Work Paper PGECOCOM105
Network Desktop Computer Power Mgmt
Revision # 3

Pacific Gas & Electric Company

Customer Energy Efficiency Department

Network Desktop Computer Power Management Software

Measure Codes: M03

August 24, 2012

At-a-Glance Summary

Applicable Measure Codes:	**M03 – Network Desktop Computer Power Management Software.**
Measure Description:	Installation of software that puts unused network Desktop Computers in various modes that use less energy.
Energy Impact Common Units:	Per workstation equipped with a copy of the software (each)
Base Case Description:	Networked Desktop Computers without power management software. Source: PG&E Calculations
Base Case Energy Consumption:	No BC energy consumption calculated – the variability in BC consumption is too great to allow a meaningful calculation. Source: PG&E Calculations
Measure Energy Consumption:	No MC energy consumption calculated – the variability in demand and energy use are much larger than differential savings to be meaningful Source: PG&E Calculations
Energy Savings (Base Case – Measure)	Demand – 0.020 kW per equipped workstation Energy – 200 KWh/yr per equipped workstation. Source: PG&E Calculations
Costs Common Units:	$ per workstation (software installation) (each)
Base Case Equipment Cost ($/unit):	$0 – no management software installed.
Measure Equipment Cost ($/unit):	$20 per workstation Source: PG&E Calculations
Installation Labor Cost ($/Unit)	$6.79 (NR-MISC Labor $67.88 x 0.1 hr) Source: *DEER2008 Measure Cost Summary_Rev_06-02-08.xls*
Incremental Measure Cost ($/unit):	$26.79 per workstation Source: PG&E Calculations
Effective Useful Life (years):	5 years. Source: PG&E Calculations
Program Type:	Retrofit and New Construction
Net-to-Gross Ratios:	0.6 Source: 2011 DEER
Important Comments:	This measure not shown in DEER. The work paper Network DESKTOP COMPUTER Plug Load Power Management Software WP 070402.doc used as a starting point. Installation Service Rate, ISR is not factored into the Savings for Governmental Partnership Measures.

At-A-Glance Measure List (per Installation)

								1st Baseline								2nd Baseline													
Measure Code	VersionSource	Measure Description	Measure Application Type	Building Type	Building Vintage	Climate Zone	Unit Definition	KW Peak Electric Demand Reduction	KWh Electric Savings	THM Gas Savings	(EUL) LIFE CYCLE	Base Case Cost ($/unit)	Measure Cost ($/unit)	Labor Cost ($/unit)	IMC Incremental Measure Cost ($/unit)	KW Peak Electric Demand Reduction	KWh Electric Savings	THM Gas Savings	LIFE CYCLE	Base Case Cost ($/unit)	Measure Cost ($/unit)	Labor Cost ($/unit)	IMC Incremental Measure Cost ($/unit)	GRR_kW	GRR_kWh	GRR_thm	NTG	Implementation Method [DI, DD, I]	ISR
M03	Calculations	Network Desk	ROB	Any	Any	Any	Installation	0.02	200	0	5		20	6.79	26.79									1	1	1	0.6	I	1

Work Paper Approvals

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Document Revision History

Revision #	Date	Description	Author (Company)
Superseded Workpaper	**04/02/07**	**Network DESKTOP COMPUTER Plug Load Power Management Software**	**Gerry Hamilton (PG&E)**
Revision 0	**04/22/08**	**PGECOCOM105 R0 -- Network DESKTOP COMPUTER Power Management Software**	**Steve Blanc (PG&E)**
Revision 0.1	**4/01/09**	**Updated At A Glance tables with DEER2008 information**	**Kent Harris (PG&E)**
Revision 1	**6/15/09**	**Updated the catalog references with new catalog info, new measure life .**	**Steve Blanc (PG&E)**
Revision 2	**2/19/10**	**M03_Network Power Mgmt PGECOCOM105 R2 j3ru 100219.doc**	**Jenny Roecks (PG&E)**
Revision 3	**6/21/12**	**PGECOCOM105 Network Power Mgmt R3.doc**	**Jenny Roecks (PG&E)**
Revision 3	**8/24/12**	**PGECOCOM105 Network Power Mgmt R3.doc – Updated summary tables to meet Readi tool reqt.**	**Steve Blanc (PG&E)**

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Section 1. General Measure & Baseline Data

1.1 Measure Description & Background

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 March 1, 2007. Rebate is $15.00 per PC.

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 March 1, 2007

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;
  2. the location of the installed control software (at the server level); and
  3. the number of desktop computers controlled by the system[1].

Product Code		Rebate/Unit Measure
M03	Network Desktop Computer Power Management Software	**$15.00/desktop computer**

Program Restrictions and Guidelines

Insert any restrictions or guidelines from PG&E sources that bear on the use of, building / business types, appropriate climate zones and other restrictions

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.

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.

This workpaper uses product as an example of energy savings potential for products of this type. is generally considered by analysts to be one of best-in-class of this product type. As of 6/1/09, the PG&E qualified network control software products are:

These 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[5].

These tools assure this measure's persistence through network administration; meaning that the local user can not 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

DEER has no measure for this technology. The closest measures involve occupancy sensing of computer and lighting loads. These occupancy sensors in DEER are not network administered and are either locally controlled or part of the building Energy Management System.

DEER USE and TECHNOLOGY TABLE

Use Category Description	Use Category	Use Sub Category Description	Use Sub Category
Appliances and Plug Loads	AppPlug	Office Equipment	APlg-OffEq

Technology Groups Description	Technology Groups	Technology Types Descriptions	Technology Types
Business and Consumer Electronics	Electronics		#N/A

1.3 Codes & Standards Requirements Analysis

Title 20: This measure does not fall under Title 20 of the California Energy Regulations.
Title 24: This measure does not fall under Title 24 of the California Energy Regulations.
Federal Standards: This measure does not fall under Federal DOE or EPA Energy Regulations.

1.4 EM&V, Market Potential, and Other Studies

The Quantec Studies [2,6] refer to the market potential and savings from specific programs in the northwest and for SDG&E.
The BCHydro study discusses the use of [redacted] in the Abbottsford School District[3]. The study found for 19 test computers and monitored for one week after a baseline was measured. The savings were calculated to be 253 kWh/yr, reducing electrical use by 30%.
Roth, et al, discuss the potential energy savings of applying various technologies and measures to office equipment[4].
Greenburg relates the savings from several projects using the [redacted] tool. It also provides an explanation of the barriers to Power Management use using the built in tools in work station computers and displays and how this strategy is applied. Projects such as SCE (323 kWh/yr), Puget Sound Energy (176 kWh/yr) and others are mentioned[5]. BPA developed a calculation based on 25 hours of savings for computer and 20 hours for monitor yielding 200 kWh/yr.

Delta Wattage Assumption (ΔW): 200 kWh/yr is assumed for a number of programs based on the results of various projects from Greenburg[4] and Dimetrovsky, et al[6].

Net-to-Gross Assumption: No net-to-gross assumptions were found in existing EM&V, market potential, or other studies that were appropriate for this work paper. For the 2013-2014 program cycle, the 2011 commercial DEER value of 0.6 will be used for "All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years".[6]

In-service factor/first year installation rate: Like any software, this system would be used as soon as purchased and installed. No company would store software for later use.

Hours of Operation: Hours of operation are not established but savings in operation hours are based on the results of various projects from Greenburg[4] and Dimetrovsky, et al[6].

Effective Useful Life: Quantec[7] concluded in the SDG&E evaluation report that EUL is 5 years.

1.5 Base Cases for Savings Estimates: Existing & Above Code

The variability of computer and monitor combinations is such that the incremental savings is developed from the before and after monitoring of several actual installations. There is no Code or Standard that would apply as a Base Case guide.

1.6 Base Cases & Measure Effective Useful Lives

The EUL for this technology is estimated to be five (5) years. While DEER lists the EUL of electro-mechanical plug load sensors at ten years, this product is subject to the cyclical nature of the DESKTOP COMPUTER software and hardware industry, so a more conservative number is appropriate. This is the same value used in the SDG&E program[6]. This program is appropriate for retrofit (RET) and new construction (NEW).

1.7 Net-to-Gross Ratios for Different Program Strategies

No net-to-gross assumptions were found in existing EM&V, market potential, or other studies that were appropriate for this work paper. For the 2013-2014 program cycle, the 2011 commercial DEER value of 0.6 will be used for "All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years".

Table 1 below summarizes all applicable Net-to-Gross ratios for programs that may be used by this measure.

Table 1 Net-to-Gross Ratios

Program Approach	NTG
All other EEMs with no evaluated NTGR; existing EEM in programs with same delivery mechanism for more than 2 years	**0.60**

Section 2. Calculation Methods

2.1 Electric Energy Savings Estimation Methodologies

Experience to date shows substantial energy savings – 20 to 50 percent (or greater) of desktop Desktop Computer and monitor energy use. The variation in energy savings depends on PC/monitor hardware and scheduling strategies. The U.S. DOE, in a 2004 study of various office technologies, estimated the potential for this product class to achieve 20-31% savings. E source in a 2004 study verified and reported typical energy savings, example customers who have adopted it, utilities that have evaluated it, utilities that have/are providing incentives, reported customer satisfaction, and payback. A very similar analysis was performed by Quantec, on

behalf of the Northwest Energy Efficiency Alliance, in their 2005 *Market Progress Evaluation Report*.

Southern California Edison has undertaken an extensive technical evaluation to understand the energy and demand savings aspects of this and other plug load products. SCE's technical results are definitive and verify [redacted] claims for energy savings (within 5 percent). The findings on the [redacted] product are documented in SCE's May 2005 [redacted] *Consumption Report*. SCE's contact, Mr. Leonel Campoy, indicated that average Desktop Computer energy savings were 330 kWh/year.

San Diego Gas & Electric was the first California Investor Owned Utility to offer an incentive measure for a "software plug load sensor". The results of their 2004-2005 program are detailed in a 2006 evaluation report by Quantec[6]. The software was installed on over 12,000 Desktop Computer's within multiple school districts. The average energy savings per PC varied from 133 – 235 kWh/year.

The findings of the above mentions studies support the following forecasted energy savings[5].

Measure Name	Measure Code	Unit	Bldg Type	Bldg Vint.	Climate Zone	Gross Peak kW Reduct. Per Unit	Gross kWh/yr Savings per Unit	Gross Therm/yr Savings per Unit	Gross IMC per Unit ($)	EUL (yr)	Net to Gross Ratio
Network Desktop Computer Plug Load Power Management Software	M03	One copy of licensed software installed on a PC workstation	BCR	AV	00	0.020	200	n/a	20	5	0.8

Per Unit Summary Table

The energy savings per unit varied within the studies sited from 33.8 kWh/year to 330 kWh/year, with an average savings of about 200 kWh/year. This includes the power savings from the Desktop Computer as well as the monitor.

2.2. Demand Reduction Estimation Methodologies

Demand reduction was closely monitored in the study by Southern California Edison over a period of one month. This included 120 Desktop Computer's operating in nine different departments within SCE's network. The study found that statistically, the average Desktop Computer did use less power during peak periods by about **20W**. The use of individual Desktop Computer's could vary dramatically, but with a sample size of about 12 units or greater, the pattern for demand reduction was very clear.

2.3. Gas Energy Savings Estimation Methodologies

There are no gas energy savings associated with this measure

Section 3. Load Shapes

Load Shapes are an important part of the life-cycle cost analysis of any energy efficiency program portfolio. The net benefits associated with a measure are based on the amount of energy saved and the avoided cost per unit of energy saved. For electricity, the avoided cost varies hourly over an entire year. Thus, the net benefits calculation for a measure requires both the total annual energy savings (kWh) of the measure and the distribution of that savings over the year. The distribution of savings over the year is represented by the measure's load shape. The measure's load shape indicates what fraction of annual energy savings occurs in each time period of the year. An hourly load shape indicates what fraction of annual savings occurs for each hour of the year. A Time-of-Use (TOU) load shape indicates what fraction occurs within five or six broad time-of-use periods, typically defined by a specific utility rate tariff. Formally, a load shape is a set of fractions summing to unity, one fraction for each hour or for each TOU period. Multiplying the measure load shape with the hourly avoided cost stream determines the average avoided cost per kWh for use in the life cycle cost analysis that determines a measure's Total Resource Cost (TRC) benefit.

3.1 Base Case Load Shapes

The base case load shape would be expected to follow a typical *non-residential computer plug load* end use load shape.

3.2 Measure Load Shapes

For purposes of the net benefits estimates in the E3 calculator, what is required is the load shape that ideally represents the *difference* between the base equipment and the installed energy efficiency measure. This *difference* load profile is what is called the Measure Load Shape and would be the preferred load shape for use in the net benefits calculations.

The measure load shape for this measure is determined by the E3 calculator based on the applicable *non-residential* market sector and the *computer plug load* end-use.

Section 4. Base Case & Measure Costs

4.1 Base Case(s) Costs

Since this software is addition to any installed desktop computer workstation system the base case is having no workstation control, the base case cost is zero.

4.2 Measure Costs

The retail price of the [redacted] software is $20 per workstation license. High volume purchases lower the price to $15, or even $10 for large customers. The Quantec report[6] (2005) estimates an average IMC of $18. [redacted] is the leading product in this class, so competing suppliers would need to offer similar or better pricing. A worst case assumption for IMC would then be $20 per unit.

4.3 Incremental & Full Measure Costs

The Incremental and Full Measure costs are the same as the measure costs. The basic cost of the measure is the purchase of the software. No data is available presently on further costs of installation, but given that these systems require operating LANs and networked desktop computers, and the automation of the tools, installation configuration and startup should be minimal.

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Other References

Southern California Edison; (May 31, 2005). *Consumption Report* (contact: Leonel Campoy).

Correspondence from Kathy Burney, PG&E Program Manager for Non-Res Mass Market Down-stream programs, listing the qualifying vendors for the Network Power Management Program (May 28, 2009)

References

[1] M03 – "Desktop Computer Network Power Management Software" measure; PG&E Business Computing Catalog; 08businesscomputing.pdf; author – jbw8; Date -- 6/1/09, PG&E

[2] Dimetrosky, S., Luedtke, J. S., & Seiden, K. (2005). *Surveyor Network Energy Manager: Market Progress Evaluation Report, No. 2* (Northwest Energy Efficiency Alliance report #E05-136). Portland, OR: Quantec LLC. http://www.nwalliance.org/research/reports/136.pdf

[3] *Abbotsford School District: Computer Power Management Demonstration Project* ; BC Hydro, 2006 ; http://bchydro.com/business.story9583.html

[4] Roth, K., Larocque, G., & Kleinman, J. (2004). *Energy Consumption by Office and Telecommunications Equipment in Commercial Buildings Volume II: Energy Savings Potential* (U.S. DOE contract No. DE-AM26-99FT40465). Cambridge, MA: TIAX LLC. http://www.eere.energy.gov/buildings/info/documents/pdfs/office_telecom-vol2_final.pdf

[5] Greenberg, D. (2004). *Network Power Management Software: Saving Energy by Remote Control* (E source report No. ER-04-15). Boulder, CO: Platts Research & Consulting.

[6] DEER2011_NTGR_2012-05-16.xls from DEER Database for Energy-Efficient Resources; Version 2011 4.01 found at :http://www.deeresources.com/index.php?option=com_content&view=article&id=68&Itemid=60
Under: DEER2011 Update Documentation linked at: DEER2011 Update Net-To-Gross table
Cells: T56 and U56

[7] Dimetrosky, S., Steiner, J., & Vellinga, N. (2006). *San Diego Gas & Electric 2004-2005 Local Energy Savers Program Evaluation Report* (Study ID: SDG0212). Portland, OR: Quantec LLC.
http://www.calmac.org/publications/SDGE_ESP_EMV_Report_073106_Final.pdf