Definition of Demand (kW) Impacts Used in the 2005 DEER Update

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1.0 Overview of Definition and Calculation Procedure

This document provides a summary of the method and procedure used to calculate demand impacts for measures listed in the 2005 DEER data base. The procedure documented here was applied to all weather sensitive measures; due to the lack of data, this method was not able to be applied to all non-weather sensitive measures, however, it is envisioned that the 2004-2005 and 2006-2008 program cycle M&V activities will provide additional data that will allow most non-weather sensitive measure to have demand impacted calculated by this same procedure.

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. For buildings, such as educational facilities, which operate at greatly reduced use during the previously defined peak period, the next highest such peak is used for a period during which the facility is operated in full use mode.

The three-weekday periods, both primary (highest) and secondary (for educational facilities) are selected separately for each of the 16 official Title 24 CZ reference weather data sets that were used for the DEER calculations.

The average demand impact for a measure was calculated by two different methods depending upon the type of equipment operation. For continuously operating equipment the average demand impact is calculated by taking the energy use of the pre-measure building during the nine hours and subtracting the energy use of the post measure building and dividing by nine; thus the demand impact for these types of measures is the average impact during the pre-determined nine-hour period.. For equipment that can be expected to cycle on/off during the peak period in some climates or building types, the demand impact is defined as the "run time averaged" demand impact multiplied by a "population demand diversity factor" for the measure. In the DEER analysis weather sensitive measures (such as envelope, lighting and HVAC) in non-residential buildings were analyzed as being continuous operation measures; non-residential HVAC equipment, for example, was assumed to operate continuously (rather than cycle) to maintain code required ventilation as well as comfort. Residential HVAC equipment was analyzed as being cycling operation and thus the runtime averaged demand impact method was used for all weather sensitive residential measures.

2.0 Calculation Procedure for Runtime Averaged Demand Impact

The runtime average demand impact is calculated using a three step process as documented below.

1. The "average peak period instantaneous demand" (IP) is calculated for both the pre-measure (base case) and post-measure (EEM case) situations. This value is calculated by

summing the energy consumption for the nine-hour peak period (PkWh) and dividing by the sum of the equipment hours of runtime during the period (RT). For short time cycling equipment the runtime used in this calculation is not allowed to be less than nine times the minimum demand period of interest for the grid impact; for the DEER analysis this period was 0.15 hours (15 minutes.)

2. The building level "runtime averaged demand impact" is calculated by two alternative methods based upon the relative values of base and measure case runtime from step 1. Except for the case where the base and measure runtimes are exactly the same, there is a fraction of the longer runtime period when both the base case and measure case are running and there is a fraction of the time period when either the base or measure case is running and the other case is not. The calculations below determine the average reduction in demand during the longer of the base or measure runtime:

    a. If the base case runtime exceeds the measure runtime, then the runtime averaged building level demand impact is equal to the base case IP minus the measure case IP times the measure equipment runtime **plus** the base case IP times the base case minus the measure case equipment runtime, this entire quantity divided by the base case runtime.

$$\frac{(IP_{base} - IP_{measure}) * RT_{measure} + IP_{base} * (RT_{base} - RT_{measure})}{RT_{base}}$$

    b. If the measure runtime exceeds the base case runtime, then the runtime averaged building level demand impact is equal to the base case IP minus the measure case IP times the base case equipment runtime **plus** the meassure case average peak period instantaneous demand times the measure case minus the base case equipment runtime, this entire quantity divided by the measure case runtime.

$$\frac{(IP_{base} - IP_{measure}) * RT_{base} + IP_{measure} * (RT_{measure} - RT_{base})}{RT_{measure}}$$

3. The building level "runtime averaged demand impact" calculated in step 2 is converted to a "grid level" runtime averaged demand impact by multiplying the step 2 result by a "population demand diversity factor" for the measure. This diversity factor represents the fraction of installed measures in the total population of installed measure that are operating during the nine-hour peak period during which step 1 and 2 is performed. This diversity factor is at least building type, measure and climate zone specific. For the DEER 2005 analysis, for the weather sensitive analysis of all residential measures that effect the home cooling electric energy use, this diversity factor was equal to 0.7 for residential building types (single, multi, and mobile home) in all climate zones; it is expected that 2004-2005 and 2006-2008 M&V activities may provide additional data to allow mode accurate diversity factors to be applied in the future.

3.0 Choice of Peak Days for California Climate Zones

The periods listed below were those used for the DEER analysis as the primary and secondary peak periods for the sixteen California Title 24 CZ weather data sets. Note that the Title 24 reference year, used with the Title 24 CZ weather data sets, is 1991. The primary and secondary period used for the 2005 DEER analysis are expected to be modified as the PUC adopted avoided cost change (or are updated during 2006-2008 period) and/or Title 24 2008 standards change the weather parameters or time-dependent energy valuation (or other issues or problems are identified.)

	Primary Demand Period		Secondary Demand Period	
CTZ	**Start Date**	**End Date**	**Start Date**	**End Date**
1	30-Sep	2-Oct	1-Oct	3-Oct
2	22-Jul	24-Jul	20-Aug	22-Aug
3	17-Jul	19-Jul	25-Sep	27-Sep
4	17-Jul	19-Jul	26-Aug	28-Aug
5	3-Sep	5-Sep	3-Sep	5-Sep
6	24-Sep	26-Sep	23-Sep	25-Sep
7	9-Sep	11-Sep	10-Sep	12-Sep
8	23-Sep	25-Sep	24-Sep	26-Sep
9	23-Sep	25-Sep	24-Sep	26-Sep
10	12-Aug	14-Aug	18-Sep	20-Sep
11	21-Aug	23-Aug	16-Sep	18-Sep
12	22-Jul	24-Jul	19-Aug	21-Aug
13	30-Jul	1-Aug	19-Aug	21-Aug
14	15-Jul	17-Jul	11-Sep	13-Sep
15	9-Sep	11-Sep	11-Sep	13-Sep
16	26-Aug	28-Aug	3-Sep	5-Sep

It should be noted that quite often the hottest days, for any particular location, may fall on a weekend. For the DEER analysis, based upon the DEER demand impact definition of Section 1.0 above and the official Title 24 CZ weather datasets, only weekdays as defined by the reference year of 1991, were considered as choices for the primary and secondary demand periods identified in the above table. However, in selecting the three day period for DEER analysis, the 2-5 day period proceeding the selected days was also considered as part of the "heat wave" for the selection process.