typical T12 Linear Fluorescent Retrofits	Reduction in Wattage Change
FL, (1) 48in, ES IS lamp, Mag, W/fixt=51 ==> FL, (1) 48in, ES T8, Prem IS Bal, W/fixt=24	30%
FL, (1) 48in, ES IS lamp, Mag, W/fixt=51 ==> FL, (1) 48in, ES T8, Prem IS Bal, W/fixt=27	33%
FL, (1) 48in, ES IS lamp, Mag, W/fixt=51 ==> FL, (1) 48in, T8 lamp, IS EB, W/fixt=31	40%
FL, (1) 48in, ES IS lamp, Mag, W/fixt=51 ==> FL, (1) 48in, T8, Prem IS EB, W/fixt=25	31%
FL, (1) 48in, ES IS lamp, Mag, W/fixt=51 ==> FL, (1) 48in, T8, Prem IS EB, W/fixt=28	35%
FL, (1) 48in, STD IS lamp, Mag, W/fixt=60 ==> FL, (1) 48in, ES T8, Prem IS Bal, W/fixt=24	22%
FL, (1) 48in, STD IS lamp, Mag, W/fixt=60 ==> FL, (1) 48in, ES T8, Prem IS Bal, W/fixt=27	24%
FL, (1) 48in, STD IS lamp, Mag, W/fixt=60 ==> FL, (1) 48in, T8 lamp, IS EB, W/fixt=31	28%
FL, (1) 48in, STD IS lamp, Mag, W/fixt=60 ==> FL, (1) 48in, T8, Prem IS EB, W/fixt=25	23%
FL, (1) 48in, STD IS lamp, Mag, W/fixt=60 ==> FL, (1) 48in, T8, Prem IS EB, W/fixt=28	25%
FL, (2) 48in, ES IS lamp, Mag, W/fixt=82 ==> FL, (2) 48in, ES T8, Prem IS Bal, W/fixt=45	27%
FL, (2) 48in, ES IS lamp, Mag, W/fixt=82 ==> FL, (2) 48in, ES T8, Prem IS Bal, W/fixt=51	32%
FL, (2) 48in, ES IS lamp, Mag, W/fixt=82 ==> FL, (2) 48in, T8 lamp, RS EB, W/fixt=54	36%
FL, (2) 48in, ES IS lamp, Mag, W/fixt=82 ==> FL, (2) 48in, T8, Prem IS EB, W/fixt=48	29%
FL, (2) 48in, ES IS lamp, Mag, W/fixt=82 ==> FL, (2) 48in, T8, Prem IS EB, W/fixt=54	36%
FL, (2) 48in, STD IS lamp, Mag, W/fixt=84 ==> FL, (2) 48in, ES T8, Prem IS Bal, W/fixt=45	26%
FL, (2) 48in, STD IS lamp, Mag, W/fixt=84 ==> FL, (2) 48in, ES T8, Prem IS Bal, W/fixt=51	30%
FL, (2) 48in, STD IS lamp, Mag, W/fixt=84 ==> FL, (2) 48in, T8 lamp, RS EB, W/fixt=54	33%
FL, (2) 48in, STD IS lamp, Mag, W/fixt=84 ==> FL, (2) 48in, T8, Prem IS EB, W/fixt=48	28%
FL, (2) 48in, STD IS lamp, Mag, W/fixt=84 ==> FL, (2) 48in, T8, Prem IS EB, W/fixt=54	33%
FL, (3) 48in, ES IS lamp, Mag, W/fixt=133 ==> FL, (3) 48in, T8 lamp, IS EB, W/fixt=78	44%
FL, (3) 48in, STD IS lamp, Mag, W/fixt=136 ==> FL, (3) 48in, T8 lamp, IS EB, W/fixt=78	41%
FL, (4) 48in, STD IS lamp, Mag, W/fixt=168 ==> FL, (4) 48in, T8 lamp, IS EB, W/fixt=102	30%

Residential Interior Lighting Profile for CFLs

The residential lighting profile used for indoor lighting in general, and for the CFL lamp replacement measure specifically, was reformulated based on the lighting logger study performed by KEMA as part of the evaluation of the 2006-2006 upstream lighting program. The profiles were updated based on a model that projects saturation of CFLs in the year 2013 and are intended to represent the typical hours of use of CFLs in that program year. The figure below compares the average annual CFL usage profiles for DEER v4.00 (2011) and v2.05 (2008).

Residential Interior CFL Usage Profile



Residential Interior CFL Operating Hours and Coincident Demand Factors

The revised interior lighting profiles also result in revised annual operating hours as well as coincident demand factors. The table below compares the 2008 and 2011 values. The table below compares DEER v4.00 (2011) and v2.05 (2008) interior CFL operating hours and CDFs.

Residential Interior CFL Operating Hours and Coincident Demand

		2011	2008
Operating Hours	Annual	541	796
	Daily	1.48	2.18
Coincident Demand Factor	CZ1	0.049	0.092
	CZ2	0.043	0.087
	CZ3	0.043	0.087
	CZ4	0.043	0.087
	CZ5	0.047	0.087
	CZ6	0.043	0.087
	CZ7	0.047	0.087
	CZ8	0.047	0.087
	CZ9	0.045	0.087
	CZ10	0.043	0.087
	CZ11	0.044	0.087
	CZ12	0.045	0.087
	CZ13	0.045	0.087
	CZ14	0.043	0.087
	CZ15	0.044	0.087
	CZ16	0.045	0.087

Residential Exterior CFL Lighting Operating Hours

Residential exterior CFL lighting operating hours have been revised based on the lighting logger study performed by KEMA as part of the evaluation of the 2006-2006 upstream lighting program. The operating hours were updated based on a model that projects saturation of CFLs in the year 2013 and are intended to represent the typical hours of use of incandescent lamps that are most likely to be replaced by CFLs in that program year. Coincident demand factors for exterior lighting remain unchanged at zero. The table below compares DEER v4.00 (2011) and v2.05 (2008) exterior hours of use.

Residential Exterior CFL Operating Hours and Coincident Demand

		2011	2008
Operating Hours	Annual	1249	1132
	Daily	3.42	3.10

Residential CFL Lighting Wattage Reduction

Residential interior and exterior CFL overall wattage reduction ratios have been revised based on the lighting logger study performed by KEMA as part of the evaluation of the 2006-2006 upstream lighting program. KEMA examined the residential lighting inventories and developed appropriate wattage ratios that were well supported by the sample sizes. The table below compares DEER v4.00 (2011) and v2.05 (2008) CFL wattage reduction ratios.

Wattage Reduction Ratio Recommendations for Short Term update

Location	Lamp Shape	DEER 2011	DEER 2008
INTERIOR	REFLECTOR	4.09	3.53
INTERIOR	ALL OTHER	3.47	3.53
EXTERIOR	All	4.07	3.53

Residential Refrigerator Equipment Rating set point

The new “EQUIP-RATED-T” keyword in DOE2 was not specified correctly for the simulation of residential refrigerators. This change impacts refrigerators simulated in the house as well as those simulated in the unconditioned garage. The specified value of 90 °F corresponds to the DOE rating condition for refrigerators, but for these simulations, the value must correspond to the temperature at which the specified “EQUIP-PWR-FT” curve returns a value of 1.0. This correction causes the simulated energy use of the refrigerators to increase by 17% in conditioned spaces and by as much as 22% in unconditioned spaces.

Peak-Period Demand Issues

In order to make results from standard energy simulation programs (specifically, eQUEST) consistent with the DEER demand impact results, the calculation used by the MAS tool to determine the demand impact was modified. The basic calculation remains the same: the demand savings due to an energy efficiency measure is calculated as the average reduction in energy use over a defined nine-hour demand period. The previous database version used the smoothed hourly impacts as the basis for these calculations while the latest version uses the non-modified results from the DOE2 simulations.

The difference in the demand values between these two methods is typically quite small, but occasional large deviations from expected values were observed. Changes to the HVAC control scheme for the affected system types were required in order to produce reliable demand results. These changes to the HVAC controls resulted in very little difference to the annual energy savings, but much more predictable behavior during the peak demand period. The following changes were implemented for all appropriate system types:

- Night cycle control setpoints were expanded (max 60 for heating and a minimum of 86 for cooling) so that the number of hours of night-cycling would not change significantly between the base and measures simulations. Changes in the hours of night cycle control would occasionally shift the cooling load by an hour and result in relatively large differences in the hourly energy use of the base and measure simulations during the demand period.
- Outside air is turned off during night cycle control; though rare, the induction of some latent load associated with the outside air flow during night-cycling could exasperate the night-cycle issue discussed above.
- Space heating is turned off during the peak cooling period; though rare, the occasional need for space heating during the cooling season in some climate zones would shift cooling demands by an hour and cause large changes in the hourly demand between a base case simulation with high lighting loads and a measure case with low lighting loads.

- A single chiller is used for non-HVAC measures; this prevents a step-function change in demand when the controller switches between one and two chillers. When appropriate, multiple chillers are still used for the analysis of HVAC measures.

Additions to the DEER database

A number of additions were made to the DEER database at the request of the IOUs. The following list summarizes these new entries:

- **Non-residential lighting fixtures**; over 100 new lighting measures were added to the database. Refer to the accompanying spreadsheet for a description of all changes and additions.
- **Updates for Code Baselines Based on EPACT and 2008 Title 24:** For fixture replacement and early retirement measures that are covered by Title 24 LPD requirements, linear fluorescent fixture code baselines were revised to reflect the typical fixture needed to meet the new maximum installed lighting power requirements. In general, second generation T8 lamps and electronic ballasts are required. For retrofit measures, code baselines were revised or added to all four foot and 8 foot linear fluorescent measures to reflect the July 2012 federal prohibition of manufacture and sale of T12 lamps and magnetic ballasts. All code baselines now assume T8 lamps and electronic ballasts.
- A total of **14 hot water and steam boiler measures** were added to the non-residential measure list.
- **Clothes washer and dishwasher measures** were added for all residential building types, including the multi-family apartment building.
- **Residential multi-family prototype** is now included in the database. All residential measures defined for the single-family building type have adapted to the multi-family prototype. Additional measures specific to the multi-family building type have also been added, including common water heater measure and common clothes washer measures.
- **Residential and nonresidential high efficiency heat pump measures** are now included in the database. These include residential heat pumps ranging from 13 SEER to 18 SEER and nonresidential heat pumps that align with the latest high efficiency tiers established by the Consortium for Energy Efficiency (CEE.)
- **Residential insulation retrofit** measures have been updated from the 2005 results included in v2.05. All simulation updates discussed above have been utilized in developing UES values for these measures. In v2.05 ceiling batt insulation measures were defined with a base of no insulation and various measure levels equal to standard batt insulation levels such as R-11, R-19 and R-30. These measure definitions have been revised to add standard batt insulation levels to the typical insulation for a particular home vintage as defined in DEER.

- **Agricultural greenhouse retrofit** measures have been updated to reflect results of impact evaluation work from 2006-2008 PG&E Agricultural and Food Processing Program. The changes include the improvements listed below.
  1. The measures may be taken individually, in combination or with baselines that include one of the other measures (e.g. that addition of a thermal curtain to a greenhouse that already has IR film on its roofing material.)
  2. The EUS values include two heating system types, a standard over-head gas-fired unit heater and a floor level radiant heating system (typically steam or hot water circulated through piping within the greenhouse.)
  3. Revised greenhouse simulation models for greenhouses with overhead heating systems developed in 2008 for and confirmed by the 2006-2008 PG&E Agricultural and Food Processing Program impact evaluation. These model changes addressed major issues that affected energy savings associated with the various measures - predominantly prior incorrect temperature stratification assumptions.
  4. The 2006-2008 impact evaluation found that radiant heating systems will dramatically reduce the savings due to the elimination of temperature stratification within the greenhouse. Stratification increased energy use as temperatures above the greenhouse are higher, resulting in a larger heating load that would occur if the temperature were uniform. The 2006-2008 report notes this a major contributing factor to low realization rates (39% for IR film measures and 62% for thermal curtains). The measure updates reflect the addition of this heating system type which was identified as the primary type of heating system utilized in California greenhouses.
  5. IR films attached to walls and single-layer roofing materials are included in the database showing zero savings.

- **Select non-updated results from DEER2005 retired**:
  Non-updated measures from the DEER2005 database that were included in the DEER2008 database were evaluated for relevancy in the current planning cycle. Measure that were updated in version 3.02 or 4.00 were dropped as were measures that are either no longer relevant or covered by updated IOU workpapers. See the appendix for the status of all DEER 2005 measures include in the previous version.

Changes to the DEER database Structure

The format for the DEER2011 Measure and Energy Impact tables follow the new SPTdb format developed by ED and presented in these documents available on the DEEResources.com web site:

- Updated SPTdb Tables and Reporting process - 1Sept2011.pdf
- The new SPT database - 2Sept2011.pptx
- SPT Data Format with Examples -version 0.97.xls

The new format makes extensive use of a standardized set of classification fields to identify measures and technologies and is part of the common format that will be used for all ED measure information reporting.

All DEER UES results that are part of the DEER2011 database are included in the new database. The source for all UES values are identified as one of the following:

- **DEER2005 v2.01**
  Non-updated results from the DEER2005 database that are still relevant.
- **DEER2008 v2.05**
  Results from the official release of the DEER2008 database.
- **DEER2008 v3.02**
  Results from the updated DEER2008 database that were referenced as version 3.02. Includes HVAC interactive effects results that weight indoor lighting measures across applicable HVAC system types.
- **DEER2011 v4.00**
  New results for this release.

READI ("Remote Ex-Ante Database Interface") is a database tool developed to give users access to all of the DEER2011 data via a remote connection to the ED database. An internet connection and access through ports 22 or 5432 is required to use the program. The latest version of the program can be found on the DEEResources.com web site.

Changes to the DEER Results

The accumulation of changes listed in this document has caused a large portion of the DEER energy impact results to change at least slightly. Some updates have caused specific results to change significantly, such as the large office lighting profile fix.

Other changes, such as the various HVAC control and sizing issues listed above, have had only a small effect on the electricity energy and demand results, but have a profound effect on the secondary natural gas impact. In almost all cases, the heating energy "take back" associated with commercial lighting measures has decreased dramatically (on the order of 25 – 60%).

Figure 1 shows the large decrease in the negative gas impacts for a lighting measure in the multi-story retail building prototype. This result is typical of prototypes with central plant HVAC systems and is largely due to changes in the control mechanism of the oldest vintage HVAC system and the fix to the boiler sizing.

Figure 2 shows the same type of results for the small office building prototype, a building with packaged HVAC equipment. In this case, there is very little difference in the negative gas impacts since the two changes mentioned above do not apply to packaged HVAC equipment.

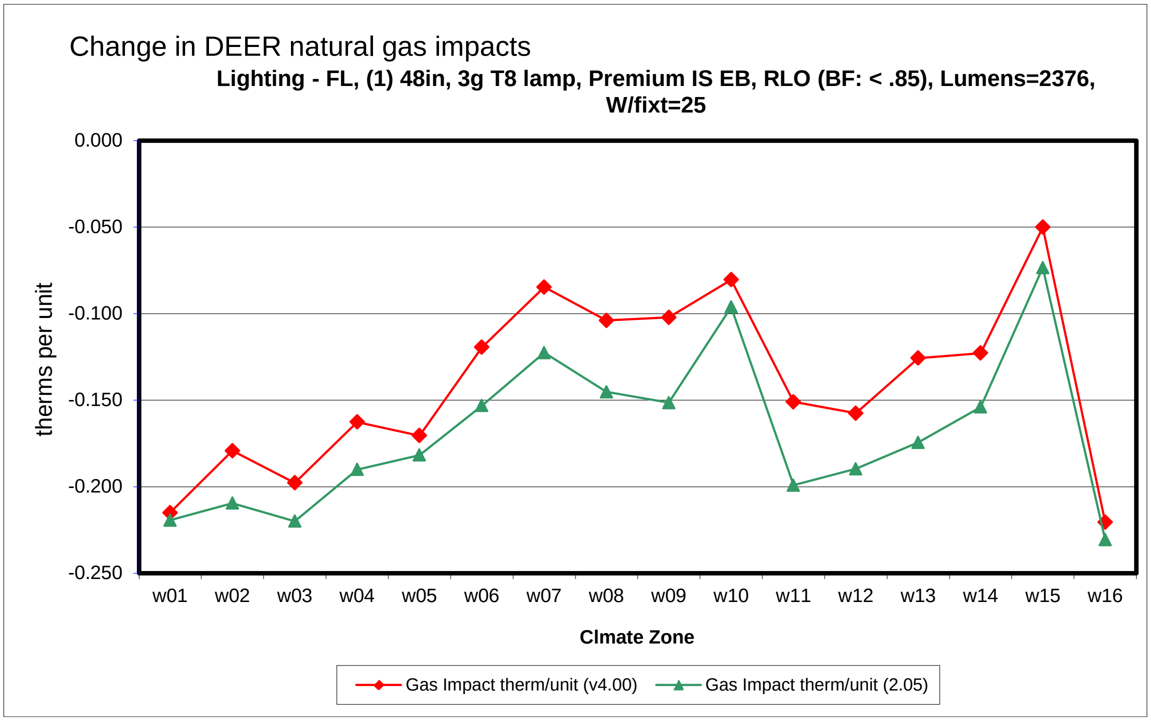


Figure 1. Showing a large decrease in the gas heating "take back" associated with a lighting measure in the **Multi-Story Retail, Existing Vintage** prototype

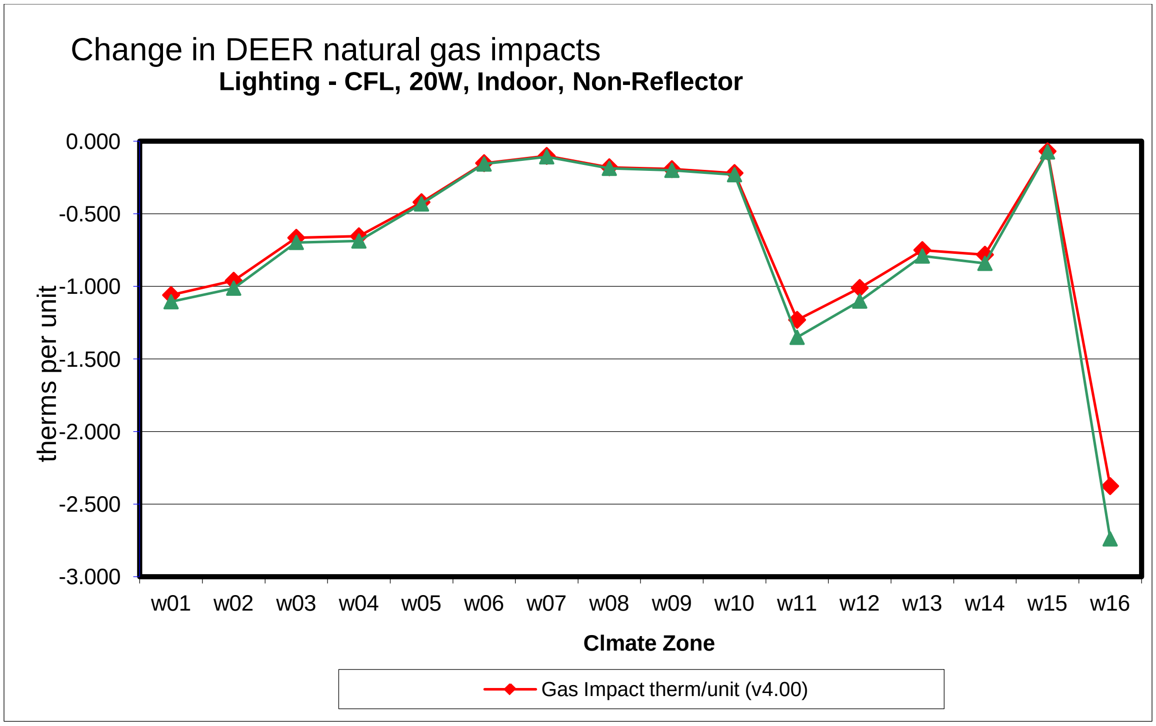


Figure 2. Showing a small change in gas heating "take back" associated with a lighting measure in the **Small Office Building, Existing Vintage** prototype

Figure 3 shows the energy and demand impacts for the recent vintage large office building prototype. The change in demand savings in climate zones CZ01, CZ03 and CZ05 is due to the design chiller size decreasing by approximately 20% in these climate zones. The change in chiller design size is a direct results of the economizer set point issue discussed above.

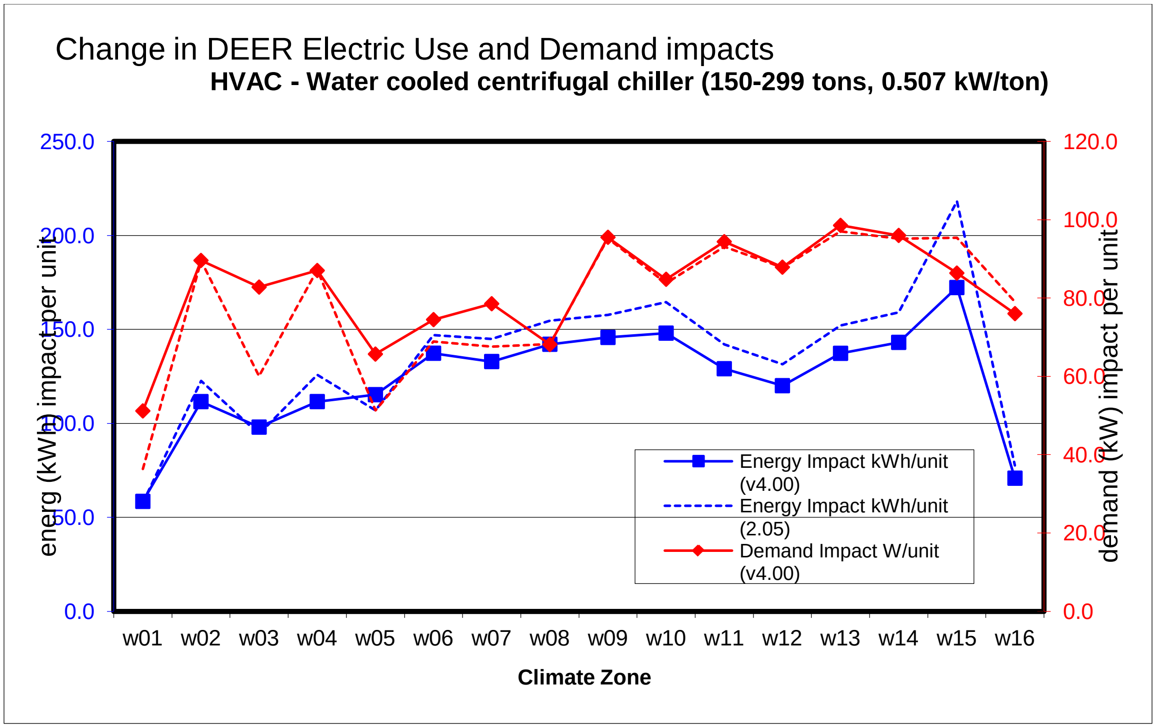


Figure 3. Showing the change in demand impacts for climate zones CZ01, CZ03 and CZ05 for the **Large Office Building, 2002-2005 Vintage** prototype

Figure 4 shows the decrease in the gas energy savings per kBTUh capacity for a hot water system in the small office prototype. This decrease per unit of capacity is due to the increase in assumed heating capacity of the hot water system, as discussed above. The actual energy savings in total therms is actually slightly larger in the new version, but the capacity increased by 25% in this case.

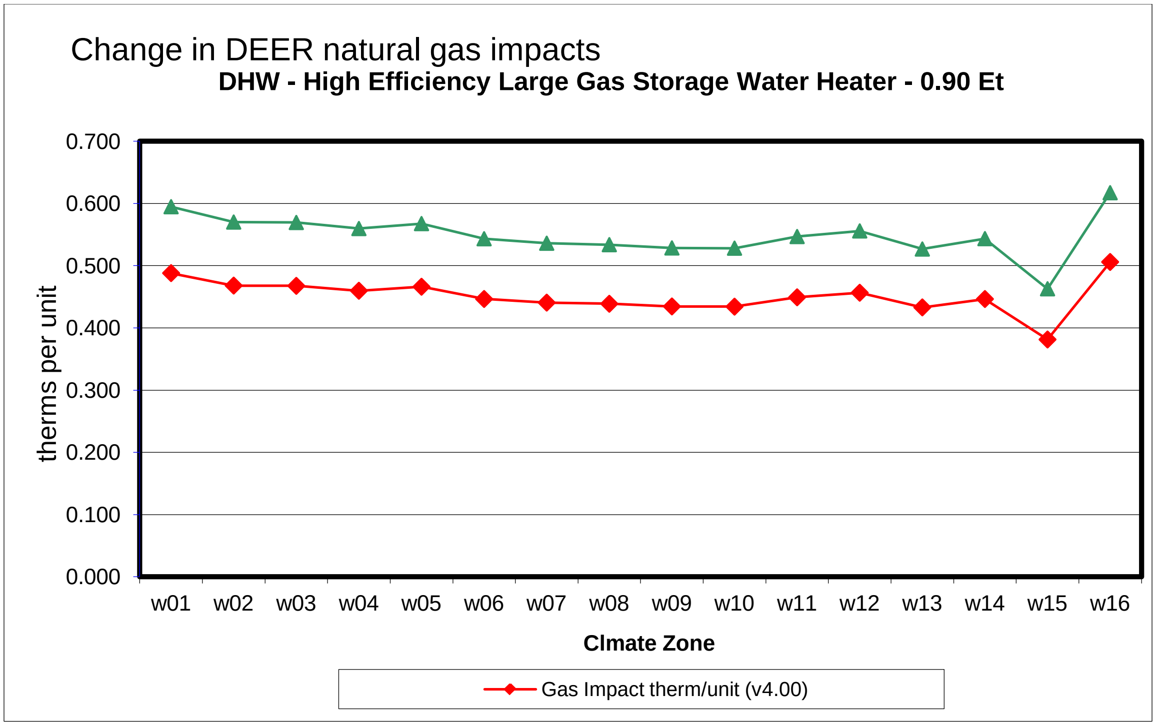


Figure 4. Showing the decrease in gas savings per kBTUh capacity of the hot water system for the **Small Office Building, Existing vintage** prototype

For the residential models, the largest change in the results is due to the DOE2.2 bug-fix that corrected the amount of outside air associated with duct losses to the outside. Figure 5 shows a significant drop in the demand and energy savings in most climate zones for a SEER 14 HVAC measure applied to the mobile home prototype. The earlier database savings values were exaggerated, especially in the hotter climate zones, due to the bug that increased the cooling and heating loads and made the duct system appear to be extremely inefficient. The mobile home prototype is assumed to have no return ductwork, thus all duct leakage is lost to the outside. The DOE2.2 code was basically doubling duct air losses to the outside before the bug fix.

This issue did not impact the single-family residence to the same degree, as a smaller fraction of the total duct air loss is assumed to be to the outside. Figure 6 shows the same impacts for the single-family residence; in this case the savings increase overall, and the largest decrease is on the order of a few percent.

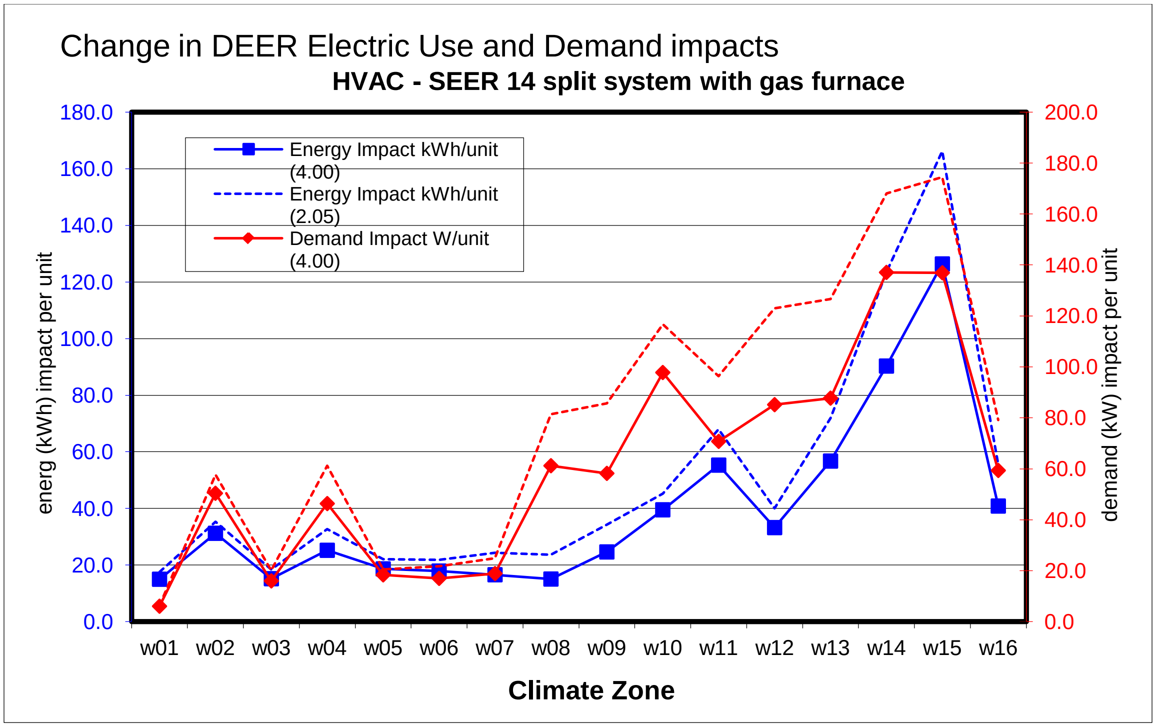


Figure 5. Showing a significant decrease in electricity energy and demand savings for an HVAC measures applied to the **Mobile Home, Existing Vintage** prototype

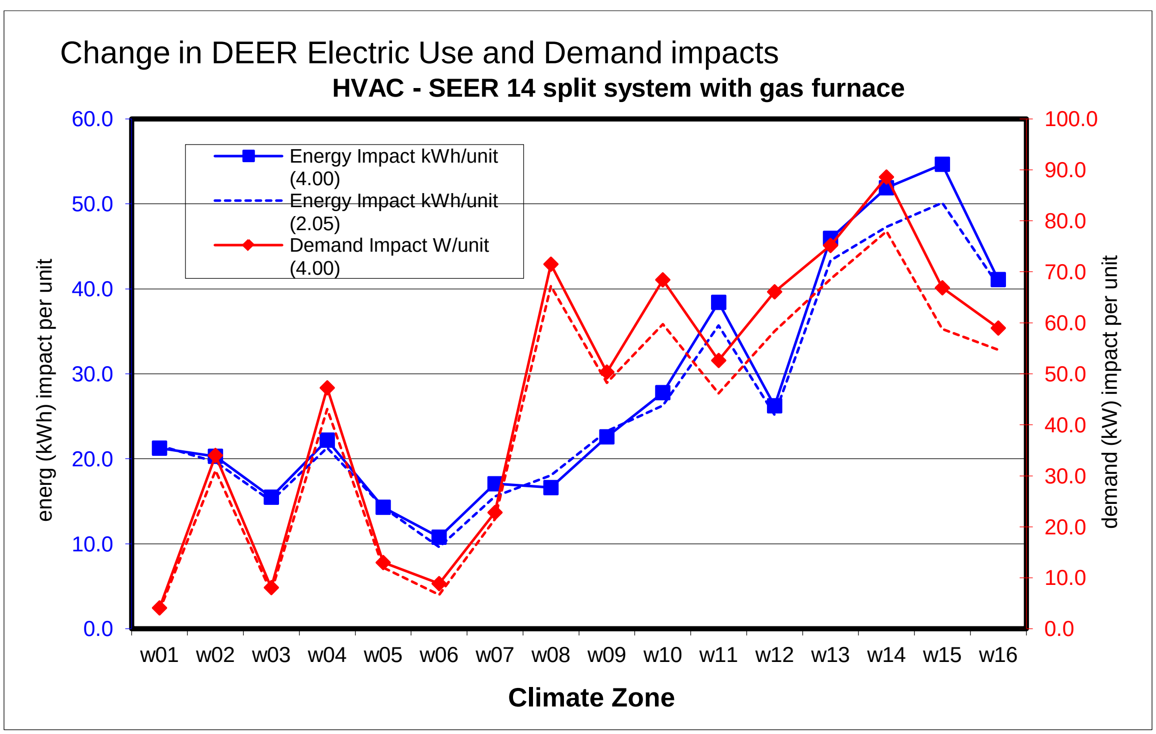
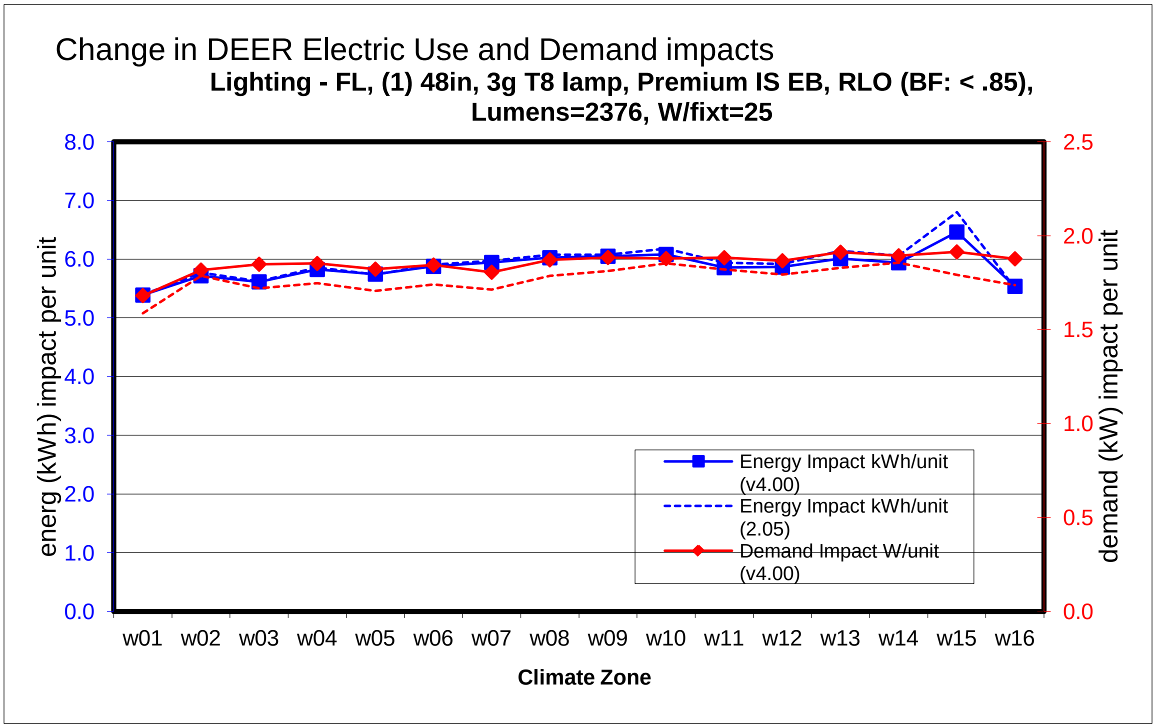


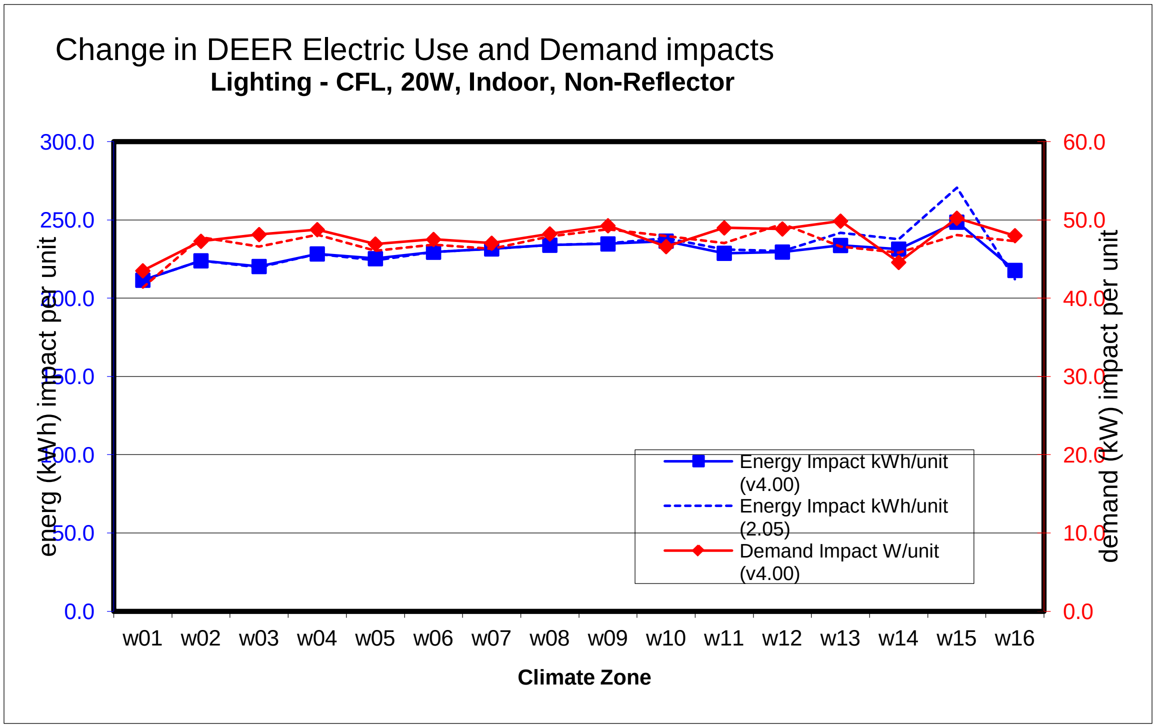
Figure 6. Showing a small change in electricity energy and demand savings for an HVAC measures applied to the **Single-Family, Existing Vintage** prototype

The accompanying spreadsheet "DEEER Database - Compare v2.05 to v4.00.xls." demonstrates the changes in energy impacts for a variety of building types, measures categories and climate zones, including the weighted IOU territories. Some sample graphs from this workbook are provided below:

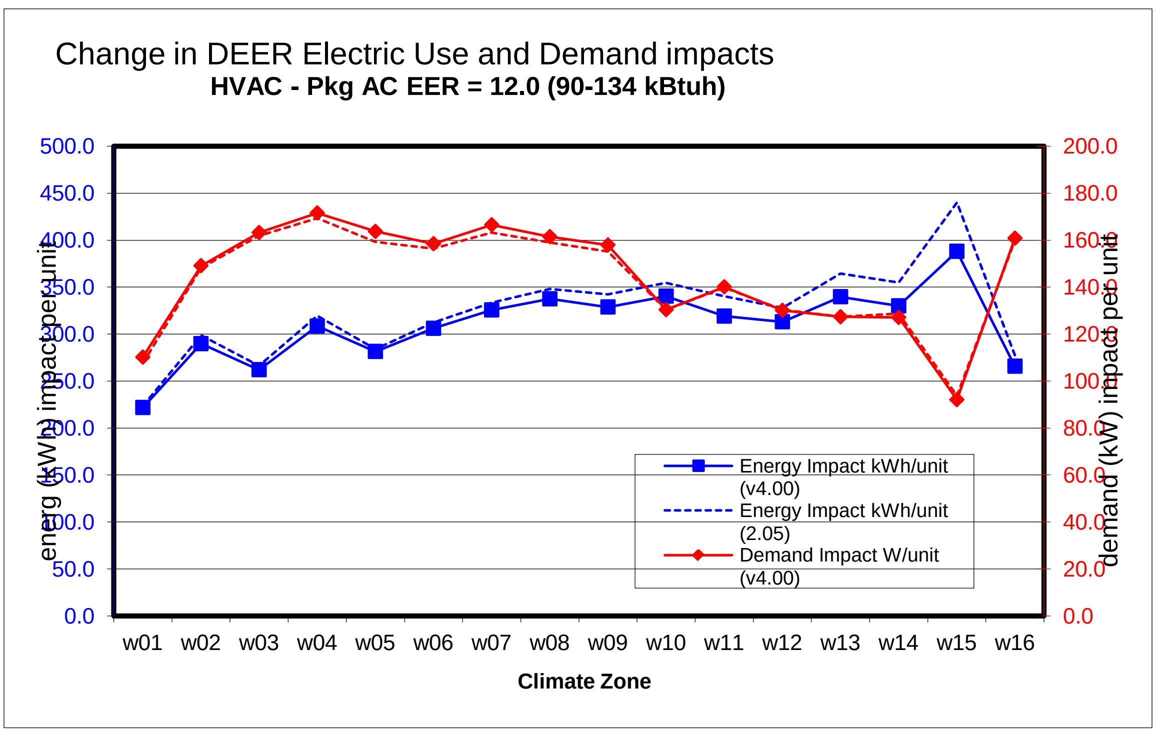
Nonresidential Linear Fluorescent Measure for Small Office



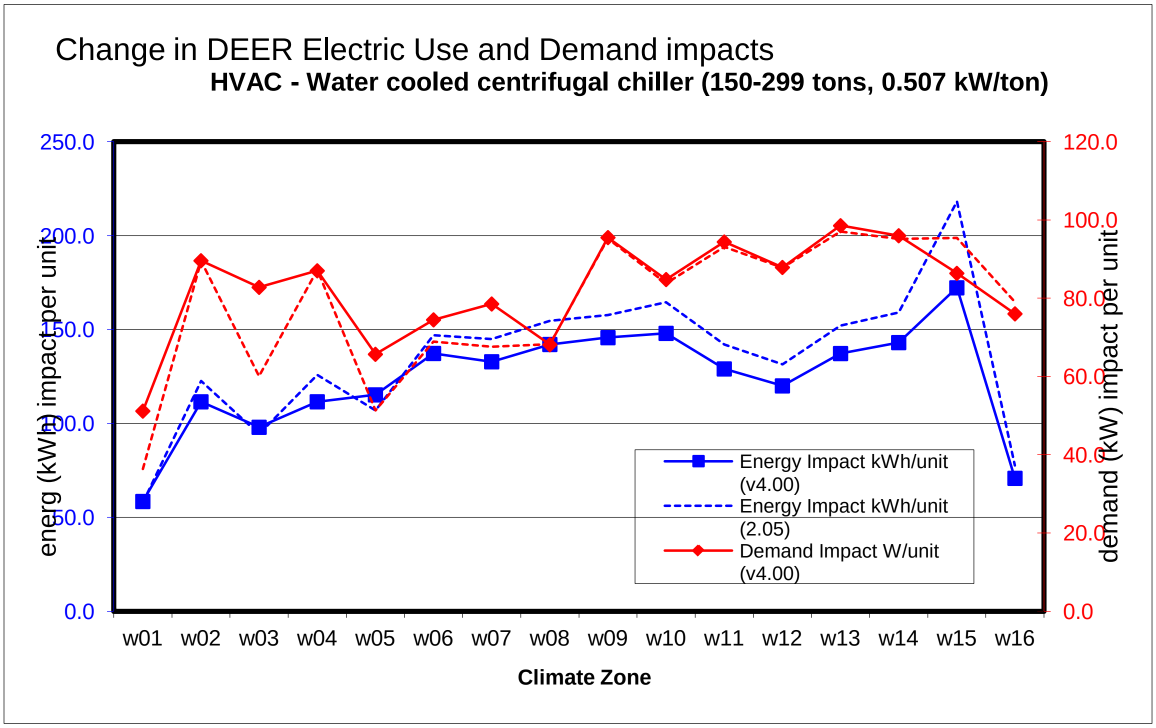
CFL Measure for Small Retail



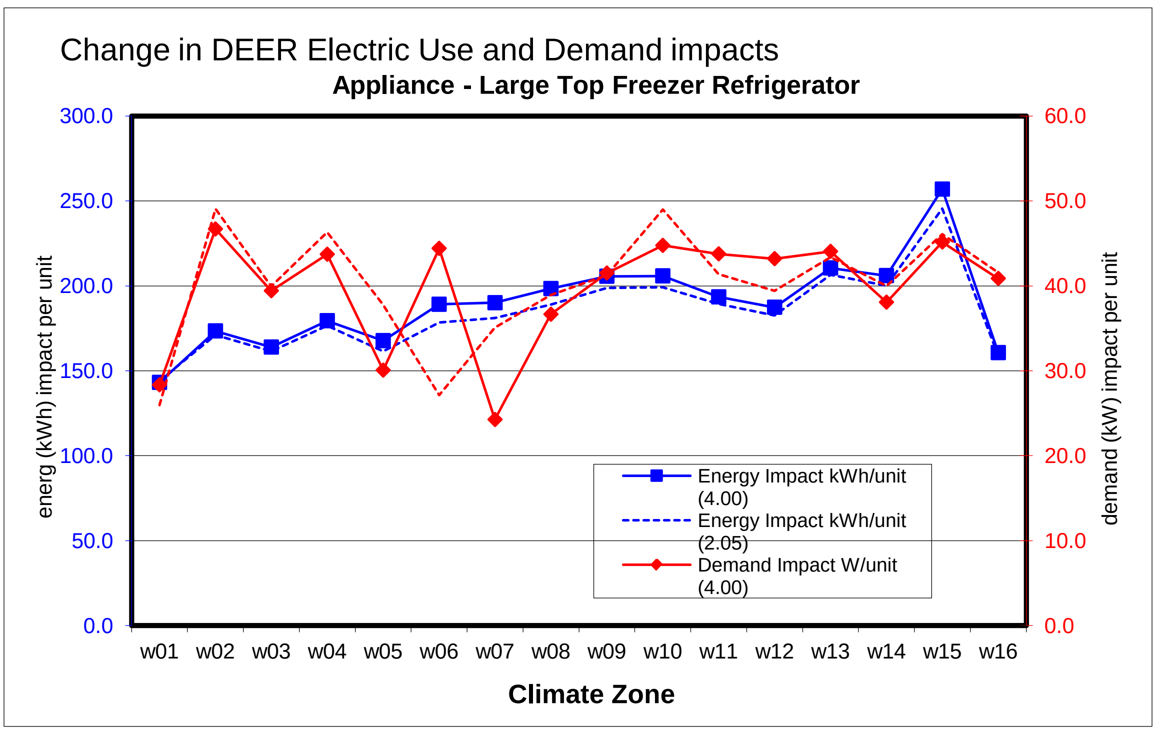
Package HVAC Measure for Small Office



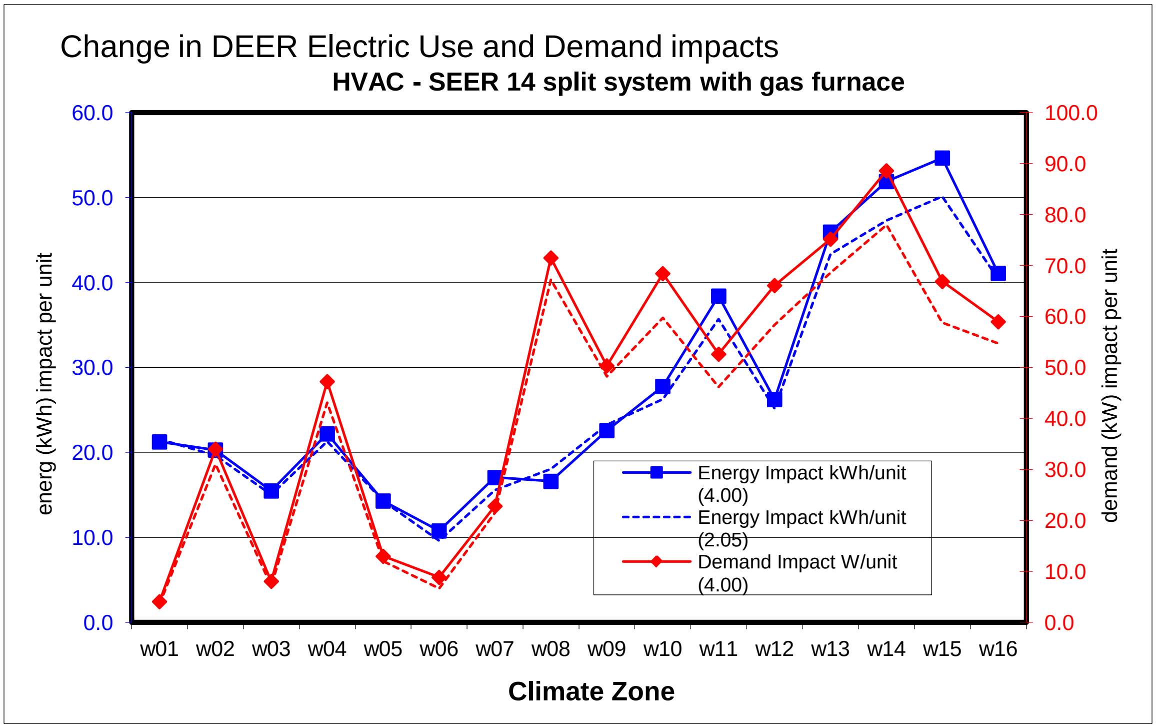
Chiller Measure for Large Office



New Refrigerator Measure for Single Family



Package HVAC Measure for Single Family



Appendix – Lighting Operating Hours and Coincident Demand Factors

LINEAR FLUORESCENT AND HIGH BAY FIXTURES			--- Linear Fluorescent/High Bay Coincident Demand Factors ---												
Building Type	Operating Hours	CDF (range)*	CZ1 (or all)	CZ2	CZ3	CZ4	CZ5	CZ6	CZ7	CZ8	CZ9	CZ10	CZ11	CZ12	CZ13
Assembly	2610	0.53	0.53	--	--	--	--	--	--	--	--	--	--	--	--
Primary School	2140	0.02 - 0.62	0.62	0.02	0.02	0.02	0.62	0.02	0.62	0.62	0.02	0.02	0.02	0.02	0.02
Secondary School	2280	0.02 - 0.71	0.71	0.02	0.02	0.02	0.71	0.02	0.71	0.71	0.02	0.02	0.02	0.02	0.02
Community College	2420	0.02 - 0.81	0.81	0.49	0.49	0.49	0.81	0.49	0.81	0.81	0.49	0.49	0.49	0.49	0.02
University	2350	0.03 - 0.72	0.72	0.44	0.44	0.44	0.72	0.44	0.72	0.72	0.44	0.44	0.44	0.44	0.03
Relocatable Classroom	2480	0.02 - 0.7	0.70	0.02	0.02	0.02	0.70	0.02	0.70	0.70	0.02	0.02	0.02	0.02	0.02
Grocery	4910	0.69	0.69	--	--	--	--	--	--	--	--	--	--	--	--
Hospital	5260	0.83	0.83	--	--	--	--	--	--	--	--	--	--	--	--
Nursing Home	4160	0.68	0.68	--	--	--	--	--	--	--	--	--	--	--	--
Hotel	1950	0.24	0.24	--	--	--	--	--	--	--	--	--	--	--	--
Motel	1550	0.17	0.17	--	--	--	--	--	--	--	--	--	--	--	--
Bio/Tech Manuf.	3530	0.85	0.85	--	--	--	--	--	--	--	--	--	--	--	--
Light Industrial Manuf.	3220	0.92	0.92	--	--	--	--	--	--	--	--	--	--	--	--
Large Office	2640	0.71	0.71	--	--	--	--	--	--	--	--	--	--	--	--
Small Office	2590	0.69	0.69	--	--	--	--	--	--	--	--	--	--	--	--
Sit-Down Restaurant	4830	0.80	0.80	--	--	--	--	--	--	--	--	--	--	--	--
Fast-Food Restaurant	4840	0.81	0.81	--	--	--	--	--	--	--	--	--	--	--	--
Department Store	3380	0.76	0.76	--	--	--	--	--	--	--	--	--	--	--	--
Big Box Retail	4270	0.85	0.85	--	--	--	--	--	--	--	--	--	--	--	--
Small Retail	3380	0.88	0.88	--	--	--	--	--	--	--	--	--	--	--	--
Conditioned Storage	3420	0.70	0.70	--	--	--	--	--	--	--	--	--	--	--	--
Unconditioned Storage	3420	0.70	0.70	--	--	--	--	--	--	--	--	--	--	--	--
Refrigerated Warehouse	4770	0.56	0.56	--	--	--	--	--	--	--	--	--	--	--	--

COMPACT FLUORESCENT LAMPS			--- Compact Fluorescent Coincident Demand Factors ---												
Building Type	Operating Hours	CDF (range)*	CZ1 (or all)	CZ2	CZ3	CZ4	CZ5	CZ6	CZ7	CZ8	CZ9	CZ10	CZ11	CZ12	CZ13
Assembly	2300	0.41	0.41	--	--	--	--	--	--	--	--	--	--	--	--
Primary School	2240	0.02 - 0.63	0.63	0.02	0.02	0.02	0.62	0.02	0.62	0.62	0.02	0.02	0.02	0.02	0.02
Secondary School	2330	0.02 - 0.72	0.72	0.02	0.02	0.02	0.71	0.02	0.71	0.71	0.02	0.02	0.02	0.02	0.02
Community College	2420	0.02 - 0.81	0.65	0.42	0.49	0.49	0.81	0.49	0.81	0.81	0.49	0.49	0.49	0.49	0.02
University	2370	0.03 - 0.72	0.67	0.44	0.44	0.44	0.72	0.44	0.72	0.72	0.44	0.44	0.44	0.44	0.03
Relocatable Classroom	2600	0.02 - 0.73	0.73	0.02	0.02	0.02	0.70	0.02	0.70	0.70	0.02	0.02	0.02	0.02	0.02
Grocery	3890	0.49	0.49	--	--	--	--	--	--	--	--	--	--	--	--
Hospital	4200	0.72	0.72	--	--	--	--	--	--	--	--	--	--	--	--
Nursing Home	3570	0.56	0.56	--	--	--	--	--	--	--	--	--	--	--	--
Hotel	1670	0.20	0.20	--	--	--	--	--	--	--	--	--	--	--	--
Motel	1370	0.15	0.15	--	--	--	--	--	--	--	--	--	--	--	--
Bio/Tech Manuf.	3090	0.78	0.78	--	--	--	--	--	--	--	--	--	--	--	--
Light Industrial Manuf.	2580	0.78	0.78	--	--	--	--	--	--	--	--	--	--	--	--
Large Office	3000	0.63	0.63	--	--	--	--	--	--	--	--	--	--	--	--
Small Office	2980	0.68	0.68	--	--	--	--	--	--	--	--	--	--	--	--
Sit-Down Restaurant	4830	0.80	0.80	--	--	--	--	--	--	--	--	--	--	--	--
Fast-Food Restaurant	4810	0.81	0.81	--	--	--	--	--	--	--	--	--	--	--	--
Department Store	3710	0.63	0.63	--	--	--	--	--	--	--	--	--	--	--	--
Big Box Retail	4350	0.69	0.69	--	--	--	--	--	--	--	--	--	--	--	--
Small Retail	4010	0.70	0.70	--	--	--	--	--	--	--	--	--	--	--	--
Conditioned Storage	2760	0.57	0.57	--	--	--	--	--	--	--	--	--	--	--	--
Unconditioned Storage	2760	0.57	0.57	--	--	--	--	--	--	--	--	--	--	--	--
Refrigerated Warehouse	4730	0.55	0.55	--	--	--	--	--	--	--	--	--	--	--	--

Appendix – Status of 2005 DEER Measures

DEER 2005 Measure ID	Sector	**Included in DEER 2011?**	Reason for Removing	Measure Name	Measure Description
D03-001	NonRes	FALSE	Modeling method updated	Reduced Lighting - 10% reduction	all lighting levels reduced by 10%
D03-002	NonRes	FALSE	Modeling method updated	Reduced Lighting - 40% reduction	all lighting levels reduced by 40%
D03-003	NonRes	TRUE		Small area lighting sensor control	lighting level reduced based on bldg type, activity area
D03-004	NonRes	TRUE		Large area lighting sensor control	lighting level reduced based on bldg type, activity area
D03-005	NonRes	TRUE		Add daylighting controls to side-lit space w/ cont. ctrl	add daylighting controls, min. lumen level based on bldg type
D03-006	NonRes	TRUE		Add daylighting controls to side-lit space w/ 2-step ctrl	add daylighting controls, min. lumen level based on bldg type
D03-007	NonRes	TRUE		Add daylighting controls to top-lit space w/ cont. ctrl	add daylighting controls, min. lumen level based on bldg type
D03-008	NonRes	TRUE		Add daylighting controls to top-lit space w/ 1-step ctrl	add daylighting controls, min. lumen level based on bldg type
D03-009	NonRes	TRUE		Add daylighting controls to top-lit space w/ 2-step ctrl	add daylighting controls, min. lumen level based on bldg type
D03-010	NonRes	TRUE		EMS system reduced unoccupied lighting levels	minimum unoccupied lighting power density based on bldg type
D03-011	NonRes	FALSE	Modeling method updated	Plug Loads reduced by 5%	all plug loads reduced by 5%
D03-012	NonRes	FALSE	Modeling method updated	Plug Loads reduced by 10%	all plug loads reduced by 10%
D03-013	NonRes	TRUE		Older building ceiling/roof insulation up to current standards	Ceiling R-value for oldest vintages increased to 'new' level
D03-014	NonRes	FALSE	no longer needed	Insulation added to poorly insulated DHW tanks	Approximately R-12 tank insulation, based on tank size
D03-016	NonRes	TRUE		Light Colored Roof	Roof absorptivity = 0.45

D03-017	NonRes	TRUE	North glass SHGC 15% less than required	North glass SHGC 15% less than required by T-24
D03-018	NonRes	TRUE	East glass SHGC 20% less than required	East glass SHGC 20% less than required by T-24
D03-019	NonRes	TRUE	South glass SHGC 20% less than required	South glass SHGC 20% less than required by T-24
D03-020	NonRes	TRUE	West glass SHGC 20% less than required	West glass SHGC 20% less than required by T-24
D03-021	NonRes	TRUE	North glass SHGC 20% less than required	North glass SHGC 20% less than required by T-24
D03-022	NonRes	TRUE	East glass SHGC 30% less than required	East glass SHGC 30% less than required by T-24
D03-023	NonRes	TRUE	South glass SHGC 30% less than required	South glass SHGC 30% less than required by T-24
D03-024	NonRes	TRUE	West glass SHGC 30% less than required	West glass SHGC 30% less than required by T-24
D03-025	NonRes	TRUE	High perf glass (PI 1.15) and cont dayltg ctrls in side-lit spaces	glass w/ indicated performance index in daylit spaces, cont. ctrl
D03-026	NonRes	TRUE	High perf glass (PI 1.26) and cont dayltg ctrls in side-lit spaces	glass w/ indicated performance index in daylit spaces, cont. ctrl
D03-027	NonRes	TRUE	High perf glass (PI 1.38) and cont dayltg ctrls in side-lit spaces	glass w/ indicated performance index in daylit spaces, cont. ctrl
D03-028	NonRes	TRUE	High perf glass (PI 1.15) and 2-step dayltg ctrls in side-lit spaces	glass w/ indicated performance index in daylit spaces, 2-step ctrl
D03-029	NonRes	TRUE	High perf glass (PI 1.26) and 2-step dayltg ctrls in side-lit spaces	glass w/ indicated performance index in daylit spaces, 2-step ctrl
D03-030	NonRes	TRUE	High perf glass (PI 1.38) and 2-step dayltg ctrls in side-lit spaces	glass w/ indicated performance index in daylit spaces, 2-step ctrl
D03-031	NonRes	TRUE	High perf glass (PI 0.81) and cont dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, cont. ctrl
D03-032	NonRes	TRUE	High perf glass (PI 0.92) and cont dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, cont. ctrl
D03-033	NonRes	TRUE	High perf glass (PI 1.03) and cont dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, cont. ctrl
D03-034	NonRe	TRUE	High perf glass (PI 0.81) and 1-step dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit

	s				spaces, 1-step ctrl
D03-035	NonRes	TRUE		High perf glass (PI 0.92) and 1-step dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, 1-step ctrl
D03-036	NonRes	TRUE		High perf glass (PI 1.03) and 1-step dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, 1-step ctrl
D03-037	NonRes	TRUE		High perf glass (PI 0.81) and 2-step dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, 2-step ctrl
D03-038	NonRes	TRUE		High perf glass (PI 0.92) and 2-step dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, 2-step ctrl
D03-039	NonRes	TRUE		High perf glass (PI 1.03) and 2-step dayltg ctrls in top-lit spaces	skylight w/ indicated performance index & T24 reqmts in daylit spaces, 2-step ctrl
D03-040	NonRes	FALSE	Updated in v4.00	Centrifugal chillers (< 150 tons) with improved kW/ton	Water cooled centrifugal chiller (0.560 kW/ton)
D03-041	NonRes	FALSE	Updated in v4.00	Reciprocating air-cooled chillers with improved kW/ton	Air cooled package reciprocating chiller (1.008 kW/ton)
D03-042	NonRes	FALSE	Updated in v4.00	VSD Centrifugal Chiller (< 150 tons) w/Load control tower	Water cooled VSD centrifugal chiller (0.560 kW/ton), load control tower
D03-043	NonRes	FALSE	no longer needed	Gas Absorption Central Chiller (direct fired)	Gas absorption chiller (direct fired) (0.0071 EIR, 1.0 HIR)
D03-044	NonRes	TRUE		Chilled Water Loop temperature control	Chilled water loop temperature set to 'Load Reset'
D03-045	NonRes	TRUE		Hot Water Loop temperature control	Hot water loop temperature set to 'Load Reset'
D03-046	NonRes	TRUE		Replace 3-way valves in CHW loop with 2-way	2-way valves, with single speed pump
D03-047	NonRes	TRUE		Variable speed drive for chilled water loop	add variable speed pump to chilled water loop
D03-048	NonRes	TRUE		Replace 3-way valves in HW loop with 2-way	2-way valves, with single speed pump
D03-049	NonRes	TRUE		Variable speed drive for hot water loop	add variable speed pump to hot water loop
D03-050	NonRes	TRUE		VAV box retrofit on constant volume system	damper controlled VAV with 30% min-cfm-ratio
D03-051	NonRes	TRUE		Variable Frequency Drive motors use on VAV fans	VFD with 30% min-cfm-ratio

D03-052	NonRes	FALSE	no longer needed	Convert VAVS system to PIU system	Convert VAVS sytem to PIU system
D03-053	NonRes	TRUE		Make-up Air Indirect Evaporative cooling	indirect evap cooling for make-up air only, 65% effectiveness
D03-054	NonRes	TRUE		Make-up Air Indirect Evaporative cooling	indirect evap cooling for make-up air only, 65% effectiveness
D03-055	NonRes	TRUE		Base ventilation rate 25% higher than required	standard ventilation rate
D03-056	NonRes	TRUE		heat recovery from exhaust hoods	70% heat recovery effectiveness
D03-057	NonRes	TRUE		rotary air-to-air enthalpy heat recovery	70% sensible and latent recovery effectiveness
D03-058	NonRes	TRUE		Packaged system Economizer retrofit	Add econo with Econo-Lockout=NO, DB limit = 68, Max OSA = 100%
D03-059	NonRes	TRUE		Central HVAC system Economizer retrofit	Add ecomizer with Econo-Lockout=NO, DB limit = 68, Max OSA = 100%
D03-060	NonRes	TRUE		Restore degraded economizer performance	ecomizer with Econo-Lockout=NO, DB limit = 68, Max OSA = 100%
D03-061	NonRes	FALSE	requires update	Dirty Air-cooled condenser coils are cleaned	standard equipment efficiency
D03-062	NonRes	TRUE		Convert Air-Cooled Condenser to Water-Cooled	packaged system with water cooled condenser
D03-063	NonRes	TRUE		Two-Speed Tower Fans replace Single-Speed	Two-speed tower fans on all central plants
D03-064	NonRes	TRUE		Variable-Speed Tower Fans replace Two-Speed	Variable-speed tower fans on all central plants
D03-065	NonRes	TRUE		High efficiency gas furnace replace std efficiency	packaged system with 94 AFUE furnace
D03-066	NonRes	FALSE	Updated in v4.00	High efficiency Large boiler (>300 kBTU/hr)	Central boiler with efficiency of 85%
D03-067	NonRes	FALSE	Updated in v4.00	High efficiency Small boiler (<300 kBTU/hr)	Central boiler with efficiency of 84.5%
D03-068	NonRes	FALSE	Updated in v4.00	High efficiency Steam boiler (<300 kBTU/hr)	Central steam boiler with efficiency of 84%
D03-069	NonRe	TRUE		High efficiency WLHP system for Large Office	WLHP system with 14.0 EER / 4.6 COP

	s				
D03-070	NonRes	TRUE		Variable flow hydronic water loop	2-way valves, with VSD pumping
D03-071	NonRes	TRUE		time clocks control packaged system operation	Supply fan operation matches building operation
D03-072	NonRes	FALSE	requires update	Suite of EMS measures	CHW & HW reset, reduced nighttime lighting levels
D03-073	NonRes	TRUE		Install programmable thermostats in older bldgs	unoccupied period has heating setback/cooling setup
D03-075	NonRes	TRUE		Increased duct insulation in older vintages	Old vintage increases duct insulation to R-4.2, 78-91 vintage to R-8
D03-076	NonRes	FALSE	Updated in v4.00	High eff. packaged split system A/C (< 65k, single phase)	14 SEER (12.15 EER) Split-System Air Conditioner
D03-077	NonRes	FALSE	Updated in v4.00	High eff. packaged split system HP (< 65k, single phase)	14 SEER (12.19 EER) / 8.6 HSPF (3.52 COP) A/C Heat Pump
D03-078	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system A/C (< 65k, single phase)	14 SEER (12.15 EER) Package Air Conditioner
D03-079	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system A/C (65-134k)	11 EER Package Air Conditioner
D03-080	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system HP (< 65k, single phase)	14 SEER (12.19 EER) / 8.6 HSPF (3.52 COP) Package A/C Heat Pump
D03-081	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system HP (65-134k)	11 EER / 3.4 COP Split/Package A/C Heat Pump
D03-082	NonRes	TRUE		High eff. packaged system with evap cooled cond (< 65k)	14 EER Water-Cooled Package Air Conditioner
D03-083	NonRes	TRUE		High eff. packaged system with evap cooled cond (>= 65k)	14 EER Water-Cooled Package Air Conditioner
D03-084	NonRes	TRUE		High eff. packaged terminal air-conditioner (< 7k)	11.29 EER (based on vintage) package terminal A/C
D03-085	NonRes	TRUE		High eff. packaged terminal heat pump (< 7k)	11.17 EER / 3.3 COP (based on vintage) package terminal HP
D03-086	NonRes	TRUE	removed older vintages	Premium efficiency of better motors used for application	premium motor efficiency based on typical motor size
D03-087	NonRes	TRUE	removed older vintages	Premium efficiency of better motors used for application	premium motor efficiency based on typical motor size

D03-088	NonRes	TRUE	removed older vintages	Premium efficiency of better motors used for application	premium motor efficiency based on typical motor size
D03-089	NonRes	TRUE	removed older vintages	Premium efficiency of better motors used for application	premium motor efficiency based on typical motor size
D03-090	NonRes	TRUE	removed older vintages	Premium efficiency of better motors used for application	premium motor efficiency based on typical motor size
D03-091	NonRes	TRUE	removed older vintages	Premium efficiency of better motors used for application	premium motor efficiency based on typical motor size
D03-094	NonRes	FALSE	Updated in v4.00	tankless electric hot water system	zero tank loss
D03-095	NonRes	TRUE		DHW circulation pump contolled by timeclock	DHW circulation pump turns off during low operation hours
D03-098	NonRes	TRUE		Add water economizer heat exchanger to CW Loop	Non integrated evaporator precooler heat exchanger
D03-099	NonRes	TRUE		High eff. packaged terminal air-conditioner (7-15k)	10.27 EER (based on vintage) package terminal A/C
D03-100	NonRes	TRUE		High eff. packaged terminal air-conditioner (> 15k)	9.25 EER (based on vintage) package terminal A/C
D03-101	NonRes	TRUE		High eff. packaged terminal heat pump (7-15k)	10.15 EER / 3.1 COP (based on vintage) package terminal HP
D03-102	NonRes	TRUE		High eff. packaged terminal heat pump (> 15k)	9.13 EER / 3.0 COP (based on vintage) package terminal HP
D03-103	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system A/C (135-239k)	10.8 EER Package Air Conditioner
D03-104	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system A/C (240-759k)	10.0 EER Package Air Conditioner
D03-105	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system A/C (>= 760k)	10.0 EER Package Air Conditioner
D03-106	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system HP (135-239k)	10.8 EER / 3.4 COP Package A/C Heat Pump
D03-107	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system HP (240-759k)	10.0 EER / 3.4 COP Package A/C Heat Pump
D03-108	NonRes	FALSE	Updated in v4.00	High eff. packaged split system A/C (< 65k, 3 phase before 2008)	12 SEER three phase split-system A/C
D03-109	NonRe	FALSE	Updated in v4.00	High eff. packaged unitary system A/C (< 65k, 12 SEER, 3 phase	12 SEER three phase package A/C

	s			before 2008)	
D03-110	NonRes	FALSE	Not needed	High eff. packaged unitary system A/C (< 65k, 13 SEER, 3 phase before 2008)	13 SEER three phase package A/C
D03-111	NonRes	FALSE	Updated in v4.00	High eff. packaged split system HP (< 65k, 3 phase before 2008)	12 SEER / 7.4 HSPF three phase split-system A/C heat pump
D03-112	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system HP (< 65k, 12 SEER, 3 phase before 2008)	12 SEER / 7.4 HSPF three phase package A/C Heat Pump
D03-113	NonRes	FALSE	Updated in v4.00	High eff. packaged unitary system HP (< 65k, 13 SEER, 3 phase before 2008)	13 SEER / 7.7 HSPF three phase package A/C Heat Pump
D03-114	NonRes	FALSE	Updated in v4.00	Air-cooled screw chiller with improved kw/ton	Air cooled screw chiller (1.008 kW/ton)
D03-115	NonRes	FALSE	Updated in v4.00	Reciprocating water-cooled chillers with improved kW/ton	Water cooled reciprocating chiller (0.672 kW/ton)
D03-116	NonRes	FALSE	Updated in v4.00	Centrifugal chillers (150-299 tons) with improved kW/ton	Water cooled centrifugal chiller (0.507 kW/ton)
D03-117	NonRes	FALSE	Updated in v4.00	Centrifugal chillers (>= 300 tons) with improved kW/ton	Water cooled centrifugal chiller (0.461 kW/ton)
D03-118	NonRes	FALSE	Updated in v4.00	Water-cooled screw chiller (< 150 tons) with improved kw/ton	Water cooled screw chiller (0.632 kW/ton)
D03-119	NonRes	FALSE	Updated in v4.00	Water-cooled screw chiller (150-299 tons) with improved kw/ton	Water cooled screw chiller (0.574 kW/ton)
D03-120	NonRes	FALSE	Updated in v4.00	Water-cooled screw chiller (>= 300 tons) with improved kw/ton	Water cooled screw chiller (0.511 kW/ton)
D03-121	NonRes	FALSE	Updated in v4.00	VSD Centrifugal Chiller (150-299 tons) w/Load control tower	Water cooled VSD centrifugal chiller (0.507 kW/ton), load control tower
D03-122	NonRes	FALSE	Updated in v4.00	VSD Centrifugal Chiller (>= 300 tons) w/Load control tower	Water cooled VSD centrifugal chiller (0.461 kW/ton), load control tower
D03-123	NonRes	TRUE		Floor insulation raised to 2005 levels	Floor insulation raised to 2005 levels
D03-124	NonRes	TRUE		High eff. packaged unitary system HP (>= 760k)	9.7 EER / 3.3 COP Package A/C Heat Pump
D03-201	NonRes	FALSE	no longer needed	Air-cooled multiplex system w/extensive refrigeration equipment maintenance	Normal setpoints, representing tighter control
D03-202	NonRes	FALSE	no longer needed	Substitute high efficiency motors for standard efficiency	Utilizes a PSC motor

D03-203	NonRe s	FALSE	no longer needed	Substitute high efficiency motors for standard efficiency	Utilizes an EC motor
D03-204	NonRe s	FALSE	no longer needed	Adds an 85°F holdback valve, active only when needed	Heat reclaim with SCT controlled to 85°F via holdback valve when heat is needed
D03-205	NonRe s	TRUE		Cover open MT cases between 1-5 a.m.	Night cover reduces infiltration by 50% for 4 hours/night
D03-206	NonRe s	TRUE		Retrofit glass doors on open MT cases; additional lighting	Open fixture is retrofitted with doors and additional lighting
D03-207	NonRe s	TRUE		Replace open MT case with new case with doors	Replace open fixtures with fixtures having doors
D03-208	NonRe s	FALSE	Workpaper	Install automatic door closer on walk-in cooler doors	Applies a multiplier of 60% to the base-case infiltration
D03-209	NonRe s	FALSE	Workpaper	Install automatic door closer on walk-in freezer doors	Applies a multiplier of 60% to the base-case infiltration
D03-210	NonRe s	FALSE	no longer needed	Cycle fan off with thermostat; duty cycle occasionally when off	Evaporator fan cycles w/ thermostat; when off cycles on peridoically
D03-211	NonRe s	FALSE	no longer needed	Replace multiplex air-cooled condenser with evaporative condenser	Evaporative condenser of T24 efficiency, 2-speed fan, 80°SCT
D03-212	NonRe s	FALSE	no longer needed	Upgrade from 53 Btu/Watt @ 10°F TD to 85 Btu/Watt	Same capacity condenser, sized at 10°F TD, and efficiency of 85 Btu/Watt, 80°F SCT
D03-213	NonRe s	FALSE	no longer needed	Reduce design SCT by ~5°F and improve efficiency	Same capacity condenser but ~5°F lower SCT, 200 Btu/Watt, 80°F SCT
D03-214	NonRe s	FALSE	no longer needed	Replace single-compressor system with subcooled multiplex	Multiplex system, air-cooled, subcooler on both LT & MT circuits, floating head
D03-215	NonRe s	FALSE	no longer needed	Replace single-compressor system with subcooled multiplex	Multiplex system, evap-cooled, subcooler on both LT & MT circuits, floating head
D03-216	NonRe s	FALSE	no longer needed	Replace single-compressor system with subcooled multiplex (high efficiency)	Multiplex system, hi-eff air-cooled, subcooler on both LT and MT circuits
D03-217	NonRe s	FALSE	no longer needed	Replace single-compressor system with subcooled multiplex (high efficiency)	Multiplex system, hi-eff evap-cooled, subcooler on both LT and MT circuits
D03-218	NonRe s	TRUE		Addition of a LT subcooler to an air-cooled multiplex	Low-temp subcooler (50°F) powered by medium-temp suction group
D03-219	NonRe s	TRUE		Addition of LT and MT subcoolers to an air-cooled multiplex	Low- and medium-temp subcoolers powered by a new high-temp suction group
D03-220	NonRe	TRUE		Floating SST control on LT and MT suction groups	SST setpoint reset based on worst-case demand

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D03-221	NonRes	TRUE		Floating SCT controlled to 70°F	SCT controlled to 70°F
D03-222	NonRes	TRUE		Floating SCT controlled to 70°F	SCT controlled to 70°F
D03-223	NonRes	TRUE		Ambient following SCT setpoint, 70°F minimum	Control SCT to ambient + 12°F TD, 70°F min, backflood setpoint of 68°F
D03-224	NonRes	TRUE		Wetbulb following SCT setpoint, 70°F minimum	Control SCT to wetbulb + 17°F TD, 70°F min, backflood setpoint of 68°F
D03-225	NonRes	TRUE		Ambient following SCT setpoint, 70°F minimum, variable-spd condenser fan	Control SCT to ambient + 12°F TD, 70°F min, backflood setpt of 68°F, var-spd cond
D03-226	NonRes	TRUE		Wetbulb following SCT setpoint, 70°F minimum, variable-spd condenser fan	Control SCT to wetbulb + 17°F TD, 70°F min, backflood setpt of 68°F, var-spd cond
D03-227	NonRes	FALSE	Workpaper	Turn off fixture lights when store closed	Turn off lights between midnight and 6 a.m.
D03-228	NonRes	FALSE	no longer needed	Eliminate anti-sweat heaters from doors	Eliminate door heaters, 54W/door frame heat only, fixed output
D03-301	NonRes	FALSE	no longer needed	Extensive refrigeration equipment maintenance	Normal setpoints, representing tighter control
D03-302	NonRes	FALSE	no longer needed	Size condenser to ~5°F lower TD, 400 Btu/Watt	Condenser sized at ~18°F TD, 400 Btu/watt fan & pump, 80°F SCT setpoint
D03-303	NonRes	FALSE	no longer needed	Size condenser to ~5°F lower TD, efficient fans & pump, WB following setpt	Condenser sized at ~ 18°F TD, 400 Btu/watt fan & pump, WB-following SCT setpnt
D03-304	NonRes	FALSE	no longer needed	Add variable-speed control to one compressor in each suction group	Variable-speed drive to trim one compressor, remainder stage fully loaded
D03-305	NonRes	FALSE	no longer needed	Add mechanical subcooler to LT liquid line, fed by MT system	Subcooler on LT liquid circuit, provided by MT circuit, controlled to 50°F
D03-306	NonRes	TRUE		Floating SST control on LT and MT suction groups	SST setpoint reset based on worst-case demand
D03-307	NonRes	TRUE		Floating SCT controlled to 70°F	SCT controlled to 70°F, 68°F backflood control setpoint
D03-308	NonRes	TRUE		Wetbulb following SCT setpoint, 70°F minimum	Control SCT to wetbulb + 9°F TD, 70°F minimum, backflood setpoint of 68°F
D03-309	NonRes	TRUE		Wetbulb following SCT setpoint, 70°F min, variable-spd condenser fan	Control SCT to wetbulb + 9°F TD, 70°F min, backflood setpt of 68°F, var-spd cond

D03-401	Res	TRUE		Programmable Thermostat	Programmable Thermostat
D03-402	Res	FALSE	Updated in v4.00	13 SEER (11.09 EER) Split System Air Conditioner	13 SEER (11.09 EER) Split System Air Conditioner
D03-403	Res	FALSE	Updated in v4.00	14 SEER (11.99 EER) Split-System Air Conditioner	14 SEER (11.99 EER) Split-System Air Conditioner
D03-404	Res	FALSE	Updated in v4.00	15 SEER (12.72 EER) Split-System Air Conditioner	15 SEER (12.72 EER) Split-System Air Conditioner
D03-405	Res	TRUE		Direct Evaporative Cooler	Direct Evaporative Cooler
D03-406	Res	TRUE		Indirect Evaporative Cooler	Indirect Evaporative Cooler
D03-407	Res	TRUE		Direct-Indirect Evaporative Cooler	Direct-Indirect Evaporative Cooler
D03-408	Res	FALSE	Updated in v4.00	Typical Refrigerant Charge Adjustment (< ±20% rated charge)	Standard Cooling Performance (proper refrigerant charge)
D03-409	Res	FALSE	Updated in v4.00	High Refrigerant Charge Adjustment (>= ±20% rated charge)	Standard Cooling Performance (proper refrigerant charge)
D03-410	Res	FALSE	Updated in v4.00	Condensing 90 AFUE (1.11 HIR) Furnace	Condensing 90 AFUE (1.11 HIR) Furnace
D03-411	Res	FALSE	Updated in v4.00	Condensing 92 AFUE (1.08 HIR) Furnace	Condensing 92 AFUE (1.08 HIR) Furnace
D03-412	Res	FALSE	Updated in v4.00	Condensing 94 AFUE (1.06 HIR) Furnace	Condensing 94 AFUE (1.06 HIR) Furnace
D03-413	Res	FALSE	Updated in v4.00	Condensing 96 AFUE (1.03 HIR) Furnace	Condensing 96 AFUE (1.03 HIR) Furnace
D03-414	Res	FALSE	Updated in v4.00	13 SEER (11.07 EER) / 8.1 HSPF (3.28 COP) A/C Heat pump	13 SEER (11.07 EER) / 8.1 HSPF (3.28 COP) A/C Heat pump
D03-415	Res	FALSE	Updated in v4.00	14 SEER (12.19 EER) / 8.6 HSPF (3.52 COP) A/C Heat Pump	14 SEER (12.19 EER) / 8.6 HSPF (3.52 COP) A/C Heat Pump
D03-416	Res	FALSE	Updated in v4.00	15 SEER (12.70 EER) / 8.8 HSPF (3.74 COP) A/C Heat Pump	15 SEER (12.70 EER) / 8.8 HSPF (3.74 COP) A/C Heat Pump
D03-417	Res	FALSE	Updated in v4.00	18 SEER (12.8 EER) / 9.2 HSPF (3.66 COP) A/C Heat Pump	18 SEER (12.88 EER) / 8.5 HSPF (3.32 COP) A/C Heat Pump
D03-418	Res	FALSE	Updated in v4.00	Duct Sealing (Total Leakage Reduced from 40% of AHU flow to 12%)	Duct Sealing (Total Leakage Reduced from 40% of AHU flow to 12%)
D03-420	Res	FALSE	Updated in v4.00	Ceiling R-0 to R-30 Insulation-Batts	Ceiling R-0 to R-30 Insulation-Batts
D03-421	Res	FALSE	Updated in v4.00	Ceiling R-0 to R-38 Insulation-Batts	Ceiling R-0 to R-38 Insulation-Batts
D03-422	Res	FALSE	Updated in v4.00	Ceiling Vintage to R-30 Insulation-Batts	Ceiling Vintage to R-30 Insulation-Batts
D03-423	Res	FALSE	Updated in v4.00	Ceiling Vintage to R-38 Insulation-Batts	Ceiling Vintage to R-38 Insulation-Batts
D03-424	Res	FALSE	Updated in v4.00	Ceiling Vintage to R-49 Insulation-Batts	Ceiling Vintage to R-49 Insulation-Batts
D03-426	Res	TRUE		Floor R-0 to R-19 Insulation Batts	Floor R-0 to R-19 Insulation Batts
D03-427	Res	TRUE		Floor R-0 to R-30 Insulation Batts	Floor R-0 to R-30 Insulation Batts
D03-428	Res	TRUE		Floor R-19 to R-30 Insulation-Batts	Floor R-19 to R-30 Insulation-Batts

D03-429	Res	TRUE		Wall 2x4 R-15 Insulation-Batts	Wall 2x4 R-15 Insulation-Batts
D03-430	Res	TRUE		Wall 2x6 R-19 Insulation-Batts	Wall 2x6 R-19 Insulation-Batts
D03-431	Res	TRUE		Wall 2x6 R-21 Insulation-Batts	Wall 2x6 R-21 Insulation-Batts
D03-435	Res	TRUE		Wall 2x4 R-13 Batts + R-5 Rigid	Wall 2x4 R-13 Batts + R-5 Rigid
D03-436	Res	TRUE		Wall 2x6 R-19 Batts + R-5 Rigid	Wall 2x6 R-19 Batts + R-5 Rigid
D03-437	Res	TRUE		Wall 2x6 R-21 Batts + R-5 Rigid	Wall 2x6 R-21 Batts + R-5 Rigid
D03-438	Res	FALSE	Updated in v4.00	Wall Blow-In R-0 to R-13 Insulation	Wall Blow-In R-0 to R-13 Insulation
D03-439	Res	FALSE	no longer needed	Low-Income Weatherization w/out Evaporative Cooler	Infiltration of 0.35 Air Changes per Hour
D03-440	Res	FALSE	no longer needed	Low-Income Weatherization w/ Evaporative Cooler	Direct Evap Cooling with Infiltration of 0.35 Air Changes per Hour
D03-441	Res	TRUE		Whole House Fans	Whole House Fans
D03-442	Res	FALSE	requires update	Default Window With Sunscreen	Default Window With Sunscreen
D03-443	Res	FALSE	requires update	Single Pane Clear Glass With Reflective Film	Single Pane Clear Glass With Reflective Film
D03-444	Res	FALSE	requires update	Single Pane Clear Glass With Spectrally Selective Film	Single Pane Clear Glass With Spectrally Selective Film
D03-445	Res	FALSE	requires update	Single Pane Clear Glass With Standard Film	Single Pane Clear Glass With Standard Film
D03-446	Res	FALSE	requires update	U-0.50 / SHGC-0.65 (clear) Window	U-0.50 / SHGC-0.65 (clear) Window
D03-447	Res	FALSE	requires update	U-0.40 / SHGC-0.65 (clear) Window	U-0.40 / SHGC-0.65 (clear) Window
D03-448	Res	FALSE	requires update	U-0.35 / SHGC-0.55 (clear) Window	U-0.35 / SHGC-0.55 (clear) Window
D03-449	Res	FALSE	requires update	U-0.25 / SHGC-0.35 (clear) Window	U-0.25 / SHGC-0.35 (clear) Window
D03-450	Res	FALSE	requires update	U-0.50 / SHGC-0.40 (tint) Window	U-0.50 / SHGC-0.40 (tint) Window
D03-451	Res	FALSE	requires update	U-0.40 / SHGC-0.40 (tint) Window	U-0.40 / SHGC-0.40 (tint) Window
D03-452	Res	FALSE	requires update	U-0.35 / SHGC-0.32 (tint) Window	U-0.35 / SHGC-0.32 (tint) Window
D03-453	Res	FALSE	requires update	U-0.25 / SHGC-0.22 (tint) Window	U-0.25 / SHGC-0.22 (tint) Window
D03-458	Res	FALSE	Updated in v4.00	Duct Sealing (Total Leakage Reduced from 24% of AHU flow to 12%)	Duct Sealing (Total Leakage Reduced from 24% of AHU flow to 12%)
D03-459	Res	FALSE	Updated in v4.00	Typical Refrigerant Charge Adjustment (< ±20% rated charge) + Duct Sealing	Standard Cooling Performance, reduced duct loss
D03-460	Res	FALSE	Updated in v4.00	High Refrigerant Charge Adjustment (>= ±20% rated charge) + Duct Sealing	Standard Cooling Performance, reduced duct loss

D03-461	Res	FALSE	Updated in v4.00	Basic Furnace Upgrade to 81% AFUE	Basic Furnace Upgrade to 81% AFUE
D03-462	Res	FALSE	Updated in v4.00	Mobile Home Duct Sealing (Supply Leakage Reduced from 35% of AHU flow to 15%)	Mobile Home Duct Sealing (Supply Leakage Reduced from 35% of AHU flow to 15%)
D03-463	Res	FALSE	Updated in v4.00	16 SEER (11.61 EER) Split System Air Conditioner	16 SEER (11.61 EER) Split System Air Conditioner
D03-464	Res	FALSE	Updated in v4.00	17 SEER (12.28 EER) Split-System Air Conditioner	17 SEER (12.28 EER) Split-System Air Conditioner
D03-465	Res	FALSE	Updated in v4.00	18 SEER (13.37 EER) Split-System Air Conditioner	18 SEER (13.37 EER) Split-System Air Conditioner
D03-466	Res	FALSE	Updated in v4.00	16 SEER (12.06 EER) / 8.4 HSPF (3.48 COP) A/C Heat Pump	16 SEER (12.06 EER) / 8.4 HSPF (3.48 COP) A/C Heat Pump
D03-467	Res	FALSE	Updated in v4.00	17 SEER (12.52 EER) / 8.6 HSPF (3.26 COP) A/C Heat Pump	17 SEER (12.52 EER) / 8.6 HSPF (3.26 COP) A/C Heat Pump
D03-468	Res	FALSE	Updated in v4.00	Mobile Home Duct Sealing (Supply Leakage Reduced from 25% of AHU flow to 15%)	Mobile Home Duct Sealing (Supply Leakage Reduced from 25% of AHU flow to 15%)
D03-801	Res	FALSE	Updated in v4.00	13 Watt Intergral CFL - Outdoor	13 Watt < 800 Lumens - screw-in - Outdoor
D03-802	Res	FALSE	Updated in v4.00	13 Watt Intergral CFL - Outdoor	13 Watt >=800 Lumens - screw-in - Outdoor
D03-803	Res	FALSE	Updated in v4.00	14 Watt Intergral CFL - Outdoor	14 Watt - screw-in - Outdoor
D03-804	Res	FALSE	Updated in v4.00	15 Watt Intergral CFL - Outdoor	15 Watt - screw-in - Outdoor
D03-805	Res	FALSE	Updated in v4.00	16 Watt Intergral CFL - Outdoor	16 Watt - screw-in - Outdoor
D03-806	Res	FALSE	Updated in v4.00	18 Watt Intergral CFL - Outdoor	18 Watt < 1,100 Lumens - screw-in - Outdoor
D03-807	Res	FALSE	Updated in v4.00	18 Watt Intergral CFL - Outdoor	18 Watt >=1,100 Lumens - screw-in - Outdoor
D03-808	Res	FALSE	Updated in v4.00	19 Watt Intergral CFL - Outdoor	19 Watt >=1,100 Lumens - screw-in - Outdoor
D03-809	Res	FALSE	Updated in v4.00	20 Watt Intergral CFL - Outdoor	20 Watt - screw-in - Outdoor
D03-810	Res	FALSE	Updated in v4.00	23 Watt Intergral CFL - Outdoor	23 Watt - screw-in - Outdoor
D03-811	Res	FALSE	Updated in v4.00	25 Watt Intergral CFL - Outdoor	25 Watt <1,600 Lumens - screw-in - Outdoor
D03-812	Res	FALSE	Updated in v4.00	25 Watt Intergral CFL - Outdoor	25 Watt >=1,600 Lumens - screw-in - Outdoor
D03-813	Res	FALSE	Updated in v4.00	26 Watt Intergral CFL - Outdoor	26 Watt <1,600 Lumens - screw-in - Outdoor
D03-814	Res	FALSE	Updated in v4.00	26 Watt Intergral CFL - Outdoor	26 Watt >=1,600 Lumens - screw-in - Outdoor
D03-815	Res	FALSE	Updated in v4.00	28 Watt Intergral CFL - Outdoor	28 Watt - screw-in - Outdoor
D03-816	Res	FALSE	Updated in v4.00	30 Watt Intergral CFL - Outdoor	30 Watt - screw-in - Outdoor
D03-817	Res	FALSE	Updated in v4.00	36 Watt Intergral CFL - Outdoor	36 Watt - screw-in - Outdoor
D03-818	Res	FALSE	Updated in v4.00	40 Watt Intergral CFL - Outdoor	40 Watt - screw-in - Outdoor

D03-819	Res	FALSE	Updated in v4.00	13 Watt Fixture CFL - Outdoor	13 Watt < 800 Lumens - pin based hardwire fixture - Outdoor
D03-820	Res	FALSE	Updated in v4.00	13 Watt Fixture CFL - Outdoor	13 Watt >=800 Lumens - pin based hardwire fixture - Outdoor
D03-821	Res	FALSE	Updated in v4.00	14 Watt Fixture CFL - Outdoor	14 Watt - pin based hardwire fixture - Outdoor
D03-822	Res	FALSE	Updated in v4.00	15 Watt Fixture CFL - Outdoor	15 Watt - pin based hardwire fixture - Outdoor
D03-823	Res	FALSE	Updated in v4.00	16 Watt Fixture CFL - Outdoor	16 Watt - pin based hardwire fixture - Outdoor
D03-824	Res	FALSE	Updated in v4.00	18 Watt Fixture CFL - Outdoor	18 Watt < 1,100 Lumens - pin based hardwire fixture - Outdoor
D03-825	Res	FALSE	Updated in v4.00	18 Watt Fixture CFL - Outdoor	18 Watt >=1,100 Lumens - pin based hardwire fixture - Outdoor
D03-826	Res	FALSE	Updated in v4.00	19 Watt Fixture CFL - Outdoor	19 Watt >=1,100 Lumens - pin based hardwire fixture - Outdoor
D03-827	Res	FALSE	Updated in v4.00	20 Watt Fixture CFL - Outdoor	20 Watt - pin based hardwire fixture - Outdoor
D03-828	Res	FALSE	Updated in v4.00	23 Watt Fixture CFL - Outdoor	23 Watt - pin based hardwire fixture - Outdoor
D03-829	Res	FALSE	Updated in v4.00	25 Watt Fixture CFL - Outdoor	25 Watt <1,600 Lumens - pin based hardwire fixture - Outdoor
D03-830	Res	FALSE	Updated in v4.00	25 Watt Fixture CFL - Outdoor	25 Watt >=1,600 Lumens - pin based hardwire fixture - Outdoor
D03-831	Res	FALSE	Updated in v4.00	26 Watt Fixture CFL - Outdoor	26 Watt <1,600 Lumens - pin based hardwire fixture - Outdoor
D03-832	Res	FALSE	Updated in v4.00	26 Watt Fixture CFL - Outdoor	26 Watt >=1,600 Lumens - pin based hardwire fixture - Outdoor
D03-833	Res	FALSE	Updated in v4.00	28 Watt Fixture CFL - Outdoor	28 Watt - pin based hardwire fixture - Outdoor
D03-834	Res	FALSE	Updated in v4.00	30 Watt Fixture CFL - Outdoor	30 Watt - pin based hardwire fixture - Outdoor
D03-835	Res	FALSE	Updated in v4.00	40 Watt Fixture CFL - Outdoor	40 Watt - pin based hardwire fixture - Outdoor
D03-836	Res	FALSE	Updated in v4.00	55 Watt Fixture CFL - Outdoor	55 Watt - pin based hardwire fixture - Outdoor
D03-837	Res	FALSE	Updated in v4.00	65 Watt Fixture CFL - Outdoor	65 Watt - pin based hardwire fixture - Outdoor
D03-838	Res	FALSE	Updated in v4.00	20W CFL Table Lamp	20W CFL Table Lamp - pin based
D03-839	Res	FALSE	Updated in v4.00	25W CFL Table Lamp	25W CFL Table Lamp - pin based
D03-840	Res	FALSE	Updated in v4.00	30W CFL Table Lamp	30W CFL Table Lamp - pin based
D03-841	Res	FALSE	Updated in v4.00	55W CFL Table Lamp	55W CFL Table Lamp - pin based
D03-842	Res	FALSE	Updated in v4.00	55W CFL Torchiere	55W CFL Torchiere - pin based
D03-843	Res	FALSE	Updated in v4.00	70W CFL Torchiere (two LAMPs)	70W CFL Torchiere (two LAMPs) - pin based
D03-844	NonRes	FALSE	Updated in v4.00	50W Metal Halide	50W Metal Halide

D03-845	NonRes	FALSE	Updated in v4.00	75W Metal Halide	75W Metal Halide
D03-846	NonRes	FALSE	Updated in v4.00	100W Metal Halide	100W Metal Halide
D03-852	NonRes	FALSE	Updated in v4.00	Premium T8 El Ballast	Four ft. 2 lamp fixture, ballast factor of less than or equal to 0.77
D03-853	NonRes	FALSE	Updated in v4.00	T8 32W Dimming El Ballast	Four ft. 2 lamp fixture
D03-854	NonRes	FALSE	Updated in v4.00	De-lamp from 4', 4 lamp/fixture	Four ft. 4 lamp fixture
D03-855	NonRes	FALSE	Updated in v4.00	De-lamp from 8', 4 lamp/fixture	Eight ft. 4 lamp fixture
D03-856	NonRes	FALSE	update required	Occ-Sensor - Wall box	Assume control 3 2-lamp fixtures w/T8 34W EL Ballast
D03-857	NonRes	FALSE	update required	Occ-Sensor - Plug loads	Assume control 50W of task lighting and a computer monitor
D03-858	NonRes	FALSE	update required	Timeclock:	Controling 4 - 70W (95W w/ballast) HPS fixtures
D03-859	NonRes	FALSE	update required	Photocell:	Assume in conjunction with time-clock controling 4 - 70W (95W w/ballast) HPS fixtures
D03-901	NonRes	FALSE	no longer needed	High Efficiency Copier	0-20 copies/minute
D03-902	NonRes	FALSE	no longer needed	High Efficiency Copier	21 44copies/minute
D03-903	NonRes	FALSE	no longer needed	High Efficiency Copier	Over 45 copies/minute
D03-904	NonRes	FALSE	Workpaper	High Efficiency Gas Fryer	Base use = 25 kBtu/hour; Eff use = 15 kBtu/hour
D03-905	NonRes	FALSE	Workpaper	High Efficiency Gas Griddle	Base use = 25 kBtu/hour; Eff use = 20 kBtu/hour
D03-906	NonRes	FALSE	Workpaper	High Efficiency Electric Fryer	Base use = 2.8 kW/hour; Eff use = 2.4 kW/hour
D03-907	NonRes	FALSE	Workpaper	Hot Food Holding Cabinet	Base use = 1.35 kW/hour; Eff use = 0.43 kW/hour
D03-908	NonRe	FALSE	Workpaper	Connectionless Steamer	Base use = 1.0 kW/hour; Eff use = 0.5 kW/hour

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D03-909	NonRes	FALSE	no longer needed	Point of Use Water Heat	Point of Use Water Heat
D03-910	NonRes	FALSE	no longer needed	Circulation Pump Timeclock	Circulation Pump Timeclock
D03-911	NonRes	FALSE	Updated in v4.00	High Eff. Water Heater, EF=0.64	High Eff. Water Heater
D03-912	NonRes	FALSE	Workpaper	Vending Machine Controller	Cold Drink Vending Machine
D03-913	NonRes	FALSE	Workpaper	Vending Machine Controller	Uncooled Snack Machine
D03-914	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 1 HP	Open Drip Proof: 2076 Hours of Operation
D03-915	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 5 HP	Open Drip Proof: 2076 Hours of Operation
D03-916	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 10 HP	Open Drip Proof: 2076 Hours of Operation
D03-917	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 15 HP	Open Drip Proof: 2076 Hours of Operation
D03-918	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 20 HP	Open Drip Proof: 2820 Hours of Operation
D03-919	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 25 HP	Open Drip Proof: 2820 Hours of Operation
D03-920	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 50 HP	Open Drip Proof: 2820 Hours of Operation
D03-921	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 100 HP	Open Drip Proof: 2820 Hours of Operation
D03-922	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 150 HP	Open Drip Proof: 2820 Hours of Operation
D03-923	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 200 HP	Open Drip Proof: 2215 Hours of Operation
D03-924	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 1 HP	Closed Drip Proof: 2076 Hours of Operation
D03-925	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 5 HP	Closed Drip Proof: 2076 Hours of Operation

D03-926	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 10 HP	Closed Drip Proof: 2076 Hours of Operation
D03-927	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 15 HP	Closed Drip Proof: 2076 Hours of Operation
D03-928	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 20 HP	Closed Drip Proof: 2820 Hours of Operation
D03-929	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 25 HP	Closed Drip Proof: 2820 Hours of Operation
D03-930	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 50 HP	Closed Drip Proof: 2820 Hours of Operation
D03-931	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 100 HP	Closed Drip Proof: 2820 Hours of Operation
D03-932	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 150 HP	Closed Drip Proof: 2820 Hours of Operation
D03-933	NonRes	FALSE	is current code requirement	Premium Efficiency Motor - 200 HP	Closed Drip Proof: 2215 Hours of Operation
D03-934	Res	FALSE	Workpaper	Faucet Aerators	Faucet Aerators
D03-935	Res	FALSE	update required	Heat Pump Water Heater	Heat pump water heater, EF=2.9
D03-936	Res	FALSE	update required	Pipe Wrap	Pipe wrap
D03-937	Res	FALSE	Workpaper	Low Flow Showerhead	Low Flow Showerhead
D03-938	Res	FALSE	Updated in v4.00	High Efficiency Water Heater	High Efficiency Water Heater - Gas, EF = 0.63
D03-939	Res	FALSE	Updated in v4.00	High Efficiency Water Heater	High Efficiency Water Heater - Electric, EF=0.93
D03-940	Res	FALSE	no longer needed	Point of Use Water Heat	Point of Use Water Heat
D03-941	Res	FALSE	out-of-date	Efficient Clothes Dryer	High Efficiency Electric Clothes Dryer with Moisture Sensor.
D03-942	Res	FALSE	out-of-date	Efficient Clothes Dryer	High Efficiency Gas Clothes Dryer with Moisture Sensor.
D03-943	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 1.5 cf	CEE Tier 1: MEF=1.42, 1.5 cf Capacity
D03-944	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 1.5 cf	CEE Tier 2: MEF=1.60, 1.5 cf capacity
D03-945	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 1.5 cf	CEE Tier 3: MEF=1.80, 1.5 cf capacity
D03-946	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 2.65 cf	CEE Tier 1: MEF=1.42, 2.65 cf capacity
D03-947	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 2.65 cf	CEE Tier 2: MEF=1.60, 2.65 cf capacity

D03-948	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 2.65 cf	CEE Tier 3: MEF=1.80, 2.65 cf capacity
D03-949	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 3.5 cf	CEE Tier 1: MEF=1.42, 3.5 cf capacity
D03-950	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 3.5 cf	CEE Tier 2: MEF=1.60, 3.5 cf Capacity
D03-951	Res	FALSE	Updated in v4.00	Energy Star Clothes Washer - 3.5 cf	CEE Tier 3: MEF=1.80, 3.5 cf Capacity
D03-952	Res	FALSE	Updated in v4.00	Energy Star Dish Washer	Energy Star Dishwasher, EF=0.58
D03-953	Res	FALSE	Updated in v4.00	Energy Star Dish Washer	Energy Star Dishwasher, EF=0.58
D03-966	Res	FALSE	not allowed by T20 anymore	Efficient Single Speed Pool Pump	Efficient Single Speed Pool Pump, 1.5 hp
D03-967	Res	FALSE	not allowed by T20 anymore	Efficient Two Speed Pool Pump	Efficient Two Speed Pool Pump, 1.5 hp
D03-970	NonRes	FALSE	out-of-date	Low Pressure Sprinkler Nozzle - Portable	Low pressure sprinkler nozzle, Portable system.
D03-971	NonRes	FALSE	out-of-date	Low Pressure Sprinkler Nozzle - Solid set	Low pressure sprinkler nozzle, Solid set system.
D03-972	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - Field/Vegs - non well	Micro irrigation in fields without a well
D03-973	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - Field/Vegs - well	Micro irrigation in fields with a well
D03-974	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - Decid Trees - non well	Micro irrigation of deciduous trees without a well
D03-975	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - Decid Trees - well	Micro irrigation of deciduous trees with a well
D03-976	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - Citrus Trees - non well	Micro irrigation of citrus trees without a well
D03-977	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - Citrus Trees - well	Micro irrigation of citrus trees with a well
D03-978	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - grapes - non well	Micro irrigation of grapes without a well
D03-979	NonRes	FALSE	out-of-date	Sprinkler to Micro irrigation - grapes - well	Micro irrigation of grapes with a well
D03-980	NonRes	FALSE	Updated in v4.00	Infrared Film for Greenhouses	Greenhouse Infrared Film
D03-981	NonRes	FALSE	Updated in v4.00	Greenhouse Heat Curtain	Greenhouse Heat Curtain

D03-982	NonRes	FALSE	out-of-date	Variable Frequency Drives with feedback controls for Dairy Pumps	Add VFD to Dairy Vacuum Pump
D03-983	NonRes	FALSE	out-of-date	Ventilation Fans or Box Fans (6)	High efficiency ventilation fan
D03-984	NonRes	FALSE	out-of-date	High Volume Low Speed Fans 16 Ft Diameter (4)	16 Foot Diameter fan with 35 Ft Spacing Free Stall Barn
D03-985	NonRes	FALSE	out-of-date	High Volume Low Speed Fans 18 Ft Diameter (3)	18 Foot Diameter fan with 40 Ft Spacing Free Stall Barn
D03-986	NonRes	FALSE	out-of-date	High Volume Low Speed Fans 20 Ft Diameter (3)	20 Foot Diameter fan with 50 Ft Spacing Free Stall Barn
D03-987	NonRes	FALSE	out-of-date	High Volume Low Speed Fans 24 Ft Diameter (2)	24 Foot Diameter fan with 60 Ft Spacing Free Stall Barn

Appendix A-2

This appendix describes how the building type effective full-load hours (EFLH) and coincident factor (CF) values were developed using data gathered as part of the 2006-2008 Small Commercial Contract Group evaluation (Small Com evaluation). It also describes how the activity area distributions were calculated.

EFLH and CF Calculations

Setup (applies to both the EFLH and CF calculations)

The Small Commercial evaluation involved the installation of nearly 7,000 lighting loggers in over 1,200 commercial buildings throughout California. Extensive training and QC procedures were applied to the lighting logger installations, as is documented in the Small Com report.

The ON/OFF transition data from each lighting logger was processed into a percent ON per hour format. Each logger was then extrapolated into an 8760 lighting use shape, as described in the Small Com report. Since some sites saw multiple loggers installed in the same activity areas, the 8760 use shapes were averaged together to create a single 8760 for each activity area at each site. The number of lamps represented by each logger was used as a weight to create this site level activity area shape.

The first step in calculating the EFLH and CF values for this DEER update was the creation of the weekly usage profiles. Each site level activity area 8760 was collapsed to an 8-day use shape (five weekdays, 2 weekends and an eighth day for holidays). These site level activity area 8-day shapes were then averaged together to make an 8-day shape for each building type - activity area that was reported in Small Com. The total number of lamps logged within each activity area at each site was used as a weight to create these building type - activity area shapes.

In this way, we arrived at a percent ON value for each hour (0-23) of each weekday (1-8) at each building type – activity area. To explain in symbols, if we let where $HR_{h,w,b,a}$ be the average hours ON during hour *h* on weekday *w* at building type *b* and activity area *a*, then we have:

$$HR_{h,w,b,a} = \frac{\sum_s \left(w_{s,a} \cdot HR_{s,h,w,a}\right)}{\sum_s w_{s,a}}$$

where the sums are taken over all sites *s* such that *s* has building type *b* and activity area *a*.

The term $w_{s,a}$ represents the total number of lamps at site *s* in activity area *a*. So, in this case, $\sum_s w_{s,a}$ would represent the total number of lamps in activity areas *a* in sites with building type *b*. The term $HR_{s,h,w,a}$ represents the percent ON in activity area *a* site *s* during hour *h* on weekday *w*.

EFLH Calculation

The calculation of the EFLH value at building type *b* ($EFLH_b$) is most clearly described by the following equations:

$$EFLH_b = \sum_a \left(PctAA_{b,a} \cdot EFLH_{b,a} \right)$$

where the sum is taken over all activity areas *a* such that building type *b* has activity area *a* as a final reported activity area.

The term $PctAA_{b,a}$ represents the percentage that activity area *a* takes up in building type *b* (so we have $\sum_a PctAA_{b,a} = 1$ for each *b*; the calculation of these $PctAA_{b,a}$ terms is described in the next section).

The term $EFLH_{b,a}$ is the EFLH at building type *b* and activity area *a*, as defined by[1]:

$$EFLH_{b,a} = 354 \left(\frac{\sum_{w=1}^{7} DayTot_{w,b,a}}{7} \right) + 11 \left(DayTot_{8,b,a} \right)$$

The term $DayTot_{w,b,a}$ represents the average daily hours ON for weekday *w* (Sunday=1, Monday=2,…,Saturday=7, and Holiday=8), at building type *b* and activity area *a*. It is defined as

$$DayTot_{w,b,a} = \sum_{h=0}^{23} HR_{h,w,b,a}$$

where $HR_{h,w,b,a}$ is the average hours ON during hour *h* ($0 \leq h \leq 23$) on weekday *w* at building type *b* and activity area *a*, as described in the section above. Note, $0 \leq HR_{h,w,b,a} \leq 1$.

CF Calculation

The DEER Peak Definition is as follows:

1 The numbers 11 and 354 appear in this calculation because we assume there are 11 holidays and 354 non-holidays in a year.

"The DEER demand impact is defined as the average demand impact, for an installed measure, as would be "seen" at the electric grid level, averaged over the nine hours, between 2PM and 5PM, during the three consecutive weekday period which contains the weekday with the highest temperature of the year."[2]

Since the profiles used for this update are 8-day profiles, we average the weekday hours between 2 and 5pm to find the CF. In symbols, the CF at building type *b* is calculated as follows:

$$CF_b = \sum_a \left(PctAA_{b,a} \cdot CF_{b,a}\right)$$

where $CF_{b,a}$ represents the CF at building type *b* and activity area *a* (the term $PctAA_{b,a}$ is the same as mentioned above and defined below). The term $CF_{b,a}$ is calculated as

$$CF_{b,a} = \frac{\sum_{w=2}^{6}\left(\sum_{h=14}^{16} HR_{h,w,b,a}\right)}{15}$$

We divide by 15 here because we are taking the average over 15 hours. The term $HR_{h,w,b,a}$ is the same as used above.

Activity Area Distributions

The Small Com onsite survey included an inventory of rebated technologies beyond the lamps that were actually logged. These data were used to calculate the activity area distributions, which represent the percentage of building lighting attributable to each activity area. These activity area distributions were created separately for CFL and linear lamps.

The first step in the calculation was to find the total lamps surveyed within each activity area at each site. These site – activity area lamp counts were then summed to find the total number of lamps in each building type – activity area.

The lamp count from each building type – activity area was divided by the total number of lamps for that building type to find the percentage distribution. Letting $PctAA_{b,a}$ represent the percentage that activity area *a* represents within building type *b*, this calculation is described by the following equations:

$$PctAA_{b,a} = \frac{Lamps_{b,a}}{Lamps_b}$$

[2] http://www.doe2.com/download/AvoidedCost/ConsultantsReport_2006-03-20/3-21-06%20Update%20Attach3.pdf

where $Lamps_b = \sum_a Lamps_{b,a}$ (with the sum being taken over all activity areas a contained within building type b) represents the total number of lamps found at all sites having building type b. Likewise, the term $Lamps_{b,a}$ represents the total number of lamps found in activity areas a at sites with building type b. It is calculated as

$$Lamps_{b,a} = \sum_s Lamps_{s,a}$$

where the sum is taken over all sites s with building type b. The term $LAmps_{s,a}$ represents the total number of lamps surveyed in activity area a at site s.

Appendix A-3

Commercial HVAC

Table –A-3-1: Overview of Methods, Data, and NTGR Results

DEER Update Technology Group 2 – Commercial HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values***	**Program Delivery Approach**	**Data Sources**	**NTGR Values from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
HVAC Maintenance: Refrigerant Charge Adjustment	No specific DEER value listed for this EEM and delivery approach. The default value of 0.70 for EEMs not otherwise addressed with no convincing strategies to reduce free-ridership may apply.	Midstream	Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs, 2006 – 2008 Program Year, Final Consultant Report, Volumes 1 and 2, KEMA, February 10, 2010	The study evaluated four IOU programs. The study indicates that the IOU programs used an NTGR of 0.85 for this EEM in '06-'08. The results varied among IOU programs as followed: **NTGR** **Sample Size** PG&E2068 0.54 122 PG&E2080 0.55 92 SCE2507 0.94 23 SDG&E3043 0.70 23 Total: 260	Modified version of the SRA since the utility programs gave contractors flexibility in terms of both marketing and incentives. The participant surveys were supplemented with contractor surveys. The simple NTG questionnaire included questions aimed at addressing "…the effect of acceleration on the lifetime savings stream and partial increase in efficiency levels or quantities of efficient measures."	The sample sizes for the SCE and SDG&E programs are too low for reliable standalone values. Future programs are unlikely to offer the RCA EEM as a standalone measure. Going forward, the EEM is part of the IOUs HVAC Quality Maintenance Programs. These programs launched in June 2011. There are significant uncertainties and issues that persist for this measure. It is anticipated that the ongoing 2010-2012 EM&V research efforts may address many of the issues. Given the change in delivery approach for this measure going forward, I do not recommend that the study's NTGR values be re-calculated at this time to remove the effects of either partial and/or deferred free-ridership. This may be warranted only if the IOU programs intend to offer the measure standalone. The program level NTGR values yields a kWh weighted value of 0.79 and a kW

DEER Update Technology Group 2 – Commercial HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values***	**Program Delivery Approach**	**Data Sources**	**NTGR Values from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
						weighted value of 0.66. The combined weighted average is 0.73 rounded-up. **Recommend that the program level weighted average value of 0.73 be used for the standalone RCA measure, midstream delivery approach.**
RCx Packages	DEER lists 0.90 for electric EEMs and 1.0 for natural gas EEMs.	Downstream, Customized Incentives	2006 – 08 Retro-Commissioning Impact Evaluation, Final Report, SBW Consulting, Inc., February 8, 2010	The evaluation inspected and tested measures at sites that participated in RCx programs as part of either the 2002–03 or 2004–05 program cycles. The study determined the following NTGR values per IOU (Tables 18 through 21 in the study's final report): **NTGR** (**kWh** / **kW** / **Therms**), **Sample Size** PG&E 0.80 / 0.76 / 0.86, 73 SCE 0.86 / 0.78 / 0.91, 29 SCG - / - / 0.92, 15 SDG&E 0.75 / 0.75 / 0.68, 3 Total: 120	The study used the SRA methodologies, specifically the Standard – Very Large NTG Method for all the impact evaluated sites and the Basic NTG Method on a random selection of additional sites to complete a 50% sample size, to estimate project and program-level NTGRs. The method used a 0 to 10 scoring system for key questions to estimate the NTGR, rather than fixed categories and assigned weights. The method asked respondents to jointly consider and rate the importance of the many likely events and factors that may have influenced their decision making, rather than focus only on rating the program's importance. The approach was customized to reflect the unique requirements of the retro-commissioning HIM evaluation. An additional set of questions, aimed at assessing deferred free-ridership, were asked of those decision makers who indicated they would have pursued RCx work absent a	The study found generally low levels of free ridership across the projects. Weight averaging the program level values yields a kWh NTGR of 0.82, a kW NTGR of 0.77. These yield an average electric NTGR of 0.80. The natural gas program level values yield a Therms NTGR value of 0.82. The evaluation included a large number of programs in the study, over two dozen, and 96 different measures. The custom nature of the 225 projects examined and the large number of measures makes it difficult to predict what mix will make-up RCx in the future, and how the factors should be adjusted to forecast NTGR values. In addition, there are persistence issues for some of the measures considered part of the RCx packages and potential overlaps with the HVAC Quality Maintenance programs should be examined in the future. Given these uncertainties, it is not recommended that the potential effects of partial

DEER Update Technology Group 2 – Commercial HVAC Systems and Building Envelope

EEM Categories	Current NTGR Values*	Program Delivery Approach	Data Sources	NTGR Values from Data Sources	Methods Used in Data Sources to Estimate the NTGR Values	Proposed NTGR Value Estimate for 2011
					program.	and/or deferred free-ridership be removed from this measure at this time. **Recommend that we use the overall weighted average values of NTGR for electric and natural gas, 0.80 and 0.82, for the RCx Packages EEM.**
Water-Cooled Chillers: Centrifugal, Screw, Scroll, Reciprocating, Centrifugal with VSD, Screw with VSD, "Frictionless" with VSD Air-Cooled Chillers: Screw, Scroll, Reciprocating, Screw with VSD, "Frictionless" with VSD	DEER listing for "All HVAC" for Large Non-residential Customized Incentives is 0.64. (This is the same value adopted for all Large Non-Residential Custom Measures.)	Customized Incentives	Major Commercial Contract Group, Volume I, Final Impact Evaluation Report, 2006 – 2008 Program Years, SBW Consulting, Inc., February 10, 2010	The study determined the following NTGR for IOU programs that included Custom HVAC measures in the results mix: **NTGR** (**kWh** / **kW**) – **Sample Sizes** SCE2517 0.59 0.57 47 SDGE3010 0.70 0.68 33 SDGE3025 0.56 0.54 27 Total: 107	The study used the SRA methodology to estimate the NTGR values. Three levels of analysis methodologies were used: the Standard – Very Large applied to the largest and most complex projects. The Standard NTGR approach involves a less detailed level of analysis, was applied to projects with moderately high levels of gross savings. The Basic NTGR was applied to all remaining projects. The paid incentive was the main determinant used to assign a project to an assigned rigor level. Sites with incentives of $200,000 or more were assigned to the Standard Very Large rigor level and sites with incentives less than $50,000 were assigned to the Basic rigor level. All other sites were assigned to the Standard rigor level. Supplemental Decision Maker questions were posed to those sites assigned to the Standard and Standard Very Large rigor levels. The NTGR values were calculated as the average of	There are two ways to derive a representative Chiller Replacement NTGR: (1) Weight averaging the program level values that contain Custom HVAC. This approach yields a kWh weighted value of 0.60, a kW weighted value of 0.59, and an overall average of 0.59. (2) Use the project level NTGR values for chiller projects found among the samples. The main drawback is the low number of chiller projects (14). Averaging the project level values yields an NTGR of 0.56. Thus, the two approaches yield values within a very narrow range, from 0.56 to 0.59. The study does not indicate that there are adjustments for partial free-ridership. However, deferred free-ridership adjustments are apparent in the chiller project level values, but given the low sample size, unaddressed free-ridership issues in the Custom Incentive Programs, and the narrow range of the weighted averages, and the ongoing efforts of the Custom and Ex

DEER Update Technology Group 2 – Commercial HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values***	**Program Delivery Approach**	**Data Sources**	**NTGR Values from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
					three scores: (1) Timing and Selection, (2) Program Influence, and (3) No-Program. The No-Program score includes adjustments for deferred free-ridership.	Ante reviews, removing the effect of deferred free-ridership is not warranted. **Recommend that the mid-point of the range, rounded up to 0.58, be used as the Chiller Replacement NTGR value for the Customized Incentive delivery approach.**
Water- and Air-Cooled Package Heat Pumps and Air Conditioners Air-Cooled Split System Air Conditioners and Heat Pumps	The DEER uses the default NTGR of 0.85 for the Upstream Prescriptive Rebates for Packaged AC Systems from 65 - 135 kBTU/hr in size. For Downstream Prescriptive Rebates, the DEER lists a value of 0.50 for packaged systems under Other HVAC.	Upstream, Downstream	Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs, 2006 – 2008 Program Year, Final Consultant Report, Volumes 1 and 2, KEMA, February 10, 2010	The study estimated NTGR values for the following IOU programs based on vendor surveys only (Table 6-44): **Program** / **NTGR kWh** / **NTGR kW** / **Sample Sizes** PGE2080 0.94 0.94 10 SCE2507 0.96 0.96 10 SDGE3029 0.94 0.94 10 Total: 30 The actual vendor survey sample sizes were found in the study's Appendix G.	The SRA methodologies were employed along with vendor surveys for several programs. If no customer survey was implemented for the evaluated program, the vendor survey results were used for the NTGR estimates. If a customer survey was implemented, the vendor survey score replaced the Timing and Selection score from the customer survey. Vendor surveys were conducted for all the non-residential programs. A customer survey was conducted only for the SDGE 3029 program. The survey was considered not a good fit for the customer class since it produced a 97% free-ridership value, diametrically the opposite result of the vendor surveys. Hence, the study NTGR results use only the vendor surveys to produce a consistent set of NTGR values.	The report does not separate and present the results by the upstream and downstream delivery approaches. Appendix G indicates that the participating distributors surveyed were from the upstream programs. Also, the study relied solely on the vendor surveys for its results, which tend to produce high NTGR values. The study does not clearly indicate whether the non-residential results were adjusted for either partial and/or deferred free-ridership. The presented NTGR values are the result of only vendor surveys and the VMAX score. It is difficult to conclude that the study results are a reliable indicator of the program's free-ridership due to the small sample sizes and sole reliance on the vendor surveys. **Recommend that no adjustments to the NTGR values for Packaged and Split Systems AC Replacements be made based on the study's results.**

Table A-3-1: Weight Averaged 2006 – 2008 NTGR Values for the 2011 DEER Update

RCA EEM		Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G
	PGE2068	2,172,294	0.54	1,173,039	1,923	0.54	1,038
	PGE2080	1,814,383	0.55	997,911	13,339	0.55	7,336
	SCE2507	7,020,259	0.94	6,599,043	5,923	0.94	5,568
	SDGE3043	619,598	0.70	433,719	2,183	0.70	1,528
	Totals:	11,626,534		9,203,711	23,368		15,471
		kWh Weighted Average:	**0.79**		kW Weighted Average:	**0.66**	
				0.73			

RCx EEM											
		Number of Projects	Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G	Ex Post Therms Savings	NTGR	Col I * Col J
	PG&E	135	24,077,925	0.80	19,262,340	1,755	0.76	1,334	990,090	0.76	752,468
	SCE	58	22,255,296	0.86	19,139,555	1,740	0.78	1,357	26,796	0.91	24,384
	SCG	28	-		-	-		-	664,580	0.92	611,414
	SDG&E	4	2,427,396	0.75	1,820,547	516	0.75	387	45,816	0.68	31,155
	Totals:	225	48,760,617		40,222,442	4,011		3,078	1,727,282		1,419,421
			kWh Weighted Average:	**0.82**		kW Weighted Average:	**0.77**		Therms Weighted Average:	**0.82**	
					0.80						

Custom EEM (Proxy for Chiller Replacement EEM)								
		Number of Projects	Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G
	SCE2517	1,397	384,031,109	0.59	226,578,354	57,277	0.57	32,648
	SDGE3010	719	80,812,005	0.70	56,568,404	12,223	0.68	8,312
	SDGE3025	343	57,426,089	0.54	31,010,088	7,203	0.56	4,034
			-		-	-		-
	Totals:	2459	522,269,203		314,156,846	76,703		44,993
			kWh Weighted Average:	**0.60**		kW Weighted Average:	**0.59**	
					0.59			

	Table 53: SCE2517 SPC NTGR Scoring Componen				Table 56: SDGE3025-Electric NTGR ScoringComponents and Final Score for Sample							Table 58: SDGE3010-Electric NTGR S				
SBW ID	M00490	M00502	M00535	M25098	M01208	M01315	M01323	M01326	M49222	M01357	M49153	M48838	M49024	M48711		
IOU Measure ID	2006-535	2006-520	2006-281	2007-703	1/1/3023	1/2/3197	1/1/3024	1/1/3197	1/1/3483	1/1/3216	1/1/3357	3518-2650	3518-2971	3518-2411-1		
HIM	N/A	N/A	N/A	Custom HVAC	N/A	N/A	N/A	N/A	N/A	Custom HVAC	Custom HVAC	N/A	N/A	Custom HVAC		
Case Weight	152	152	152	152	85.3	27	27	27	3	3	3	14	73.5	14		
Measure Description	Turbocor C	Chiller VS	75-200 Ton	Replace two 2	230 ton Cl	High Effici	Chiller Re	High Effici	Chiller	1- 365 ton Chil	chiller replace	Convert a	400-TON S	Retrofit with T		
Timing and Selection - Decision Maker Survey	8	10	10	10	9	6	10	5	6	10	10	8	9	10		
Program Influence - Decision Maker Survey	3.5	8	3	10	5	4	8	4	4	8	2	6	4	3		
No-Program - Decision Maker Survey	3	4.3	7.7	0	5.7	5.2	9.4	5.2	0	4.3	0	6.6	3	4		
Standard Scoring NTGR	0.48	0.74	0.69	0.5	0.66	0.51	0.91	0.47	0.2	0.74	0.1	0.69	0.53	0.57		
Timing and Selection - Adjusted or Concensus	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8	N/A	N/A		
Program Influence - Adjusted or Concensus	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6	N/A	N/A		
No-Program - Adjusted or Concensus	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	6.6	N/A	N/A		
Was Standard Very Large (Y/N)	N	N	N	N	N	N	N	N	N	N	N	Y	N	N	**Current NTGR:**	**0.64**
Scoring Overridden by other information (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	**No. of Observations:**	**14**
Final NTGR	0.48	0.74	0.69	0.50	0.66	0.51	0.91	0.47	0.20	0.74	0.10	0.69	0.53	0.57	**As-is Average NTGR:**	**0.56**
	0.48	0.74	0.69	0.50	0.66	0.51	0.91	0.47	0.20	0.74	0.10	0.69	0.53	0.57	**Recommended Mid-Point NTGR:**	**0.58**

Appendix A-4

Commercial Refrigeration

Table A-4-0-1: Overview of Methods, Data and NTGR Results by Method

DEER Updates Technology Group 5 – Commercial Refrigeration						
EEM Categories	**Current NTGRs**	**Program Delivery Approach**	**Data Sources**	**NTGRs from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Recommendations and Proposed Approaches to Estimate "Forward-Looking" NTGR Values**
Door Gasket - Vertical & Horizontal Reach-In Refrigerated Display Cases, Walk-in Coolers & Freezers	DEER 0.46	Downstream Prescriptive	Commercial Facilities Contract Group 2006 – 2008 Direct Impact Evaluation Study, Volumes 1 and 3, February 18, 2010, ADM	NTGR of 0.19	The NTG method relied exclusively on the Self-Report Approach (SRA) using a telephone survey to estimate project and domain-level Net-to-Gross Ratios. The survey for door gaskets was a modified version of the standard net-to-gross battery due to either maintenance contracts for door gasket replacements, internal program for maintaining door gaskets, or door gaskets were provided at no charge. The net-to-gross ratio was formed by averaging the composite program summary influence score and likelihood score.	Use the 0608 study results even though The difference between the existing DEER NTGR and the 0608 represents a 27%/37% change and the review did not find any justification for or discussion on the low NTGR. It is likely that the high free ridership may be due to the baseline issues.
Strip Door Curtains	DEER 0.76	Downstream Prescriptive	Commercial Facilities Contract Group 2006 – 2008 Direct Impact Evaluation Study, Volumes 1 and 3, February 18, 2010, ADM	NTGR of 0.40	The NTG method relied exclusively on the Self-Report Approach (SRA) using a telephone survey to estimate project and domain-level Net-to-Gross Ratios. The survey for strip curtains was a modified version of the standard net-to-gross battery. due to either maintenance contracts for door gasket replacements, internal program for maintaining door gaskets, or door	

DEER Updates Technology Group 5 – Commercial Refrigeration						
EEM Categories	**Current NTGRs**	**Program Delivery Approach**	**Data Sources**	**NTGRs from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Recommendations and Proposed Approaches to Estimate "Forward-Looking" NTGR Values**
					gaskets were provided at no charge. The net-to-gross ratio was formed by averaging the composite program summary influence score and likelihood score.	

Table A-4-2: 2009-2011 Q2 Tracking Data

		Actual Contribution to IOU Portfolio Savings														
		kWh Savings					**kW Savings**					**Therm Savings**				
Sector	**EDMeaGroup**	SW	PGE	SCE	SDGE	SCG	SW	PGE	SCE	SDGE	SCG	SW	PGE	SCE	SDGE	SCG
Non-Residential	Refrigeration Door Gasket	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0 %	0.0 %	0.0%	0.0%
Non-Residential	Refrigeration Strip Curtain	3.0%	5.5%	0.9%	0.6%	0.0%	2.8%	5.9%	0.3%	0.4%	0.0%	0.0%	0.0 %	0.0 %	0.0%	0.0%

Appendix A-5

Residential HVAC

Table A-5-1: Overview of Methods, Data, and NTGR Results

DEER Update Technology Group 8 – Residential HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values**	**Program Delivery Approach**	**Data Sources**	**NTGR Values in Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
Room Air Conditioners	0.70	Downstream	EM&V of the CPUC Residential Retrofit High Impact Measure Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch. 12]	The study determined the following NTGR values for the IOU programs: kWh Sample PGE 0.41 91 SCE 0.36 629 SDG&E 0.31 377 Total: 1,097	Self-Report Approach was used to estimate the net-to-gross ratio. The NTG ratio was developed using a consistent method based on measure delivery channel with appropriate decision maker phone SR surveys administered to a representative sample.	The study states for RACs that "…the self-report NTG estimated free-ridership of 58%-74%. This high rate, however, is somewhat inconsistent with the market share data reported by the Department of Energy (DOE). The National ENERGY STAR Retailer Partners are required to annually provide sales data to the DOE for dishwashers, clothes washers, room air conditioners, and refrigerators. In 2006-2008 the National ENERGY STAR retailer partners reported the **national** market share data for ENERGY STAR room air conditioners was 36%, 50%, and 43%, respectively. While this is not an estimate of free-ridership, it is an indication that sales of ENERGY STAR room air conditioners were in the 36%-50% range throughout the U.S., substantially lower than the self-reported estimate of free-ridership in this study." The reported Energy Star RAC sales in **California** are 36% in 2009, 38% in 2008, 51% in 2007, and 21% in 2006. Although retail partners that provide data to Energy Star may vary year to year making reliable direct comparisons difficult, a review

DEER Update Technology Group 8 – Residential HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values**	**Program Delivery Approach**	**Data Sources**	**NTGR Values in Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
						of the incremental cost trend and general availability of RAC units by EER level is warranted to consider an adjustment for the final recommended NTGR for the 2013-2014 timeframe. **In the interim, we recommend a 0.36 program level weighted average NTGR.**
HVAC Maintenance: Duct Sealing	0.78	Free Tune-up/Repair	EM&V of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs, 2006 – 2008 Program Year, Final Consultant Report, Volumes 1 and 2, KEMA, February 2010 [Ch. 7]	The electric energy savings weighted results are specific to the duct sealing measures within those programs and not reflective of the total program net-to-gross ratios. NTGR Sample PG&E2000 0.54 211 PGE2078 0.85 103 SCE2501 0.79 102 SCE2507 0.96 112 SDGE3035 0.80 102 Total: 630	Self-Report Approach was used to estimate the net-to-gross ratio. The program deliveries allowed flexibility to the contractor in terms of the marketing and incentive, especially for RCA and duct-sealing measures. This required a method that supplemented the participant self-report surveys with contractor surveys. The NTGR algorithm derived four separate measurements of free-ridership from different inquiry routes. These four measurements were averaged to derive the final free-ridership estimate at the measure level.	The study has errors in some of the tables for the measure install rates where the correct PASS value was not used. Our weighted averages used for the below review corrected for this problem. An overall program level weighted average, including the CMMHP programs, yields an overall electric energy savings NTGR of 0.64 and a natural gas energy savings NTGR of 0.60. Excluding the CMMHP programs from the overall program averages yields an NTGR 0.58 for electric savings and 0.56 for natural gas savings. The weighted average of the CMMHP only programs yields an NTGR of 0.79 for electric savings and 0.80 for natural gas savings. The NTGR result for the PG&E2000R program appears to be an outlier compared to the other programs. The study did not offer a direct explanation why there is such a large difference. Our review points to two possibilities. First, the PG&E2000R was the only survey with significant number of respondents to all four parts of the free-ridership measurements and the only one with enough respondents to part four (Table 7-13). Hence, it may be the only NTGR result that is based on the average of all four parts,

DEER Update Technology Group 8 – Residential HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values**	**Program Delivery Approach**	**Data Sources**	**NTGR Values in Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
						while the others may be the average of two or three of the components. Second, the PG&E2000R survey results had the highest proportion of respondents with an extreme "0.9 – 1" free-ridership ratio that isn't offset by a higher proportion of respondents in the opposite extreme of "0-0.1" free-ridership ratio range. Not including the PG&E200R results in the program level weighted averages yields NTGR values close to 0.81 for both electric and natural gas savings. The IOU level weighted averages are also a possible alternative and they would be as follows: **IOU Electric Nat. Gas** PG&E 0.56 0.57 SCE 0.83 - SCG - 0.79 SDG&E 0.80 0.80 Thus, the utility level values again point to the PG&E result as a potential extreme. Taking into consideration that the standalone DTS EEM may become a bundled EEM within the broader scope the IOUs HVAC Maintenance programs, and that it is difficult to judge, without detail examination of the survey responses and scoring, whether the PG&E2000R result is the one valid result and the other program results are outliers or vice-versa, the TG8 team believes that the '06-'08 NTGR results should not be used to determine a revised NTGR for the standalone DTS EEM. **Recommend no change to the current NTGR value of 0.78 for**

DEER Update Technology Group 8 – Residential HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values**	**Program Delivery Approach**	**Data Sources**	**NTGR Values in Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
						midstream and downstream delivery.
HVAC Maintenance: Refrigerant Charge Adjustment	0.78	Free Tune-up/Repair	Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs, 2006 – 2008 Program Year, Final Consultant Report, Volumes 1 and 2, KEMA, February 2010 [Ch. 5]	The study utilized telephone surveys to estimate the following: NTGR PG&E2000 0.63 PG&E2078R 0.78 SCE2502 0.78 SCE2507 0.97 SDGE3035 0.78	Similar to Duct Sealing NTG - A participant self-report approach was used to estimate the net-to-gross ratio. The program deliveries allowed flexibility to the contractor in terms of the marketing and incentive, especially for RCA and duct-sealing measures. This required a method that supplemented the participant self-report surveys with contractor surveys. The NTGR algorithm derived four separate measurements of free-ridership from different inquiry routes. These four measurements were averaged to derive the final free-ridership estimate at the measure level.	The program level NTGR results from this study yield an ex post energy weighted average value of 0.88 due primarily to the large ex post savings and high NTGR value for the SCE 2507 program (0.97). The differences among the program results are not well explained in the study. As with the DTS EEM, the PG&E 2000 program low results are affected by the extreme responses within the single family surveys ("0-0.1 FR ratio: 0% and 0.9-1 FR ratio 13.8%). Without the SCE result included in the average, the weighted average drops to 0.68. The midpoint between the two weighted average values is 0.78, the currently adopted value for this measure. In addition, future programs are unlikely to offer the RCA EEM as a standalone measure. Going forward, the EEM is part of the HVAC Quality Maintenance Programs. The programs launched in June 2011. There are significant uncertainties and issues that persist for this measure. It is anticipated that the ongoing 2010-2012 EM&V research efforts may address many of the issues. Given the change in delivery approach for this measure going forward, I do not recommend the study's NTGR values be used to set the recommended 2011 NTGR value. **Recommend no change to the existing NTGR value of 0.78 for midstream delivery.**

DEER Update Technology Group 8 – Residential HVAC Systems and Building Envelope						
EEM Categories	**Current NTGR Values**	**Program Delivery Approach**	**Data Sources**	**NTGR Values in Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed NTGR Value Estimate for 2011**
Roof and Wall Insulation	0.70	Downstream	EM&V of the CPUC Residential Retrofit HIM Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch. 10]	The study determined the following NTGR values for the IOU programs: kWh kW Therms PG&E 0.25 0.28 0.26 SCG 0.30 0.30 0.30 SDG&E 0.25 0.26 0.25	The evaluation used the Joint Simple SR NTG Method. The study provides little discussion about these NTGR results.	The study's approach to determining the effective level of insulation levels was reasonable and the NTGR values all cluster about the same value. This measure has been offered for well over 30 years. The measure may eventually be offered only as part of the Whole House retrofit bundles in the future and cease as a standalone measure. **Recommend a program level weighted average of 0.28 for downstream delivery.**
Air Cooled Packaged and Split System Air Conditioners and Heat Pumps	0.67, SEER≥14 0.80, SEER≥15 for AC units 0.55 for Heat Pumps	Downstream Prescriptive	Evaluation Measurement and Verification of the California Public Utilities Commission HVAC High Impact Measures and Specialized Commercial Contract Group Programs, 2006 – 2008 Program Year, Final Consultant Report, Volumes 1 and 2, KEMA, February 2010 [Ch. 6]	Telephone and onsite surveys were used to estimate the following NTGRs by IOU: kWh kW SCE2507 0.56 0.56 SDGE3029 0.53 0.54	Self-Report Approach - The NTG ratio was developed using a consistent method based on measure delivery channel with appropriate decision maker surveys administered to a representative sample.	The two residential AC replacement programs, where the residential/small commercial NTG battery was administered, have consistent NTG ratios of 53% to 56% which are very reasonable considering the amount of "green" messaging from multiple sources during the last five years and the marketing around high efficiency air conditioners. The study provides no distinction by SEER level and system types. The study did determine differences in the savings by replace-on-burnout (ROB), new construction (NC), and early retirement (ER), but did not attempt to determine separate NTGR values by delivery method. Weight averaging the program level NTGR values by energy savings and demand reduction Totals for Overall, ROB/NEW, or ER cluster about the value of 0.55. **Recommend the adoption of a statewide value of 0.55.**

Table A-5-2: Weight Averaged 2006 – 2008 NTGR Values for the 2011 DEER Update

Room AC EEM							
		Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G
	PGE2000	710,100	0.41	291,141	1,102	0.41	452
	SCE2501	7,767,934	0.36	2,796,456	7,150	0.36	2,574
	SDGE3024	1,108,704	0.31	343,698	1,062	0.31	329
				-			-
	Totals:	9,586,738		3,431,295	9,314		3,355
		kWh Weighted Average:	0.36		kW Weighted Average:	0.36	
			'06-'08 Weighted Average:	0.36			

Duct Seal EEM								
		Ex Ante kWh Savings	Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post Therms Savings	NTGR	Col I * Col J
	PGE2000R	6,148,183	3,320,019	0.54	1,792,810.16	478,929	0.54	258,621
	PGE2078	414,452	169,925	0.85	144,436.52	28,952	0.85	24,609
CMMHP	SCE2502/SCG3539	2,245,083	920,484	0.79	727,182.38	34,641	0.79	27,366
	SCE2507	508,596	249,721	0.96	239,731.81	-	0.96	-
CMMHP	SDGE3035	900,668	369,274	0.80	295,419.10	80,235	0.80	64,188
	Totals:	10,216,982	5,029,423		3,199,579.98	622,757		374,785
			kWh Weighted Average:	0.64		Therms Weighted Average:	0.60	

RCA EEM	Table 5-44	Ex Post kWh Savings	NTGR by kWh	Col C * Col D
	PGE2000	4,114,962	0.63	2,592,426
	PGE2078	406,930	0.78	317,405
CMMHP	**SCE2502**	1,497,279	0.78	1,167,878
	SCE2507	13,893,277	0.97	13,476,479
CMMHP	**SDGE3035**	402,109	0.78	313,645
	Totals:	20,314,557		17,867,833
		kWh Weighted Average:	**0.88**	
		Without SCE2507:	**0.68**	
		Average:	**0.78**	

Roof and Wall Insulation EEMs											
		Verified SQFT	Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G	Ex Post Therms Savings	NTGR	Col I * Col J
	PGE2000	17,119,510	1,561,946	0.25	390,486.47	3,258	0.28	912	890,215	0.26	231,456
	SCG3517	16,148,192	3,808,147	0.30	1,142,444.14	2,012	0.30	604	823,558	0.29	238,832
	SDGE3024	3,362,520	361,253	0.25	90,313.24	374	0.26	97	127,776	0.25	31,944
			-		-	-		-	-		-
	Totals:	36,630,222	5,731,346		1,623,244	5,644		1,613	1,841,548		502,231
			kWh Weighted Average:	**0.28**		kW Weighted Average:	**0.29**		Therms Weighted Average:	**0.27**	
			'06-'08 Weighted Average:		**0.28**						

Package and Split System AC and HP Replacement EEMs: No Delivery Method Distintion							
		Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G
	SDGE3029	699,369	0.53	370,666	967	0.54	522
	SCE2507	1,140,969	0.56	638,943	1,636	0.56	916
				-			-
				-			-
	Totals:	1,840,338		1,009,608	2,603		1,438
		kWh Weighted Average:	0.55		kW Weighted Average:	0.55	
			'06-'08 Weighted Average:	0.55			

Package and Split System AC and HP Replacement EEMs: ROB/NEW							
		Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G
	SDGE3029	22,583	0.53	11,969	34	0.54	19
	SCE2507	299,648	0.56	167,803	448	0.56	251
				-			-
				-			-
	Totals:	322,231		179,772	482		269
		kWh Weighted Average:	0.56		kW Weighted Average:	0.56	
			'06-'08 Weighted Average:	0.56			

Package and Split System AC and HP Replacement EEMs: ER							
		Ex Post kWh Savings	NTGR by kWh	Col C * Col D	Ex Post kW Reduction	NTGR by kW	Col F * Col G
	SDGE3029	676,786	0.53	358,697	933	0.54	504
	SCE2507	841,322	0.56	471,140	1,189	0.56	666
				-			-
				-			-
	Totals:	1,518,108		829,837	2,122		1,170
		kWh Weighted Average:	0.55		kW Weighted Average:	0.55	
			'06-'08 Weighted Average:	0.55			

Appendix A-6
Residential & Non-Residential Water Heating

Table A-6-1: Overview of Methods, Data Sources, and NTGR Results by Measure

DEER Updates Technology Group 3 – Residential and Commercial Water Heating						
EEM Categories	**Current NTGRs**	**Program Delivery Approach**	**Data Sources**	**NTGRs from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed Approaches to Estimate "Forward-Looking" NTGR Values**
Residential Aerators		Direct Install	EM&V of the CPUC Residential Retrofit High Impact Measure Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch. 9]	The study evaluated two SDG&E programs. The evaluation results varied among the IOU programs as followed: NTGR SDGE3017 (MH) 0.59 SDG&E3035 (SF) 0.75	This evaluation determined NTG from participant self-report responses to a telephone survey. The instrument and algorithm used was the Joint Sample Self-Report NTG method. The study evaluated three programs for two IOUs. The final report does not indicate what value was used in the IOU program plans for 2009-2011. Evaluation results varied among the IOU Programs.	There are no new evaluation studies and additional primary data sources published since 2010 that are readily available to inform the short term updates. Data should be gathered on the market saturation of aerators in the latest RASS and new incremental cost information should be used to make an assessment of likely trends in NTGR in 2012.
Residential Showerheads	DEER 0.85	Direct Install	EM&V of the CPUC Residential Retrofit High Impact Measure Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch. 9]	Results were the same when Weighted by Year and Therms NTGR SCG3517 (MH) 0.72 SDGE3017 (MF) 0.68 SDG&E3017 (SF) 0.70		
Residential Gas Storage /Instantaneous Water Heater	DEER WH gas EF>0.62=0.58	Downstream Prescriptive	EM&V of the CPUC Residential Retrofit High Impact Measure Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch. 8]	SCG3517 (2006) 0.25 SCG3517 (2007) 0.30 PGE2000 0.17 SDGE3024 0.22	Evaluation determined NTG through the Joint Sample Self-Report NTG method. The evaluation relied on telephone surveys to determine NTGR – weighted by year and Therms; No 2008 data for SCG	Note: The evaluation found a high percentage of free-riders for high-efficiency gas water heaters and conducted a search for market share data to provide additional context for the current - but was unable to acquire secondary market share data for high-efficiency hot water heaters. 2012 evaluators and or Energy Star program should be asked to provide this data for the 2012 update.
Residential Electric Storage /Instantaneous Water Heater	.58	Downstream Prescriptive				No data available on trends in sales of more efficient systems and this measure is no longer actively promoted by utilities. New generation of heat pump water heaters suggests no update may be needed for NTGR.

Appendix A-7

Residential Appliances

Table A-7-1: Overview of Methods, Data and NTGR Results by Method

DEER Updates Technology Group 9 – Residential Appliances						
EEM Categories	**Current NTGRs**	**Program Delivery Approach**	**Data Sources**	**NTGRs from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed Approaches to Estimate "Forward-Looking" NTGR Values**
Clothes Washer	CW>1.75MEF = 0.81 CW-15%> DOE Std = .85	Downstream Prescriptive	EM&V of the CPUC Residential Retrofit High Impact Measure Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch.6}	0608:NTGR[1] (Therms) PG&E2000 0.31 SCG3517 0.29 SDGE3023 (nonHIM) 0.31 Samples:	**0405** Itron October 2007: All Residential NTGR (SR) = -0.57; NTGR (DC) – 0.81 Used both the self-report and discrete choice methods for estimating CW NTGR (a) The self-report analysis used participant and non-participant data - (b) A two-stage discrete choice method modeled the probability of purchasing high-efficiency measure as the product of the probability that the measure is purchased and the probability that the high-efficiency measure is selected SR: analyzed FR from four separate ways in which the Program may influence a customer to adopt an energy-efficient measure, with each assigned a probability score. And the average of the scores represents the FR value. Questions addressed relevant topic related to accelerated purchases and thus partial free riders, program effect on efficiency level selected and the number of efficiency products purchased; relatively large sample size (>1,500 for both participants and nonparticipants) and high completion rate for the SR surveys yielded robust and statistically significant NTGR results.	Both the 0405 and the 0608 evaluations used similar self-report multi-step approach in calculating the NTGR, with the latest study using larger sample sizes but no non-participants data to corroborate the results. In addition, the 0608 self-reported NTGR values are significantly lower than the DEER (0405 study) values by 50%-52%. Recommendation: use results from 0608 to adjust numbers: Rationale: (1) multi- step methodology –same as 0405, (2) larger sample size but no nonparticipants, and (3) reported market share data for ENERGY STAR clothes washers (which is also inclusive of all the more efficient CEER tiers) was 38% in

[1] Note that SDGE3023 does not include free-ridership estimates prior to the 2008 program year, and SCG3517 does not include free-ridership estimates for the 2008 program year.

DEER Updates Technology Group 9 – Residential Appliances						
EEM Categories	**Current NTGRs**	**Program Delivery Approach**	**Data Sources**	**NTGRs from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed Approaches to Estimate "Forward-Looking" NTGR Values**
					The Discrete Choice model: -238 participants 445 non-participants: is based on hypothesized purchasing behavior that includes nonparticipants. Participant level free-ridership was estimated from these probabilities by dividing the probability of making the purchase without the program by the probability of making the purchase with the Program. DC is less prone to self-report bias, and is considered more credible than self-report results **0608** self-report NTG method only: 990 participant surveys 551 (PGE), 323 (SDGE), 116 (SCG) Participants were interviewed to measure each program's influence on that person's decision-making. The survey obtained highly structured responses concerning the probability that the household would have installed the same measure(s) at the same time in the absence of the program. The survey also included open- and closed-ended questions that focused on the participant's motivation for installing the efficiency measure. Similar to the 0405 Itron study, the NTGR algorithm derived four separate measurements of free-ridership from different inquiry routes. These four measurements were averaged to derive the final free-ridership estimate at the measure level for each program evaluated. Results from this analysis indicate a very high level of free-ridership across all three programs as compared to ex ante assumptions. The self-report NTGR is also substantially higher than the market share data reported by the Department of Energy (DOE). [2]	2006, 42%, and 24%, respectively and the 2007 Itron Market Share Report found that 45% of California CW sales were ENERGY STAR rated or higher, . While this is not an estimate of free-ridership, it is an indication that sales of ENERGY STAR clothes washers were in the 24%-42% range nationally, significantly lower than the self-reported estimate of free ridership in the study.

[2] The National ENERGY STAR Retailer Partners are required to annually provide sales data to the DOE for appliances. In 2006-2008 the National ENERGY STAR retailer partners reported the market share data for ENERGY STAR clothes washers (which is also inclusive of all the more efficient CEER tiers) was 38% in 2006, 42%, and 24%, respectively. Additionally, the 2007 Itron Market Share Report found that 45% of California CW sales were ENERGY STAR

DEER Updates Technology Group 9 – Residential Appliances						
EEM Categor ies	**Current NTGRs**	**Program Delivery Approach**	**Data Sources**	**NTGRs from Data Sources**	**Methods Used in Data Sources to Estimate the NTGR Values**	**Proposed Approaches to Estimate "Forward-Looking" NTGR Values**
Refrigerato r & Freezer	Refrig current standard = 0.57 Refrig 15% >=0.75 **Refrig Rec =0.614** Parts=716; NParts=354 Freezer Rec = 0.70	Downstream **Turn-in Recycling**	EM&V of the CPUC Residential Retrofit High Impact Measure Evaluation Report and Appendices, February 8, 2010, The CADMUS Group [Ch. 11]	NTGR by IOU for Refrigerator Recycling Programs PGE2000 051 SCE2500 0.56 SDGE3028 058	To determine (refrigerator recycling) net-to-gross ratio for each utility, a methodology similar to that employed in the 2004-2005 statewide ARP evaluation was undertaken. The methodology utilizes surveys with participants, non-participants and market actors. A weighted average of participant and non-participant responses, as well as respondents discarding primary and secondary refrigerators was calculated. This average NTG serves as the evaluation's final determination of program NTG for each utility Surveys conducted: Participant Survey = 1857; nonparticipant survey = 1173; market actors = 81	Only the Refrigerator Recycling programs evaluated in 0608. NTG values were only provided at the IOU program level. However, Controversy over the NGT values for Appliance Recycling suggests that updating this value should wait for the results of the 2010-2012 EM&V ARP study.

rated or higher. While this is not an estimate of free-ridership, it is an indication that sales of ENERGY STAR clothes washers were in the 24%-42% range throughout the U.S., (CADMUS, 2010)

Table A-7-2: CADMUS 2010

Table 134. Net-to-Gross Ratios by Utility Overall Net-To-Gross Ratio (Weighted Average of Primary/Secondary)

Utility	Participant	Non-participant	Weighted Average
PGE	0.44	0.59	**0.51**
SCE	0.52	0.60	**0.56**
SDGE	0.51	0.64	**0.58**

Primary Net-To-Gross Ratio

Utility	Participant	Non-participant	Weighted Average
PGE	0.41	0.56	0.45
SCE	0.49	0.55	0.48
SDGE	0.50	0.60	0.52

Secondary Net-To-Gross Ratio

Utility	Participant	Non-participant	Weighted Average
PGE	0.48	0.73	0.62
SCE	0.57	0.87	0.78
SDGE	0.53	0.88	0.78