**Work Paper WPSDGENROE0001**

**Revision 1**

**San Diego Gas & Electric**

**Energy Efficiency Engineering**

**Network Desktop Computer Power Management Software**

**At-a-Glance Summary**

|  |  |
| --- | --- |
| Applicable Measure Codes: | SD-C1 |
| **Measure Description:** | Network Power Management Software |
| **Base Case Description:** | No network power management software |
| **Energy Impact Common Units:** | Per computer |
| **Energy Savings :** | Refer to Ex-Ante Database |
| **Gross Measure Cost ($/unit)** | Refer to Ex-Ante Database |
| **Measure Incremental Cost ($/unit):** | Refer to Ex-Ante Database |
| **Effective Useful Life (ID):** | Plug-Software |
| **Measure Application Type:** | Retrofit Add-On (REA) |
| **Net-to-Gross Ratios (ID):** | Com-Default>2yrs; Ind-Default>2yrs; Agric-Default>2yrs |
| **Important Comments:** |  |

# Document Revision History

|  |  |  |  |
| --- | --- | --- | --- |
| **Revision #** | **MM/DD/YY** | **Author/Affiliation** | **Summary of Changes** |
| 0 | 08/17/2012 | Kelvin Valenzuela/SDG&E | Adopted from M03\_Network Power Mgmt PGECOCOM105 R3.doc, updated June 21, 2012. |
| 1 | 08/15/2014 | Rocaciano Vega/RMS | - Adopted SCE Workpaper SCE13OE001 Rev1 Power Management Software for Networked Computers, updated March 5, 2014  - Updated EUL\_ID  - Updated NTG  - Added GSIA  - Updated load shapes  - Updated building types |

# Section 1. General Measure & Baseline Data

## 1.1 Measure & Delivery Description

### 1.1a Measure Description

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 Measure Names

|  |  |
| --- | --- |
| **Product Code** | **Measure name** |
| SD-C1 | Network Power Management Software |

### 1.1b Delivery and Incentive Mechanism

The delivery methods are Financial Support – Down-stream – Deemed.

The program type is Retrofit Add-On (REA).

### 1.1c Measure Requirements

The customer must be a SDG&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 SDG&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 SDG&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.

## 1.1d 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.

## 1.2 DEER Differences Analysis

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

Table 2 DEER Difference Summary

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

## 1.3 Code Analysis

There are neither federal nor state codes applicable to Power Management Software for Networked Personal Computers.

Table 3 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 Measure Effective Useful Life

Refer to the Ex-Ante Database for the NTG values.

Table 4 EUL Value/Methodology

|  |  |  |  |
| --- | --- | --- | --- |
| EUL ID | Market | Enduse | Measure |
| Plug-Software | Non-Residential | Office Equipment | Power Management Software |

## 1.5 Net-to-Gross Ratios for Different Program Strategies

Refer to the Ex-Ante Database for the NTG values.

Table 5 Net-to-Gross Ratio

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| NTGR\_ID\* | Description\* | Sector\* | BldgType\* | ProgDelivID |
| 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 |
| 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 |
| 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 |

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

## 1.6 Time-of-Use Adjustment Factor

As directed by the CPUC in decision 06-06-063 dated June 29, 2006, time-of-use (TOU) adjustment factors are to be applied for residential A/C and commercial A/C (packaged and split-system direct-expansion cooling) measures only [N]. Since this is not an A/C measure, the TOU adjustment factor is 0. Additionally, if a measure is assigned a DEER08 load shape, i.e. the load shape starts with “DEER:” the TOU assigned to that measure should also be zero.

Table 6 TOU Summary Table

|  |  |
| --- | --- |
| **Measure** | **%** |
| Power Management Software for Networked PCs | 0 |

# Section 2. Energy Savings & Demand Reduction Calculations

## 2.1 Energy Savings & Demand Reduction Calculations

**Table 7** summarizes the unit energy savings values from the monitoring studies reviewed for this work paper. Please see attachment 1 for a full discussion of these studies [E]. These values form the basis for the deemed values in this work paper.

Table 7 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 8** were derived by averaging each of the Building Type values in **Table 7** and then adjusting savings values downwards by 40%. These savings values are found in **Table 8** under the column “Unit Energy Savings”. The Average Unit Energy Savings was derived by averaging the values for the building types in **Table 8**.

Table 8 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, I] from **Table 7**.

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 9**. The average value of unit energy savings and peak demand reduction have been applied to all 30 building types in Attachment 1.

Table 9 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 |

## 2.2 Gas Energy Savings Estimation Methodologies

There is no gas energy savings associated with this measure.

## 2.3 Installation Rate

The installation rate (IR) is identified in ex-ante database. 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 10** below.

Table 10 Installation Rate

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

## 2.4 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.

## 2.5 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 11 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 |

# 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. See **Table 12** for a list of all Building Types and Load Shapes. See the KEMA report [[2]](#endnote-1)[31] for a more thorough discussion regarding the load shapes for this measure.

Table 12 Building Types and Load Shapes

| Building Type | Load Shape |
| --- | --- |
| Assembly | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Education - Primary School | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Education - Secondary School | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Education - Relocatable Classroom | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Education - Community College | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Education - University | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Grocery | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Health/Medical - Hospital | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Health/Medical - Nursing Home | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Lodging - Hotel | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Lodging - Motel | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Manufacturing Biotech | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Manufacturing Light Industrial | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Office - Large | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Office - Small | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Restaurant - Fast-Food | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Restaurant - Sit-Down | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Retail - Multistory Large | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Retail - Single-Story Large | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Retail - Small | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Storage - Conditioned | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Storage - Unconditioned | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |
| Warehouse - Refrigerated | SDG:NON\_res:DEER:Indoor\_Non-CFL\_Ltg |

# 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.

### 4.3.1 Gross Measure Cost

Per the E3, the gross measure cost is the cost to install an energy efficient measure. This definition implies two different meanings depending on the install type. In the case of RET[[3]](#footnote-2) and REA, GMC means the full cost of the measure to purchase and install. In the case of ROB and NEW, GMC means the cost premium required to install the energy efficient measure over a less efficient piece of equipment.[[4]](#footnote-3),[[5]](#footnote-4)

For **REA**, GMC is represented by the equation below:

*GMC = Measure Equipment Cost + Measure Labor Cost*

### 4.3.2 Incremental Measure Cost

For REA there exists no base case to compare the measure to. Because of this, for **REA**, IMC is represented by the equation below:

*IMC = Measure Equipment Cost + Measure Labor Cost*

# Attachments

# 

# References

[31]

[351]



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

E. Attachment 1 – 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

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

N. D.06-06-063 Interim Opinion: 2006 Update of Avoided Costs and Related Issues Pertaining To Energy Efficiency Resources <http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/57756.PDF>

# Appendix A – ED Application Types

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 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)
2. [↑](#endnote-ref-1)
3. This part of the discussion only pertains to the RUL period or first baseline period for RET measures. [↑](#footnote-ref-2)
4. E3 Calculator TechMemo 5d.doc, Program Inputs, Page 5, http://ethree.com/public\_projects/cpuc4.php [↑](#footnote-ref-3)
5. Energy Efficiency Policy Manual Version 4, Page 8, Footnote 9 [↑](#footnote-ref-4)