**Work Paper PGECOCOM105**

**Network Desktop Computer Power Mgmt**

**Revision # 4**

**Pacific Gas & Electric Company**

**Customer Energy Solutions**

**Network Desktop Computer Power Management Software**

**Measure Codes M03**

**PGECOCOM105 R4**

PG&E provides downstream incentives to customers who install qualified network power management software in desktops. Therefore, PG&E will be claiming the following net-to-gross value:

|  |  |  |  |
| --- | --- | --- | --- |
| Measure Code | NTGR\_ID | Description | NTG |
| M03 | Com-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | 0.6 |

PG&E’s program does not differentiate between different building types, so PG&E will be claiming the average value from the studies (before interactive effects): 117.73 kWh and 0.001067 kW.

**Work Paper SCE13OE001**

**Revision 1**

**Southern California Edison Company**

**Power Management Software for Networked Computers**

# At-a-Glance Summary

|  |  |
| --- | --- |
| ****Applicable Measure Codes:**** | PG&E: M03 – Power Management Software for Networked Computers  SCE: OE-65003 – Power Management Software for Networked Computers |
| **Measure Description:** | Installation of software that places unused network Desktop Computers in various modes that use less energy. |
| **Base Case Description:** | Networked Desktop Computers without power management software. |
| **Energy Impact Common Units:** | Per Computer |
| **Energy Savings :** | Refer to Excel Calculation Attachment |
| **Gross Measure Cost ($/unit)** | Refer to Excel Calculation Attachment |
| **Measure Incremental Cost ($/unit):** | Refer to Excel Calculation Attachment |
| **Effective Useful Life (years):** | 5 years |
| **Measure Application Type:** | Retrofit Add-On (REA) |
| **Net-to-Gross Ratios:** | Refer to Table 4 for NTG |
| **Important Comments:** | **This work paper document does not contain a data set in conformance with the 4/1/14 CPUC Ex Ante Database Specification; SCE will provide that data set separately.** |

# Document Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Workpaper and Revision # | Tech. Revision | MM/DD/YY | Author/Affiliation | Summary of Changes |
| SCE13OE001.0 | No | 04/10/12 | James Hand, Teddy Kisch / Energy Solutions | Draft Work Paper adapted from the SCE 2010-2012 Work Paper WPSCNROE0003.4 |
| SCE13OE001.1 | No | 03/05/14 | Fiela Gutierrez/ Lincus, Inc. | Draft Work Paper adapted from the PG&E 2013-2014 Work Paper PGECOCOM105 & SCE 2013-2014 Work Paper SCE13OE001.0, and updated codes to 2013 Title 24 Requirements  Work paper updated for the reporting period, effective 7/1/14 – 12/31/14. |

# Section 1. General Measure & Baseline Data

# 1.1 Measure Description & Background

This work paper details the retrofit of existing computers and monitors without power management software with personal computer power management (PCPM) software.

The base case equipment for this measure assumes a typical desktop computer on a distributed network with a single LCD monitor, and is based on monitoring data. The base case power option settings will vary based on existing business policies and individual preferences. The energy savings are provided on a per computer basis. See the following tables for the list of measures included in this work paper.

Table 1 PG&E Measure Names

|  |  |
| --- | --- |
| Product Code | Measure name |
| M03 | Power Management Software for Networked Computers |

Table 2 SCE Measure Names

|  |  |
| --- | --- |
| Solution Code | Measure name |
| OE-65003 | Power Management Software for Networked Computers |

* + 1. **Pacific Gas & Electric Requirements**

**Catalog Description**

**M03** *—* The customer must be a PG&E electric customer. When submitting a rebate worksheet, customers must ensure proper documentation is attached (see below).

1. For control of desktop computers only
2. Installation must allow centralized control at the server level of the power management settings (sleep mode and shutdown) of desktop computers on a distributed network
3. The software must have a reporting feature that allows monitoring and validation of energy savings
4. Qualifying software must result from:

* A new installation, where none previously existed, or
* An upgrade of an operating system or other network support software where the desktop computer power management function did not previously exist

Qualifying software must be purchased and installed on or after January 1, 2013.

Customer must agree to provide PG&E with 100% of the savings for a period of three (3) years from the receipt of the rebate

* Qualifying software must be purchased and installed on or after January 1, 2013

**Exclusions**:

* Not for control of laptop and laptop stations

**Application Process**:

* The following documentation must be attached to and included with the application:
  1. Copy of Software License Agreement,
  2. A report (print-out) directly from the Network Energy Management Software that shows (a) the location and (b) the number of desktop computers that are being controlled by the system
* When contacted, customers must allow PG&E access to customers’ property site to verify:
  1. The software installation; and

The location of the installed control software (at the server level); and the number of desktop computers controlled by the system [G].

**Terms and Conditions**: Any non-residential electric account qualifies if facility computer workstations must be linked and controlled by a LAN system that permits the installation and operation of Desktop Computer network software. Other “T&Cs” are listed above.

**Market Applicability**: All non-residential PG&E electric customers using networked desktop computer workstations.

**1.1.2 Southern California Edison Requirements** This work paper assumes that a complete PCPM network software application is used on a Windows PC network. The PCPM network software meets the following minimal requirements:

* + The software accurately monitors, measures, manages, and reports on the electrical demand and energy usage of individual and groups of networked PCs as proven through independent measurement and verification efforts;
  + The software is a client-server application capable of handling a large computer network with thousands of PCs across multiple geographic locations from a single application server in a single location;
  + The software has built-in security that ensures both user privacy, network security, audit trails, and data integrity;
  + The software uses a robust SQL database system and schema with audit trails;
  + The software supports and manages the power options settings in multiple versions of the Windows operating systems, from Windows 95 up to the latest version of Windows 8;
  + The software identifies and manages the power option settings on individual and groups of computers,
  + The software supports scheduling to allow the power settings to vary as necessary during the day, night, week, etc. for individual and groups of computers;
  + The software allows for individuals and groups to create their own power option settings if necessary;
  + The software allows for computers running special tasks and applications to override Power Management as needed;
  + The software can assign and track the values of the power states for computers and monitors − On, Sleep, Stand-by, Hibernate, Off − for individual and groups of computers for use in estimating the demand, energy consumption, and annual savings, i.e., the application does not rely on a hardcoded set of values; and
  + The software has a separate reporting system application that can run on any workstation on the network that allows authorized individuals, besides the system administrator, to query and produce reports from the central data repository database.

**Eligibility Requirements:** Networked personal computers are eligible only if they do not have power management software currently installed.

## 1.2 Technical Description

A number of strategies have evolved to save energy in desktop computers. One class of products uses software implemented at the network level for desktop computers that allows system administrators to manipulate the internal power settings of the central processing unit (CPU) and of the monitor. These power settings are an integral part of a computer’s operating system (most commonly, Microsoft Windows; derived from laptop technologies) including “on”, “standby”, “sleep”, and “off” modes and can be set by users from their individual desktops.

Most individual computer users are unfamiliar with these energy saving settings, and hence, settings are normally set by an IT administrator to minimize user complaints related to bringing the computer back from standby, sleep, or off modes. However, these strategies use a large amount of energy during times when the computer is not in active use. Studies have shown that energy consumed during non-use periods is large, and is often the majority of total energy consumed.

IT-based tools are used to control desktop computer and monitor power settings within a network from a central location, allowing administrators to control power consumption. They also may have programming that enables system upgrades to be performed (typically during low-use periods) and energy use evaluation and reporting capabilities.

## These tools assure the measure’s persistence through network administration; meaning that the local user cannot bypass the energy management settings. While the software might allow for highly customized user preference settings, the control is ultimately at the network administrator level. This, coupled with the reporting features built into the software, provides measurement and verification tools that are not present with manual or individually controlled power management options.

## 1.3 Measure Application Type

The measure installation type for this work paper is Retrofit Add-on (REA).

**SCE**

The delivery methods are Financial Support / Down-Stream Incentive – Deemed, Financial Support - Direct Install, Partnership / Down-Stream Incentive – Deemed, and Partnership - Direct Install.

**PG&E**

The delivery methods are Financial Support / Down-Stream Incentive – Deemed and Partnership / Down-Stream Incentive – Deemed.

Note: See Appendix A for a comparison of the application types used by and incorporated into SCE systems versus the application types available in the newest revision of DEER 2014. Appendix A will serve as a translation between the outputs of this work paper and application types used by READi.

## 1.4 Measure and Base Case Cost Effectiveness Data

### 1.4.1 DEER Measure and Base Case Analysis

This specific measure is not included in the 2014 Database for Energy Efficient Resources (DEER)

Table 3 DEER Difference Summary

|  |  |
| --- | --- |
| DEER Difference Summary Table | |
| Modified DEER Methodology | No |
| Scaled DEER Measure | No |
| DEER Building Prototypes Used | No |
| Deviation from DEER | DEER14 does not contain this type of measure. |
| DEER Version | N/A |
| DEER Run ID and Measure Name (Sample) | N/A |

**Net to Gross**

The NTG value was obtained from the “DEER2011\_NTGR\_2012-05-16.xls” on the DEER website as required by Version 5 of the California Public Utilities Commission (CPUC) Energy Efficiency Policy Manual [351]. The relevant NTGR for this measure is shown in Table 4 below. Note that for the direct install delivery mechanism, a distinction between hard to reach and non-hard to reach markets will be made on a project by project basis. This work paper shows the NTG associated with a hard to reach direct install delivery mechanism and the defaulted NTG value, where in fact, a measure offered through direct install and is not “hard to reach” will receive a default NTG value.

Table 4 Net-to-Gross Ratio

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | NTG\* |
| Com-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Com | Any | DirInstall | 0.85 |
| Com-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Com | Any | Any | 0.6 |
| Ind-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ind | Any | DirInstall | 0.85 |
| Ind-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ind | Any | Any | 0.6 |
| Agricult-Default-HTR-di | All other EEM with no evaluated NTGR; direct install to hard-to-reach only. | Ag | Any | DirInstall | 0.85 |
| Agric-Default>2yrs | All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years | Ag | Any | Any | 0.6 |

\*Denotes that the column is taken from the DEER NTG Table.

**Installation Rate**

The installation rate (IR) is identified in the calculation attachment. This value is obtained from the support table available in READi. Currently there is no versioning on the installation rate table. To address appropriate selection of the installation rate the date of the work paper will serve as the last date checked for updated IR values. The installation rate varies by end use, sector, technology, application, and delivery method. The relevant IR values for this measure are shown in Table 5 below.

Table 5 Installation Rate

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| GSIA\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID | GSIAValue\* |
| Def-GSIA | Default GSIA values | Any | Any | Any | 1.0 |

**Spillage Rate**

Spillage rate will also be applied to measures however the values will not be tracked in the work papers. The spillage rate will be tracked in an external table to be supplied to the Energy Division.

**READi Technology Fields**

To support the development of the ED ex ante tables, select fields from the ex ante database will be identified in the work paper. For a full set of values associated with the measures in the work paper refer the Excel calculation template.

Table 6 READi Tech IDs

|  |  |
| --- | --- |
| READi Field Name | Values included in this work paper |
| Measure Case UseCategory | AppPlug |
| Measure Case UseSubCats | Office\_eq |
| Measure Case TechGroups | Non-DEER |
| Measure Case TechTypes | Software |
| Base Case TechGroups | Non-DEER |
| Base Case TechTypes | Desktop Computer |

### 1.4.2 Codes and Standards Analysis

There are neither federal nor state codes applicable to power management software for networked personal computers.

Table 7 Code Summary

|  |  |  |
| --- | --- | --- |
| Code | Applicable Code Reference | Effective Dates |
| Title 24 (2013) | N/A | N/A |
| Title 20 (2014) | N/A | N/A |
| Federal Standards | N/A | N/A |

### 1.4.3 SCE Non-DEER Study Review

The LBNL 1096E [H,J], LBNL-37383 [C] and the LBNL 45917 [B] were used to determine the EUL for this measure. LBNL 1096E was a study to determine the “lifetime” value for computer monitors. The LBNL 45917 study was used to determine the EUL for office and network equipment and the LBNL-37383 study was used to determine life cycle of the network computer and server.

### 1.4.4 Measure and Base Case Effective Useful Life

DEER14 update documentation provides EUL and RUL information to be used for the 2015 program cycle extension on [www.deeresources.com](http://www.deeresources.com). The DEER documentation “Summary of EUL-RUL Analysis for the April 2008 Update to DEER” provides the RUL value as a flat 1/3 of the EUL value. The RUL value will only be applied to the first baseline period for retrofit measures that have applicable code that will affect the energy savings. In all other installation types and retrofit with no applicable code that affects the energy savings, the RUL is not applicable to either the first or second baseline period.

To obtain the EUL value the DEER14 update documentation, EUL\_Summary\_10-1-08.xls [213], was consulted. Table 8 below identifies the value/methodology used for the measures in this work paper.

Table 8 DEER14 EUL Value/Methodology

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| READi EUL ID | Market | Enduse | Measure | EUL (Years) | RUL (Years) |
| Plug-Software | Non-Residential | Office Equipment | Power Management Software | 5 | N/A |

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# Section 2. Energy Savings & Demand Reduction Calculations

## Energy Savings & Demand Reduction Calculations

Table 9 summarizes the unit energy savings values from the monitoring studies reviewed for this work paper. Please see attachment 2 for a full discussion of these studies [E]. These values form the basis for the deemed values in this work paper.

Table 9 Summary of Documented Unit Energy Savings for PCPM Network Software

| **Cases** | **Building Type** | **Annual Energy Savings per Workstation** |
| --- | --- | --- |
| Quantec & EZConserve PEP | Office | 165 kWh/year |
| Puget Sound Energy | Office | 176 kWh/year |
| SCE Preliminary Evaluation | Office | 323 kWh/year |
| Portland Metro Government | Office | 34 kWh/year |
| Energy Savers Participant 3 | Office | 235 kWh/year |
| Issaquah School District | K-12 School | 211 kWh/year |
| Robert Batemen School | K-12 School | 253 kWh/year |
| Energy Savers Participant 1 | K-12 School | 133 kWh/year |
| Energy Savers Participant 2 | K-12 School | 168 kWh/year |
| CSU San Bernardino | College | 137 kWh/year |
| Cerritos College | College | 314 kWh/year |
| LBNL-1096E | All Commercial | 236 kWh/year |
| TIAX 2004 | All Commercial | 245 kWh/year Auto Off Strategy  163 kWh/year Auto Sleep Strategy |
| Intel 2007 | All Commercial | 250 kWh/year |
| NEEA 2003\*\* | All Commercial | 200 kWh/year |
| NEEA 2005 | All Commercial | 200 kWh/year |
| NEEA 2008\*\*\* | All Commercial | 180 kWh/year |

\*\* Queensborough Community College is summarized in NEEA 2003

\*\*\* Reduced NEEA 2005 value by 10% as recommended in the 2005 MPER [G]

These monitoring studies took place between 2000-06, and were installed primarily on desktop computers with Cathode Ray Tube (CRT) monitors. While the duty cycle data from these studies is likely to be still valid, there have been notable changes in monitor and desktop energy use since 2006. These changes have been primarily driven by the transition from CRT to LCD monitors and improvements in LCD monitor efficiency. Desktop computers have seen significant improvements in Sleep Mode Power, but have had limited gains in Active Mode energy use. Assuming an even stock turnover cycle, the average age of the installed desktop and monitor base is two years, or half of the EUL. This suggests that in the currently installed base, the average computer and desktop were purchased in 2014.

To account for these improvements from 2006 to 2014, we estimated a 5% annual reduction in savings, which corresponds to a 40% decrease in energy savings over the 2006-2014 period. This 5% figure is derived from average On Mode Power values taken from Energy Star Monitor lists during the 2006-2010 period.

For Offices and K-12 Schools, the recommended deemed savings summarized in Table 10 were derived by averaging each of the Building Type values in Table 9 and then adjusting savings values downwards by 40%. These savings values are found in Table 10 under the column “Unit Energy Savings”. The Average Unit Energy Savings was derived by averaging the values for the building types in Table 10.

Table 10. Energy Savings per Networked Computer

|  |  |
| --- | --- |
| Building Type | Unit Energy Savings (kWh/year) |
| Offices | 111.96 |
| K-12 Schools | 114.75 |
| College | 135.30 |
| Misc. Commercial | 108.90 |
| Average | 117.73 |

The data did not provide a differentiation between large and small offices, nor between primary and secondary schools. A conservative deemed value to represent unknown commercial building type applications and all other building types (Misc. Commercial) is derived by averaging the NEEA 2005 cases and the TIAX 2004 Auto Sleep Strategy [H, ] from Table 9.

All of the EM&V studies and work papers used to determine these savings consider the possibility of peak demand reduction values to be either negligible or non-existent. As the TIAX report indicated in its analysis, most PCs in the commercial sector are in use during peak demand periods [K]. However, this point of view fails to recognize that a runtime change, which is the main effect of PCPM Network Software, changes the demand timing of the controlled networked computers.

A change in timing can lead to peak demand reductions for large measure groups. The effect only becomes evident when a large population is analyzed with before and after hourly demand load profiles. A 2010 power management study by Barr et al [F] has the most available profile data. The study covered over 90,000 desktop computers in the construction, education, financial, government, healthcare, manufacturing, retail, and transportation sectors. Based on the usages profiles found in the study, 2.3% of energy savings from power management software occur during weekdays between 2-5 PM.

For estimated demand reduction:

Peak Demand Reduction

= (2.3% X Annual Unit Energy Averaged Savings) / Operating Hour by Building Type

And the values are shown in Table 11. The average value of unit energy savings and peak demand reduction have been applied to all 30 building types in Attachment 1.

Table 11. Peak Demand Reduction per Networked Computer

|  |  |  |  |
| --- | --- | --- | --- |
| Building Type | Unit Energy Savings (kWh/year) | Annual Operating Hours | Peak Demand Reduction (kW) |
| Offices | 111.96 | 2640 | 0.000975 |
| K-12 Schools | 114.75 | 2140 | 0.001233 |
| College | 135.30 | 2285[[1]](#footnote-1) | 0.001362 |
| Misc. Commercial | 108.90 | 3600 | 0.000696 |
| Average | 117.73 |  | 0.001067 |

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# Section 3. Load Shapes

The difference between the base case load shape and the measure load shape would be the most appropriate load shape; however, only end-use profiles are available. Therefore, the closest load shape chosen for this measure is the Occupancy Sensor load shape. See Table 12 for a list of all Building Types and Load Shapes. See the KEMA report [31] for a more thorough discussion regarding the load shapes for this measure.

Table 12 Building Types and Load Shapes

|  |  |  |
| --- | --- | --- |
| Building Type | E3 Alt. Building Type | Load Shape |
| Agricultural | Agricultural | Occupancy Sensor |
| Assembly | Misc.\_Commercial | Occupancy Sensor |
| Education - Community College | K\_thru\_12\_School | Occupancy Sensor |
| Education - Primary School | K\_thru\_12\_School | Occupancy Sensor |
| Education - Relocatable Classroom | K\_thru\_12\_School | Occupancy Sensor |
| Education - Secondary School | K\_thru\_12\_School | Occupancy Sensor |
| Education - University | K\_thru\_12\_School | Occupancy Sensor |
| Food Store | Misc.\_Commercial | Occupancy Sensor |
| Grocery | Misc.\_Commercial | Occupancy Sensor |
| Health/Medical - Clinic | Misc.\_Commercial | Occupancy Sensor |
| Health/Medical - Hospital | Misc.\_Commercial | Occupancy Sensor |
| Health/Medical - Nursing Home | Misc.\_Commercial | Occupancy Sensor |
| Industrial | Industrial | Occupancy Sensor |
| Lodging - Guest Rooms | Hotel\_Motel | Occupancy Sensor |
| Lodging - Hotel | Hotel\_Motel | Occupancy Sensor |
| Lodging - Motel | Hotel\_Motel | Occupancy Sensor |
| Manufacturing - Bio/Tech | Industrial | Occupancy Sensor |
| Manufacturing - Light Industrial | Industrial | Occupancy Sensor |
| Misc - Commercial | Misc.\_Commercial | Occupancy Sensor |
| Office - Large | Large\_Office | Occupancy Sensor |
| Office - Small | Small\_Office | Occupancy Sensor |
| Restaurant - Fast-Food | Misc.\_Commercial | Occupancy Sensor |
| Restaurant - Sit-Down | Misc.\_Commercial | Occupancy Sensor |
| Retail - Multistory Large | Large\_Retail\_Store | Occupancy Sensor |
| Retail - Single-Story Large | Large\_Retail\_Store | Occupancy Sensor |
| Retail - Small | Small\_Retail\_Store | Occupancy Sensor |
| Storage - Conditioned | Misc.\_Commercial | Occupancy Sensor |
| Storage - Unconditioned | Misc.\_Commercial | Occupancy Sensor |
| Transportation - Communication - Utilities | Trans\_Comm\_Util | Occupancy Sensor |
| Warehouse - Refrigerated | Misc.\_Commercial | Occupancy Sensor |

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# Section 4. Base Case & Measure Costs

## 4.1 Base Case Cost

For retrofit add-on measures, the base case cost is assumed to be zero because these are discretionary modifications to the customers’ existing equipment and new equipment. Their alternative is to make no changes to their existing system or expansions to their system.

## 4.2 Measure Case Cost

For the PCPM Network Software measure, the “equipment” measure costs may be interpreted as the per computer licensing charge for commercial software. The equipment retail prices of vendors’ software range from $15 - $20 per workstation license [D]. See Section 4.3 for the measure equipment costs selected for this work paper.

## 4.3 Gross and Incremental Measure Cost

Some of the EM&V studies and work papers reviewed provided either direct per computer software licensing and installation cost data, or enough information that allowed per computer costs to be estimated. The available data is summarized in Table 13.

Table 13. Available Measure and Installation Cost Data.

|  |  |  |
| --- | --- | --- |
| Case | Equipment Costs per Workstation | Installation Costs per Workstation |
| LNBL-1096E [**J**] | $19.98 | $9.00 |
| TIAX 2004 [K] | $8.00 to $20.00 | $9.00 |
| NEEA 2003 [L] | $15.00 | $2.50 |
| NEEA 2005 [**M**] | $18.00 Average | $5.00 |

Given the wide range of costs listed in Table 13, this work paper selected the LBNL-1096E report values that were used for estimating the U.S. commercial market potential, rounded to the nearest whole number:

Measure Equipment Cost \approx \!\, $20.00 per computer

Installation Labor Cost = $9.00 per computer

### 4.3.1 Gross Measure Cost

For REA measures,

Gross Measure Cost = Measure Equipment Cost + Installation Labor Cost

= $20.00 + $9.00 = $29.00 per computer

**Direct Install**

SCE directly utilizes one or more contractors as part of the program. The actual cost can vary by contractor, the date in which the work occurred, and by the volume of business. Contractor costs are confidential information and are based upon contractually agreed upon pricing as established in their purchase order with SCE; therefore, the SCE program tracking system is the only source for this data.

### 4.3.2 Incremental Measure Cost

For REA measures, the incremental measure cost is equal to the Gross Measure Cost.

**References**

A. LBNL-1096E, Note C2, page 10.

B. Ernest Orlando Lawrence Berkeley National Laboratory, “Electricity Used by Office Equipment and Network Equipment in the U.S.: Detailed Report and Appendices,” LBNL-45917, Kaoru Kawamoto, Jonathan G. Koomey, Bruce Nordman, Richard E. Brown, Mary Ann Piette, Michael Ting, and Alan K. Meier, February 2001, page 15.

C. Ernest Orlando Lawrence Berkeley National Laboratory, “Efficiency Improvements in U.S. Office Equipment: Expected Policy Impacts and Uncertainties,” LBNL-37383, J.G. Koomey, M. Cramer, M.A. Piette, and J.H. Eto, 1995.

D. THE 451 GROUP: ECO-EFFICIENT IT. 2010 THE 451 GROUP, LLC, TIER1 RESEARCH, LLC, AND/OR ITS AFFILIATES

E. Attachment 2 – Summary of Studies.pdf

F. Barr, M., C. Harty, and J. Nero. Thin Client Investigation including PC and Imaging State Data. Draft submitted to PG&E Emerging Technologies Program. June 2010. <http://www.etcc-ca.com/component/content/article/48-Commercial/2977-thin-client-investigation-including-pc-and-imaging-state-data>

G. Quantec 2005, page VI-3

H. LBNL-1096E, page 4-83

I. Quantec 2005, page VI-1 and VI-2

J. LBNL-1096E, Note C2, page 10.

K. Roth et al., December 2004, pages 4-83

L. Quantec 2003, page VI-1

M. Quantec 2005, page V-13

# Appendix A – SCE/ED Application Types

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SCE Program Type | ED Application Type | 1st Baseline Savings | 2nd Baseline Savings | 1st Baseline Cost | 2nd Baseline Cost | 1st Baseline Life | 2nd Baseline Life |
| New | New Construction (Nc) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Replace on Burnout (ROB) | Replace on Burnout (Rob)/Normal Replacement (NR) | Above Code/Standard | N/A | Incremental Cost | N/A | EUL | 0 |
| Retrofit (RET) | Early Replacement (ER) | Above Cust. Existing | Above Code/Standard | Full Cost | Incremental Cost | RUL | EUL-RUL |
| Retrofit – First Baseline Only (REF) | Early Replacement RUL (ErRul) | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |
| Retrofit Add-on (REA) | N/A | Above Cust. Existing | N/A | Full Cost | N/A | EUL | 0 |

1. Annual Operating Hours is the average of the DEER 2014 Education - University and Education – Community College building types. [↑](#footnote-ref-1)