Equipoise Consulting, Inc.

Energy Analysis

Project Management

Training

Final Report for

Southern California Gas Company's Commercial Gas Water Heaters in the Savings By Design Program -- Whole Building and Systems Approach

Submitted by:

Equipoise Consulting Incorporated

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Section 1
Executive Summary

This report presents the analysis and decisions that went into the addition of a gas component of the statewide Savings By Design (SBD) program. Although spearheaded and funded by Southern California Gas Company (SoCalGas), this was a collaborative effort. Members of the SBD collaboration (PG&E, SCE, SDG&E, and now SoCalGas) were apprised of analysis methods and took part in all the decisions made towards the inclusion of these gas savings into the SBD program.

1.1 Objectives of the Analysis

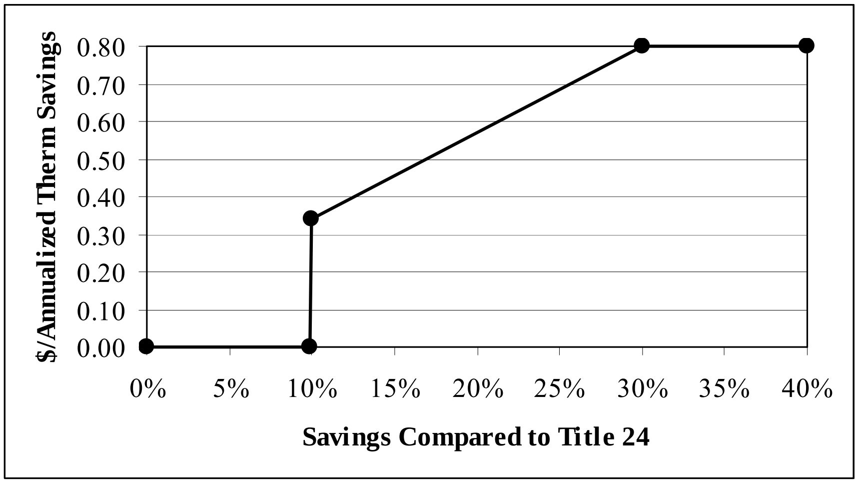
SoCalGas made a commitment to the SBD collaboration to bring therm savings into the program. The objective for PY2000 was to include gas service hot water savings as a component in the systems approach and to incorporate gas space heating and gas service hot water heating savings in the whole building approach. A technically sound method of calculating gas savings and appropriate incentive levels for service hot water in prototypes was required of the analysis. Additionally, a method of implementing and incenting therm savings in the whole building approach was needed.

1.2 Primary Results

1.2.1 Whole Building

The accepted SoCalGas proposal for adding therm savings to the whole building approach uses the integrated design element of the program and an implementation route similar to the current program. The building must continue to meet the 10% "source" savings, however, in addition to "site" kWh savings being incented, "site" therm savings for the space heating and water heating end uses would also be incented. The incentive would be on a sliding scale similar to the kWh incentive. The low end (paid for a building 10% below Title 24) would be $0.34/therm saved and the upper end (paid for a building at least 30% below Title 24) would be $0.80/therm saved (Exhibit 1.1).

Exhibit 1.1
Whole Building Sliding Scale of Therm Incentives



1.2.2 Systems Approach

The gas service hot water component added to the systems approach will incent the equipment at the lower value of $0.34/therm saved. The four agreed upon equipment types and minimum efficiency levels required for an incentive are shown in Exhibit 1.2.

Exhibit 1.2
Gas Water Heater Energy Efficient Measures

EEM #	End Use	Energy Efficient Measure	Efficiency minimum for incentive	Description of EEM	Number of manufacturers this represents
1	SHW	Small Storage Water Heaters	EF + 10%	Energy factor at least 10% over minimum required based on volume	7
2	SHW	Medium Storage Water Heaters	82.0%	Thermal efficiency at least 5% over minimum required efficiency	5
3	SHW	Large Type 1 Storage Water Heaters	82.7%	Thermal efficiency at least 6% over minimum required efficiency	8
4	SHW	Small Instantaneous Water Heaters	EF + 40%	Energy factor at least 40% over minimum required based on volume	3

Annual therm savings were calculated using ASHRAE guidelines and occupancy schedules for each of the prototypes in the systems approach. In order to allow for varying sizes of buildings, therm savings per 1,000 square foot of building space were determined (Exhibit 1.3) for inclusion in the SBD systems approach.

Exhibit 1.3
Annual Therm Savings per 1,000 Square Foot

	Storage			*Instantaneous*
Prototype	Small (EEM #1)	Medium (EEM #2)	Large (EEM #3)	Small (EEM #4)
Small Office	3.02	1.10		8.60
Large Office		1.20	1.43	9.38
Small Retail	0.95	0.35		2.70
Multi Story Large Retail	1.10	0.40		3.13
Single Story Large Retail	1.03	0.38		2.94
Medium Chain Grocery	0.44	0.16		0.23
Quick Service Restaurant	24.88	9.09		70.79
Full Service Restaurant	17.09	6.24		48.62
Hotel			4.72	30.90
Conditioned Storage	0.13			0.36
Conditioned Storage - 24 Hr.	0.25			0.70
Unconditioned Storage	0.13			0.36
Unconditioned Storage - 24 Hr.	0.25			0.70
Small Public School	5.70	2.08		16.23
Small Public School - Yr. Round	6.81	2.49		19.37
Large Public School		5.43	6.45	42.27
Large Public School - Yr. Round		6.40	7.61	49.86
Community College		5.15	6.12	40.11
Community College - Yr Round		6.09	7.24	47.44
Large University		3.67	4.37	28.61
Large University - Yr Round		4.15	11.64	32.34
Assembly	14.68	5.36	6.37	9.23
Hospital			27.53	
Small (Light) Manufacturing	4.15	1.51	1.80	11.79
Small (Light) Manufacturing - 24 Hr.	7.05	2.57	3.06	20.05
Bio-Tech	1.09	0.40	0.38	3.10
Bio-Tech - 24 Hr.	1.76	0.64	0.61	5.02

(Shaded) No estimates for this measure / building typ

A cost effectiveness for the equipment values by prototype was calculated without program costs. It was agreed that the equipment was sufficiently cost effective for inclusion in the systems approach.

Efforts during the PY2000 Savings By Design program have added a space and water heating therm incentive to the whole building approach and four types of service hot water equipment for the systems approach.

Section 2
Introduction

In their September 27, 1999 filing, Southern California Gas Company (SoCalGas) added a new construction program to their energy efficiency portfolio. This program was a statewide program called Savings By Design (SBD). An advice letter in June of 2000 added details to how SoCalGas planned to implement this program. The other three investor owned utilities (Pacific Gas & Electric (PG&E), Southern California Edison (SCE), and San Diego Gas & Electric (SDG&E)) had been working collaboratively on this program for about 18 months. As a result, most of the program implementation was already established. However, until SoCalGas joining the collaborative, the program had been wholly electric. Upon their entry into the program, SoCalGas chose to introduce natural gas therm savings as an additional component, acknowledging that the majority of savings would continue to be on the electrical side.

This section presents a synopsis of the report structure, summarizes the objective of the analysis, and introduces the program.

2.1 Report structure

This report is divided into the following four sections, in addition to the supporting appendices:

Section 1. *Executive Summary* – summarizes the information from the report.

Section 2. *Introduction* – presents a synopsis of the report structure, summarizes the objective of the analysis, and introduces the program.

Section 3. *Methodology* – presents the data sources and analysis approaches used.

Section 4. *Results* – presents the results of the analysis and subsequent decisions.

Appendix A – listing of histograms used in the analysis located within the presentation to the SBD collaborative on August 3, 2000.

Appendix B – bibliography of sources.

Appendix C – memo on the Whole Building Incentive Update.

2.2 Objectives of the Analysis

SoCalGas made a commitment to the SBD collaboration (PG&E, SCE, SDG&E, and now SoCalGas) to bring therm savings into the program. The objective for PY2000 was to include gas service hot water savings as a component in the systems approach and to incorporate gas space heating and gas service hot water heating savings in the whole building approach. A technically sound method of calculating gas savings and appropriate incentive levels for service hot water in prototypes was required of the analysis. Additionally, a method of implementing and incenting therm savings in the whole building approach was needed.

2.3 Savings By Design Program

SBD is a statewide program designed to transform energy-efficiency investment behavior in the new construction market. The program seeks to permanently reduce or eliminate transaction costs and other specific market barriers currently limiting widespread adoption of integrated building design techniques and practices. Specific program elements address both the large and small commercial new construction market segments, including public, private, and speculative building owners. Delivery strategies using the training, educational outreach, and energy centers are integral to the program.

The objective of the SBD approach is to make building designs more energy efficient, improve the efficiency of the technologies that buildings employ, provide mechanisms to evaluate program success, and permanently engender these transformations in the marketplace. By integrating interactions between multiple end-uses and efficiency technologies, a comprehensive design approach can save large amounts of energy and capital while improving comfort and productivity. The SBD program targets specific links in the new construction decision-making chain, reflecting differences in design activities and priorities between large and small buildings and various occupancies.

SBD offers assistance to make buildings more energy efficient, organized around two alternative approaches to energy efficiency. The Systems Approach is used for projects where design of the energy systems is done during different phases, where one energy system predominates, where intervention occurs late in the design, or for small buildings with simple system interactions. The Whole Building Approach is used for projects where the design team can work closely to integrate the building's energy systems, for buildings with complex system interactions, and for large, multi-use facilities.

There are three types of assistance that the SBD program offers to ensure that all market actors have the opportunity to participate at an appropriate level:

1) Design Assistance is available to building owners and to their design teams, regardless of the design approach, and is matched to the needs of the project. Under the Systems Approach, Design Assistance may include recommendations for efficient equipment, consultation on enhanced design strategies, or the provision of sample specifications. Under the Whole Building Approach, Design Assistance will involve supporting the design team in their development of a building energy simulation model, preparing a report for the owner on recommended design modifications, and facilitating the integration of any modifications into the final building design.

   One of the purposes of Design Assistance is to provide resources for the development of new skills and capabilities that design team members can apply to future projects.

2) Financial incentives are available to building owners when the efficiency of the new building exceeds the minimum SBD requirements. Thresholds are established at levels deemed to represent a cost-effective level of efficiency not generally reached without a conscious effort and investment by designers, and were set with consideration for the recent change in state energy standards. Under the Systems Approach, thresholds for qualifying equipment or designs are

set at 10 percent better than Title 24 standards. Under the Whole Building Approach, incentives become available once the overall building is shown to perform at least 10 percent better than a standard building of the same type.

These incentives encourage owners to make energy efficiency a major goal in their new buildings and help to defray some of the costs of energy efficient building components.

3) Design Team Incentives are offered to support the extra effort for integrated energy design and to reward exceptional design accomplishments. To qualify for a Design Team Incentive, the team must use a computer simulation model to optimize their design and to calculate the energy savings of the proposed building compared to the Title 24 baseline. The design team qualifies for incentives when the building design saves at least 15 percent. Again, this threshold represents a cost-effective level of efficiency not generally reached without a conscious effort and investment by designers, and was set with consideration for the recent change in state energy standards.

   Design Team incentives are paid directly to the design team and are in addition to the incentives the owner receives. It is assumed that once a design team is exposed to the many benefits of an integrated design process utilizing energy simulation analysis and life-cycle costing, it will become a necessary part of their standard practice of design.

Section 3
Methodology

Bringing gas savings into an already existing program required several steps. First, the two approaches used in the program needed different types of information to determine implementation routes. Information for the systems approach was the most detailed while the whole building approach was more conceptual with a relatively straightforward implementation. The whole building approach will be discussed first, followed by the systems approach.

3.1 Whole Building Approach

The whole building approach uses EnergyPro 2.0 or other computer simulation models such as DOE2 to determine savings. As the program had been implemented prior to including gas savings, the "source" savings, expressed in kBtuh/sq ft, of both the proposed building and standard building meeting Title 24 requirements were determined using a computer simulation. The proposed building had to use at least 10% less "source" energy than the standard building to be accepted into the program. As the proposed building savings increased beyond the minimum 10% under Title 24, the financial incentive increased as well. Actual financial incentives were paid on "site" kWh savings found in each end use. There were no incentives paid for demand reduction.

As envisioned by SoCalGas, gas incentives in the whole building approach would be implemented only for service hot water and space heating savings. No incentives would be paid for gas cooling.

The SoCalGas proposal for adding therm savings to the whole building approach used the integrated design element of the program and an implementation route similar to the current program. The building must continue to meet the 10% "source" savings, however, in addition to "site" kWh savings being incented, "site" therm savings for the space heating and water heating end uses would also be incented. The incentive would be on a sliding scale similar to the kWh incentive. The low end (paid for a building 10% below Title 24) would be $0.34/therm saved and the upper end (paid for a building at least 30% below Title 24) would be $0.80/therm saved. This approach is easy to implement in the EnergyPro 2.0 software since the underlying DOE2 program has a report that keeps track of the water heating and space heating therm use for both the proposed and standard building.

The initial incentive rate for the sliding scale of $0.34/therm is based on the Statewide Nonresidential Standard Performance Contract Program. This is the applicable incentive for small businesses (those under 250,000 therms). The top-end of the scale was set at an incentive rate similar to that of the multifamily baseline component of the residential program. The final consideration is how the proposed incentive rates correspond to incremental cost. Such analyses are harder to complete because of the wide variety of equipment and efficiency options available for new commercial construction. In some instances, the proposed incentive will cover the entire incremental cost. The main consideration is not in covering a particular portion of incremental costs, however, but to provide sufficient incentive to encourage treatment of gas efficiency options within the context of the existing SBD program. These incentives should do so.

3.2 Systems Approach

The systems approach is planned to include both space heating and service hot water equipment. However, the work for PY2000 is only on the service hot water end use with future plans to include space heating. This report covers only the service hot water end use.

The service hot water component consisted of four areas of analysis: 1) determining which equipment to include, 2) determining incremental costs of those pieces of equipment, 3) determining the estimated therm savings from each piece of equipment, and 4) determining the cost effectiveness of each piece of equipment. These areas are discussed next.

Similar to the kWh incentives, the lowest whole building level is planned to be used for the incentive level for the systems approach. That value is $0.34/therm saved.

3.2.1 Equipment Choices

The State of California energy codes require minimum mechanical efficiencies for most energy using equipment. For the service hot water equipment, these efficiencies are found in the Nonresidential Manual, Table B-9. The gas water heaters are divided into seven different types, shown in Exhibit 3.1.

Exhibit 3.1
Minimum Mechanical Equipment Efficiencies

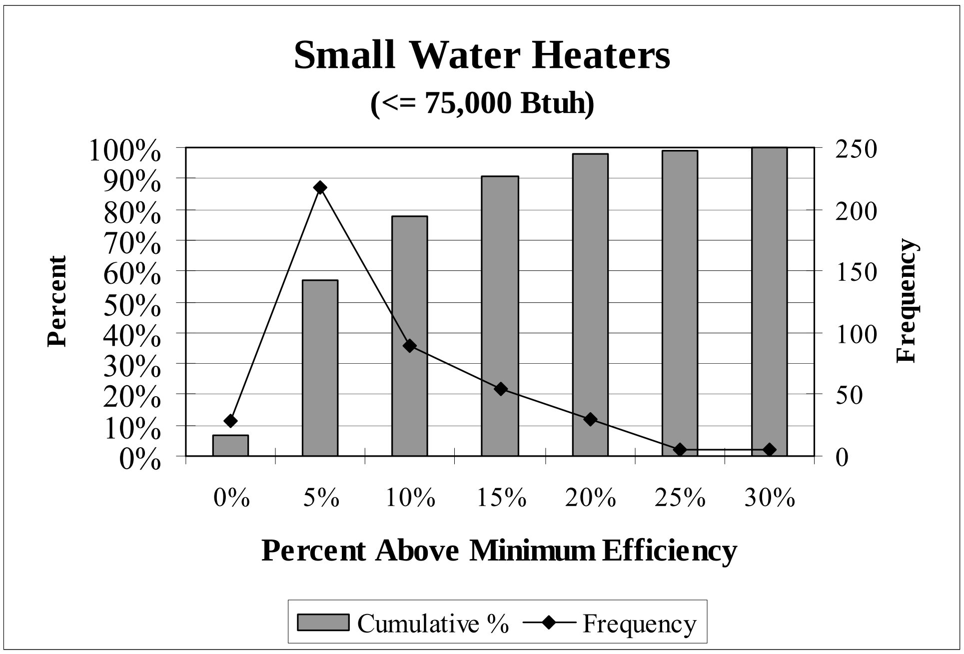
Type	Fuel	Input Rating	Volume (gallons)	Input to Volume Ratio (Btuh/gal)	Thermal Efficiency (%)	Standby Loss (%/hr)*	Energy Factor**
Storage	Gas	<= 75,000 Btu/hr	>= 20				0.62 - (0.0019 * V)
Storage	Gas	> 75,000 Btu/hr and <=155,000 Btuh/hr	All	< 4,000	78%	1.3+114/V	
Storage	Gas	> 155,000 Btu/hr	All	< 4,000	78%	1.3+95/V	
Storage	Gas	> 155,000 Btu/hr	>= 10	>= 4,000	77%	2.3+67/V	
Instantaneous	Gas	<= 200,000 Btu/hr					0.62 - (0.0019 * V)
Instantaneous	Gas	> 200,000 Btu/hr	<10	>= 4,000	80%	no requirement	
Instantaneous	Gas	> 200,000 Btu/hr	>= 10	>= 4,000	77%	2.3+67/V	

*V is "measured" volume
**V is "rated" volume

The state maintains a listing of equipment that meet these requirements through the California Energy Commission (CEC) appliance directory.

There was no information to be found on the penetration of the different types of hot water equipment and efficiencies in California, in either existing building or new construction. In lieu of real market data, the CEC appliance directory was used to create histograms of the cumulative percentage of available equipment and frequency of units binned by the percent over the minimum required efficiency for Title 24. While it is acknowledged that a simple tally of what is available does not show what is being shipped and purchased, the dearth of actual information left the team with few options. This information does at least show what is available for purchase. An example of the histograms created is presented in Exhibit 3.2, showing the data for small storage gas water heaters.

Exhibit 3.2
Example of Histogram for Hot Water Equipment



This data, then, was used as a proxy for market penetration, assuming that the higher the frequency of units, the more likely the penetration of the equipment. The chart as shown in Exhibit 3.2 must be clarified somewhat. Due to the vagaries of Excel histogram charting, the bars that represent the cumulative % do not include the actual percent above minimum efficiency value. For example, the bar at zero percent has all the units that equal the Title 24 minimum efficiency. However, the next bar represents all those pieces of equipment from zero up to, <u>but not including</u>, 5% over minimum efficiency. The third bar represents equipment equal to 5% and up to, but not including, 10%. This exhibit shows that close to 80% of the small gas water heaters available in the California are at least 9.9% higher than the minimum required efficiency.

The histograms (in Appendix A) were used to determine which of the seven types of gas water heaters should be incented as well as where the incentive level should be set (i.e., how far above the minimum efficiency).

3.2.2 Differential Cost Determination

Based on the potential equipment types and proposed incentive levels, cost data was gathered for as much of the equipment as possible. The first part of determining water heater costs entailed a literature search and Internet search for current data available on costs in the state of California. The 1996 California Conservatory Inventory, Version 4.0 (DEER) database is a collection of costs, energy savings, and market saturation data gathered from a variety of sources including regulatory and utility bodies from 1992 through 1995. This database was obtained from the CEC free of charge. The 1996 Measure Cost Study, dated December, 1996, was obtained from the CEC. Other searches found data from Pacific Northwest Laboratories in a Commercial Equipment Cost Database. The report, dated January 1995, was prepared for the U.S. Department of Energy. This report provided algorithms for contractor costs based on different variables for water heaters and boilers. No other cost data was found for water heaters. Beginning in early April 2000, retail and wholesale companies were contacted directly and costs on specific pieces of equipment were gathered. Exhibit 3.3 shows where the data of current costs were obtained. Not all points gathered were used to determine a differential cost. While an effort was made to gather only minimum efficient or a specific high efficient piece of equipment, the retailer sometimes provided other data. Exhibit 3.3 presents both the number of data points gathered and the number of data points used.

Exhibit 3.3
Data Used in Cost Estimation

Equipment Type	CEC Database	PNL Report	Retail/Wholesale # of Equipment Costs Gathered (and Used)
Small Storage	Yes	Yes	0
Small Instantaneous	No	No	8 (4 Used)
Medium Storage	No	No	13 (10 Used)
Large Storage	No	No	18 (12 Used)
Large Instantaneous	Yes	No	4 (4 Used)

Data was unavailable for large instantaneous units over 95% efficient. The information collected was used to determine a cost for each equipment size based on input rating to the unit. The differential cost values were used to determine cost effectiveness.

3.2.3 Prototypical Savings Estimates

Compared to energy use of other end uses' such as HVAC, there is not much information available for water heating. ASHRAE has been involved in determining useful values for design purposes for many years. However, little is available in the way of robust monitored data of actual energy uses. A literature search was done to find as many resources as possible for the values used in the estimate of prototypical therm savings. A bibliography is shown in Appendix B.

Based on the findings of the literature search, therm savings were estimated for each EEM using ASHRAE values and occupancy values from the prototypes. The algorithm used to determine therm use is shown in Exhibit 3.4. Therm use was calculated for both a standard and a high efficiency unit and the values subtracted to determine the annual therm savings. The estimate of use is conservative in that no piping or standby losses have been calculated in these values (with the exception of small units with an Energy Factor, that do account for standby losses).

Exhibit 3.4
Hourly Therm Use Algorithm

$$\text{RequiredHourlyHeaterInput} = \frac{C1 * N1 * Cp * d \ * \Delta T}{\eta}$$

Where:

C1 = Recovery capacity (gallons/person-hr)
N1 = Number of People in that hour (#)
Cp = Specific heat of water (1 Btu/lb F)
d = Density of water (8.33 lb/gal)
ΔT = Difference between input and output water temperatures (F)
n = Efficiency of the water heater (unitless)

The 1999 ASHRAE Applications Handbook, chapter 48, was used to determine the recovery capacity (Figures 14-21). The number of people per hour was based on the occupancy schedule from the prototypes. However, there were five exceptions to how the occupancy was implemented in the prototypes used to the determine water heater savings.

- For the three retail prototypes (small, single story large, and multi story large), the hourly number of people estimated is a function of shopping and does not reflect the probable number of people using the hot water consuming facilities. Therefore, the occupancy in the prototypes was set to 10% of the DOE2 model occupancy values.
- Similarly, the grocery prototype estimate of hot water use was based on 5% of the DOE2 model occupancy values.
- The assembly prototype assumed occupancy every day of the year. This did not appear reasonable. For the days occupied, the prototype occupancy schedules were used, but the actual number of days in use was reduced to 50% of weekdays (125 days) and 75% of Saturdays/Sundays/Holidays (85.5 days). These reductions were set conservatively.

There were four prototypes that did not follow the exact algorithm shown in Exhibit 3.4.

- The quick service and full service restaurants were analyzed by the number of meals per day (and corresponding ASHRAE recovery capacity values). The actual number of meals used in the analysis was set at 500 for full service and 1,000 for quick service. While the values are somewhat arbitrary, the LBL report (1995) indicated about twice as many meals per day for quick service as for full service. Also, the ASHRAE handbook stated that quick service restaurants tend to average between 250 and 500 gallons of hot water per day. The value of 1,000 meals per day gave this model an estimated 460 gallons. These two sources were used to verify that the meals per day numbers were probably in line.

- Hotel use was determined based on number of rooms with the assumption that there were 2 people on average per room and, therefore, 402 rooms in the hotel. ASHRAE values of the recovery capacity required per room is based solely on the room use, not any other use in the hotel. Research provided information on laundry and foodservice use, but only for one monitored site. A single site was not considered sufficient to modify the prototypical therm usage, and thus was not used. Therefore, the estimated savings are for the guestrooms only. Again, this is a conservative estimate.
- Hospital use was determined based on number of patient beds. There were 1,333 beds in the hospital prototypes. An average of 80% capacity was used to determine hot water use (1,067 beds). The ASHRAE value of hot water use in nursing homes was used and includes hot water use in tubs, showers, wash basins, service sinks, kitchen equipment, and general cleaning. It does not include water required for laundry or hydrotherapy purposes. This is a conservative estimate as well.

The recovery capacity values in Exhibit 3.4 were taken from Figures 14 through 21 in the 1999 ASHRAE Applications Handbook (pages 48.13, 48.14). These figures show a usable storage capacity/recovery capacity function and are typically used to help determine storage requirements. In all cases, the midpoint storage capacity for that particular relevant figure was used to determine the recovery capacity. The actual values used for usable storage and recovery capacity are shown in Exhibit 3.5.

Exhibit 3.5
Usable Storage and Recovery Capacity by Prototype

Prototype	**Storage Capacity**		**Recovery Capacity**	
Small Office	1	gallon/person	0.18	gallons/hour/person
Large Office	1	gallon/person	0.18	gallons/hour/person
Small Retail	1	gallon/person	0.18	gallons/hour/person
Multi Story Large Retail	1	gallon/person	0.18	gallons/hour/person
Single Story Large Retail	1	gallon/person	0.18	gallons/hour/person
Medium Chain Grocery	1	gallon/person	0.18	gallons/hour/person
Quick Service Restaurant	4	gallons/maximum meal/hour	0.25	gallons/hour/meal
Full Service Restaurant	4	gallons/maximum meal/hour	0.65	gallons/hour/meal
Hotel	8	gallons/room	1.50	gallons/hour/room
Conditioned Storage (Regular and 24 Hr.)	1	gallon/person	0.18	gallons/hour/person
Unconditioned Storage (Regular and 24 Hr)	1	gallon/person	0.18	gallons/hour/person
Small Public School (Traditional and Yr. Round)	1	gallon/person	0.16	gallons/hour/person
Large Public School (Traditional and Yr. Round)	2	gallons/person	0.25	gallons/hour/person
Community College (Regular and Yr. Round)	1 or 2	gallons/person, depending on classroom or multi-use area	0.16 or 0.25	gallons/hour/person
Large University (Regular and Yr. Round)	1 or 2	gallons/person, depending on classroom or multi-use area	0.16 or 0.25	gallons/hour/person
Assembly	1	gallon/person	0.18	gallons/hour/person
Hospital	8	gallons/bed	1.75	gallons/hour/bed
Small (Light) Manufacturing (Regular and 24 Hr.)	1	gallon/person	0.18	gallons/hour/person
Hr.)	1	gallon/person	0.18	gallons/hour/person

The difference in temperature between the incoming main water line and the outgoing hot water line was set at 55° F (110° hot water and 55° feed water). The hot water temperature was set at the maximum hot water temperature allowed in public lavatories by code (Nonresidential Manual, page 4-32) and the cold water temperature was based on the average ground temperature of 55° F.

The hourly therm savings were calculated for weekdays, Saturdays, and Sunday/Holidays. The values were then summed by the day type and then multiplied by the number of days per year with that savings value to get the annual therm savings. This algorithm is shown in Exhibit 3.6.

Exhibit 3.6
Annual Therm Savings Algorithm

$$\text{Annual Therm Savings} = \sum_{d=1}^{3}\left(\sum_{h=1}^{24} \text{HourlyHeaterInput}_{h,\,d}\right) * \text{Days}_{d}$$

The annual therm savings value was used in the determination of cost effectiveness.

3.2.4 Cost Effectiveness

The EEMs were analyzed for cost effectiveness by determining a Public Purpose Test (PPT) ratio. A value over 1.0 is considered cost effective. The PPT was calculated as shown in Exhibit 3.7. It does not include program costs, but was used as a preliminary test to see if the gas water heaters were viable based solely on efficiency differences.

Exhibit 3.7
PPT Algorithm

$$\text{PPT Ratio} = \frac{\text{NPV Factor} * \text{Annual Therm Saved}}{\text{Differential Cost}}$$

The NPV factor is the net present value of a therm of energy taken out to either 13 or 15 years. The small storage units used a NPV factor of 13 years (a typical residential water heater). The other units used a NPF factor of 15 years (typical nonresidential water heater). The factors used in the PPT ratio are shown in Exhibit 3.8. The factors were obtained from SoCalGas on 7/28/00. The factors are the net present value of 1 therm saved annually for 13 and 15 years respectively. The annual avoided gas costs and discount rate used to calculate the NPV factors are consistent with those adopted by the CPUC for use in the utilities' PY2000 energy efficiency applications.

Exhibit 3.8
NPV Factors

NPV Factor	
NPV13	$ 3.77
NPV15	$ 4.16

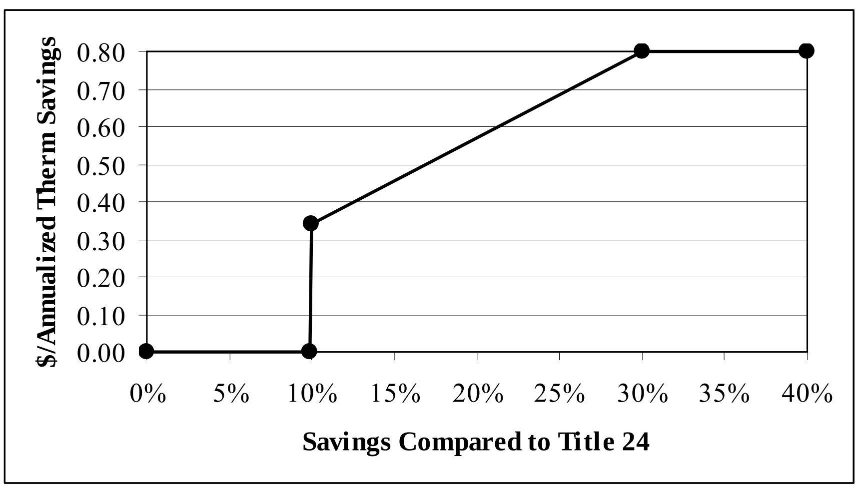
Section 4
Results

The SBD collaborative group met in San Diego on August 3, 2000. During that meeting, the whole building and systems approach were outlined and decisions were made by the group. The presentation of this meeting is available in Appendix A. There was another meeting on September 12, 2000 where decisions were made, but there was no formal presentation for that meeting.

4.1 Whole Building

The approach as outlined in section 3.1 was accepted by the collaborative during the August 3, 2000 meeting with the caveat that more data was required on the derivation of the actual low and high incentive values. An email was sent to the group on August 10, 2000 describing how the low and high values were determined. During the SBD collaborative meeting on September 12, 2000 when it was brought up, no disagreement was heard about this scale and it is considered adopted. The agreed upon sliding scale is shown in Exhibit 4.1

Exhibit 4.1
Whole Building Sliding Scale of Therm Incentives



4.2 Systems Approach

The amount of $0.34/therm saved is planned for systems approach incentives.

Decisions were made for the systems approach equipment during the August 3, 2000 meeting. At that time, the group decided that PG&E would act for the whole group in looking at the cost effectiveness of the equipment.

4.2.1 Energy Efficient Measures for SBD Systems Approach

Histograms were created for each of the seven types of gas water heaters shown in Exhibit 3.1. They are included in Appendix A. Each histogram was scrutinized by the SBD collaborative at the August 3, 2000 meeting to decide which pieces of equipment should be incented. There were two pieces of equipment that were dropped from potential incentives due to their high percentages (or lack thereof) above minimum efficiency. These were the large type 2 storage water heaters, the 4th type in Exhibit 3.1, and the large type 1 instantaneous water heaters, the 6th type in Exhibit 3.1. Therefore, five types of service hot water equipment were judged to have adequate number of potential high efficiency equipment to be included in the systems approach.

Each of the five equipment types were analyzed by the SBD program team to determine the actual efficiency level that should be incented. Based on the currently available technology, not all equipment had a wide range of efficiencies over minimum. If the units were not at least 10% over the minimum standard efficiency, the incentive break was chosen to represent an incentive for the top 25% of the available equipment. This is in line with other decisions by the SBD collaboration.

Of the five types of service hot water heaters that were judged to be included, the group felt that the most likely use of the large instantaneous water heater was in a process setting. As such, an approach estimating the actual savings would need more details than the current hot water modeling could provide. Additionally, the SBD collaborative decided that industrial processes would be handled outside of the current systems calculator. For these reasons, large instantaneous water heaters were dropped from consideration in the systems approach calculator. As a measure, they would be incented on a site-by-site basis.

The final choices for the energy efficient measures (EEMs) to be included in the systems approach for the gas service hot water end use are shown in Exhibit 4.2.

Exhibit 4.2
Efficiency Levels to be Incented

EEM #	End Use	Energy Efficient Measure	Efficiency minimum for incentive	Description of EEM	Number of manufacturers this represents
1	SHW	Small Storage Water Heaters	EF + 10%	Energy factor at least 10% over minimum required based on volume	7
2	SHW	Medium Storage Water Heaters	82.0%	Thermal efficiency at least 5% over minimum required efficiency	5
3	SHW	Large Type 1 Storage Water Heaters	82.7%	Thermal efficiency at least 6% over minimum required efficiency	8
4	SHW	Small Instantaneous Water Heaters	EF + 40%	Energy factor at least 40% over minimum required based on volume	3

During the meeting on September 12, 2000, the collaborative decided that the values should be scaled linearly up if the efficiency of the proposed unit is higher than the minimum incentive values shown in Exhibit 4.2 and an upper limit to the efficiency should be placed in CaNCcalc (Exhibit 4.3). While the maximum thermal efficiency appears high for measure #3, manufacturers specification sheet for one such unit was obtained from the dealer. In this, it states that the fuel-to-water efficiency was verified by

UL to ANSI Z21.10.3 standards. (The standards were not purchased, but assumed to accurately depict efficiency values.)

Exhibit 4.3
Maximum Allowed Efficiencies

Measure	Maximum Allowed Efficiency
1 – Small Storage Units	0.70 Energy Factor
2 – Medium Storage Units	0.95 Thermal Efficiency
3 – Large Storage Units	0.99 Thermal Efficiency
4 – Small Instantaneous Units	0.95 Energy Factor

There are 19 different prototypes in the systems approach, with 8 of the prototypes having two schedules for a total of 27 different prototype/schedule combinations. Each EEM was not appropriate for each combination. The SBD collaborative looked at each prototype and EEM and decided on the incentives specific for each combination shown in Exhibit 4.4.

Exhibit 4.4
Prototype and EEM Combinations

	Storage			***Instantaneous***
Prototype	Small (EEM #1)	Medium (EEM #2)	Large (EEM #3)	Small (EEM #4)
Small Office	X	X		X
Large Office		X	X	X
Small Retail	X	X		X
Multi Story Large Retail	X	X		X
Single Story Large Retail	X	X		X
Medium Chain Grocery	X	X	X	X
Quick Service Restaurant	X	X		X
Full Service Restaurant	X	X		X
Hotel			X	X
Conditioned Storage (Regular and 24 Hr.)	X			X
Unconditioned Storage (Regular and 24 Hr)	X			X
Small Public School (Traditional and Yr. Round)	X	X		X
Large Public School (Traditional and Yr. Round)		X		X
Community College (Regular and Yr. Round)		X	X	X
Large University (Regular and Yr. Round)		X	X	X
Assembly		X	X	X
Hospital			X	
Small (Light) Manufacturing (Regular	X	X	X	X
Bio-Tech (Regular and 24 Hr.)	X	X	X	X

Once the specific pieces of equipment were determined, the therm savings by prototype and differential cost were analyzed.

4.2.2 Differential Costs

The results of the data collected on differential costs are shown in Exhibit 4.5.

Exhibit 4.5
Estimated Differential Costs

EEM #	Energy Efficient Measure	Efficiency minimum for incentive	Differential Cost per Unit	Differential Cost per kBtu/h
1	Small Storage Water Heaters	EF + 10%	$ 21.15	
2	Medium Storage Water Heaters	82.0%		$ 1.06
3	Large Type 1 Storage Water Heaters	82.7%		$ 0.27
4	Small Instantaneous Water Heaters	EF + 40%		$ 11.32

Because the differential cost for the large storage unit was based on a small sample and was so low, it was felt that this would provide an artificially high PPT ratio. The differential cost for the medium storage water heaters was used to determine the PPT ratio for the large storage water heaters, not the differential cost shown in Exhibit 4.5.

4.2.3 Therm Savings

The estimated annual therm savings by EEM and prototype are shown in Exhibit 4.6. These are savings for the specific size of building of the prototype.

Exhibit 4.6
Annual Therm Savings by Prototype and EEM

	Storage			*Instantaneous*
Prototype	Small (EEM #1)	Medium (EEM #2)	Large (EEM #3)	Small (EEM #4)
Small Office	75.6	27.6	-	214.9
Large Office	-	301.1	357.9	2,344.4
Small Retail	23.7	8.7	-	67.6
Multi Story Large Retail	164.8	60.2	-	468.9
Single Story Large Retail	135.2	49.4	-	384.7
Medium Chain Grocery	26.2	9.6	-	13.3
Quick Service Restaurant	69.7	25.5	-	198.2
Full Service Restaurant	90.6	33.1	-	257.7
Hotel	-	-	849.1	5,562.4
Conditioned Storage	63.9	-	-	181.8
Conditioned Storage - 24 Hr	123.5	-	-	351.3
Unconditioned Storage	63.9	-	-	181.8
Unconditioned Storage - 24 Hr	123.5	-	-	351.3
Small Public School	136.9	50.0	-	389.5
Small Public School - Yr Round	163.4	59.7	-	464.9
Large Public School	-	689.4	819.4	5,368.1
Large Public School - Yr Round	-	813.1	966.5	6,331.8
Community College	-	618.1	734.7	4,812.9
Community College - Yr Round	-	731.1	869.1	5,693.3
Large University	-	3,674.6	4,368.0	28,614.5
Large University - Yr Round	-	4,153.4	11,639.5	32,342.5
Assembly	499.1	182.3	216.7	313.7
Hospital	-	-	6,881.4	-
Small (Light) Manufacturing	414.5	151.4	180.0	1,179.2
Small (Light) Manufacturing - 24 Hr	704.7	257.4	306.0	2,004.7
Bio-Tech	217.7	79.5	75.6	619.4
Bio-Tech - 24 Hr.	352.9	128.9	122.5	1,004.0

(Shaded cells:) No estimates for this measure / building type

In order to allow for variation in building usage with size, the systems approach calculator was provided with the annual therms saved per 1,000 square foot of building. The square foot of the building would be multiplied by the savings per 1,000 square foot to get the estimated annual therm savings for that prototype. These are shown in Exhibit 4.7.

Exhibit 4.7
Annual Therm Savings per 1,000 Square Foot

Prototype	Storage			Instantaneous
	Small (EEM #1)	Medium (EEM #2)	Large (EEM #3)	Small (EEM #4)
Small Office	3.02	1.10		8.60
Large Office		1.20	1.43	9.38
Small Retail	0.95	0.35		2.70
Multi Story Large Retail	1.10	0.40		3.13
Single Story Large Retail	1.03	0.38		2.94
Medium Chain Grocery	0.44	0.16		0.23
Quick Service Restaurant	24.88	9.09		70.79
Full Service Restaurant	17.09	6.24		48.62
Hotel			4.72	30.90
Conditioned Storage	0.13			0.36
Conditioned Storage - 24 Hr.	0.25			0.70
Unconditioned Storage	0.13			0.36
Unconditioned Storage - 24 Hr.	0.25			0.70
Small Public School	5.70	2.08		16.23
Small Public School - Yr. Round	6.81	2.49		19.37
Large Public School		5.43	6.45	42.27
Large Public School - Yr. Round		6.40	7.61	49.86
Community College		5.15	6.12	40.11
Community College - Yr Round		6.09	7.24	47.44
Large University		3.67	4.37	28.61
Large University - Yr Round		4.15	11.64	32.34
Assembly	14.68	5.36	6.37	9.23
Hospital			27.53	
Small (Light) Manufacturing	4.15	1.51	1.80	11.79
Small (Light) Manufacturing - 24 Hr.	7.05	2.57	3.06	20.05
Bio-Tech	1.09	0.40	0.38	3.10
Bio-Tech - 24 Hr.	1.76	0.64	0.61	5.02

No estimates for this measure / building typ

With the therm savings and differential costs estimated, the cost effectiveness of the equipment without program costs could be determined.

4.2.4 Cost Effectiveness

The PPT ratios for each of the EEMs are shown in Exhibit 4.8. The PPT ratio was meant to give an idea of whether the EEMs were cost effective just on their own merit (i.e., based solely on the cost of the equipment). During a meeting between PG&E and Equipoise on 8/14/00, it was agreed that the PPT values indicated that the gas water heaters would be cost effective as a whole, even though specific EEM/prototype combinations showed values under 1.0.

Exhibit 4.8
PPT Ratio without Program Costs

Prototype	Storage			Instantaneous
	Small (EEM #1)	Medium (EEM #2)	Large (EEM #3)	Small (EEM #4)
Small Office	13.5	0.9		0.6
Large Office	-	4.0	1.2	2.2
Small Retail	4.2	0.3		0.2
Multi Story Large Retail	10.2	2.0		1.3
Single Story Large Retail	9.6	1.6		1.1
Medium Chain Grocery	4.7	0.3		0.0
Quick Service Restaurant	12.4	0.8		0.6
Full Service Restaurant	15.5	1.1		0.7
Hotel			2.8	7.9
Conditioned Storage	11.4			0.5
Conditioned Storage - 24 Hr	22.0			1.0
Unconditioned Storage	11.4			0.5
Unconditioned Storage - 24 Hr	22.0			1.0
Small Public School	6.9	1.6		1.0
Small Public School - Yr Round	8.2	2.0		1.2
Large Public School		4.4	2.7	2.4
Large Public School - Yr Round		5.2	3.2	2.8
Community College		2.6	2.4	1.5
Community College - Yr Round		3.1	2.8	1.8
Large University		3.0	3.4	1.6
Large University - Yr Round		3.4	9.0	1.9
Assembly	6.8	1.7	0.7	0.2
Hospital			22.5	
Small (Light) Manufacturing	45.0	5.0	0.6	3.3
Small (Light) Manufacturing - 24 Hr	76.5	8.4	1.0	5.7
Bio-Tech	12.2	2.6	0.2	1.8
Bio-Tech - 24 Hr.	19.8	4.2	0.4	2.8

(Shaded cell) No estimates for this measure / building type

4.3 Summary

Through a collaborative effort, gas therm savings have been added to the Savings By Design program. A whole building incentive for gas space heating and gas service hot water heating was determined, along with how to implement the incentive in the computer simulations. Four specific types of gas service water heating equipment were added to the systems approach. Therm savings values that are prototype and service water heating type specific have been included in the calculator for the systems approach. These values are in a therms per square foot unit to allow for differences in the size of the buildings being built.

Appendix A – Histograms of Equipment / Presentation of August 3, 2000

Slide 1

Therm Incentives for Savings By Design

Systems and Whole Building Approach

Carlos Ruiz - Southern California Gas
Mary Sutter - Equipoise Consulting Inc.

August 3, 2000

Slide 2

Outline

- Systems Approach for Gas Water Heaters
  - Standards and Minimum Efficiencies
  - Histograms - decisions on what is in and what is out - also decisions on specific incentive efficiency level
  - Prototypes - decisions on what prototypes are available for incentives - decisions on baselines
  - The Next Step
- Whole Building Therm Incentives

2

Slide 3

1998 Efficiency Standards

- Minimum Efficiency
- Controls
  - Adjustable temperature
  - Pump on/off
  - Flow
- Storage Insulation
- State Buildings

3

Slide 4

Minimum Efficiencies

Type	Fuel	Input Rating	Volume (gallons)	Input to Volume Ratio (Btuh/gal)	Thermal Efficiency (%)	Standby Loss (%/hr)*	Energy Factor**
Storage	Gas	<= 75,000 Btu/hr	>= 20				0.62 - (0.0019 * V)
Storage	Gas	> 75,000 Btu/hr and <=155,000 Btuh/hr	All	< 4,000	78%	1.3+114/V	
Storage	Gas	> 155,000 Btu/hr	All	< 4,000	78%	1.3+95/V	
Storage	Gas	> 155,000 Btu/hr	>= 10	>= 4,000	77%	2.3+67/V	
Instantaneous	Gas	<= 200,000 Btu/hr					0.62 - (0.0019 * V)
Instantaneous	Gas	> 200,000 Btu/hr	<10	>= 4,000	80%	no requirement	
Instantaneous	Gas	> 200,000 Btu/hr	>= 10	>= 4,000	77%	2.3+67/V	

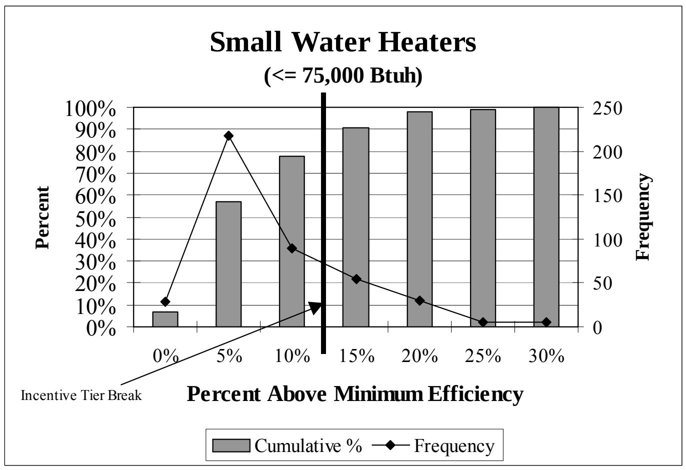
*V is "measured" volume
**V is "rated" volume

From the CEC Nonresidential Manual, July 1999
Table B-9 Minimum Mechanical Equipment Efficiencies

4

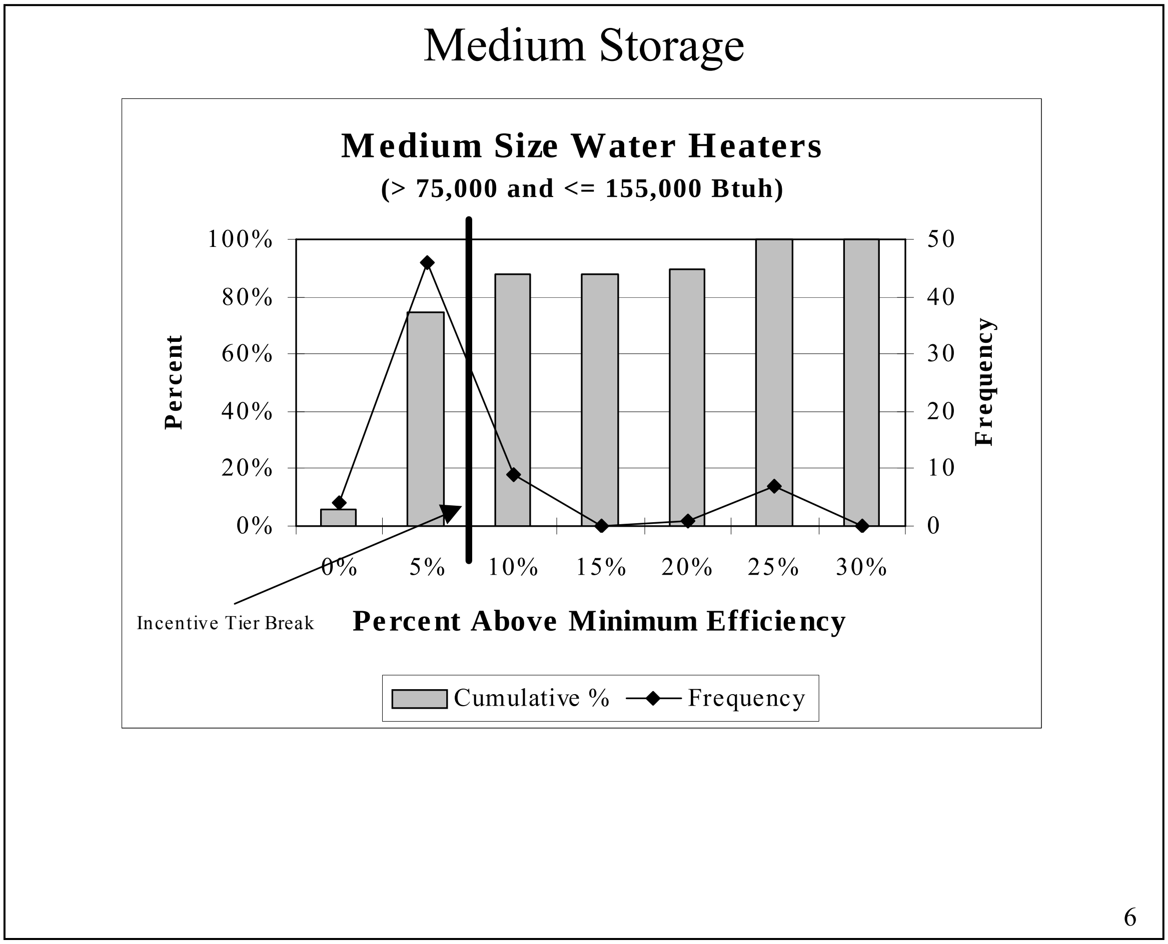
Slide 5

Small Storage



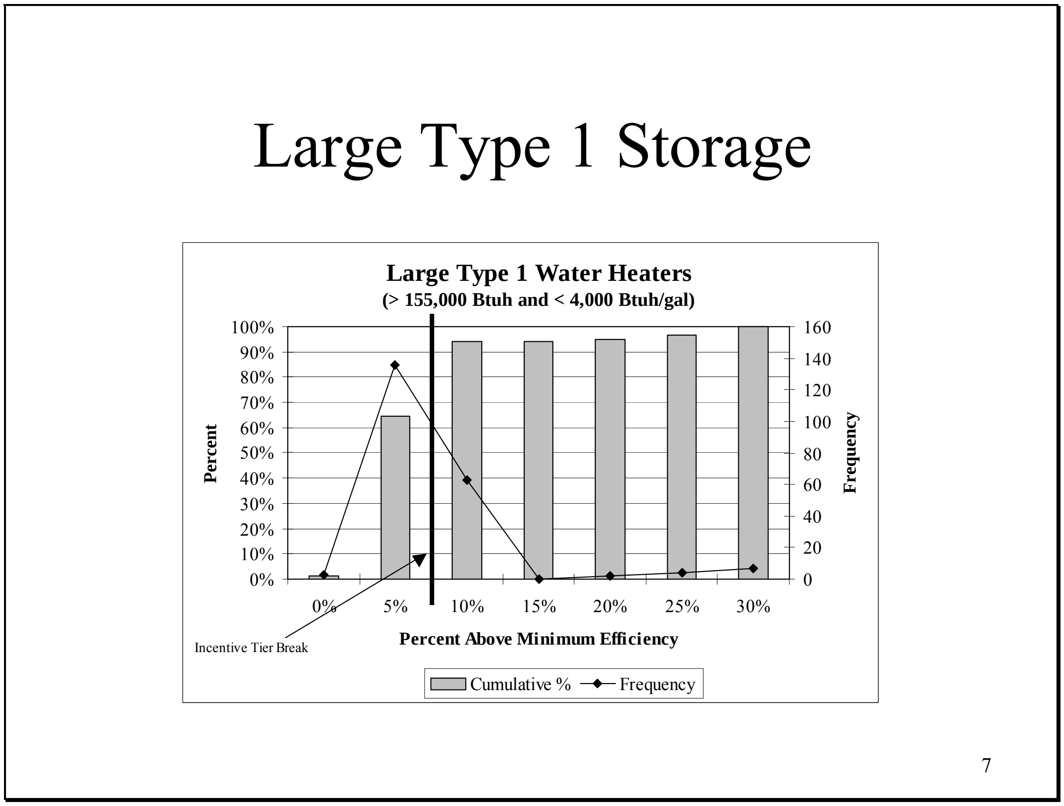
5

Slide 6



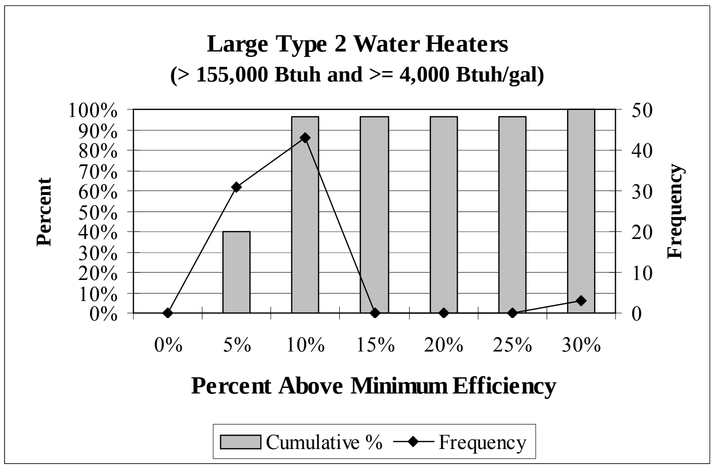
Medium Storage
Medium Size Water Heaters
(> 75,000 and <= 155,000 Btuh)
100%
80%
60%
40%
20%
0%
Percent
50
40
30
20
10
0
Frequency
0%
5%
10%
15%
20%
25%
30%
Incentive Tier Break
Percent Above Minimum Efficiency
Cumulative %
Frequency
6

Slide 7


Large Type 1 Storage
Large Type 1 Water Heaters
(> 155,000 Btuh and < 4,000 Btuh/gal)
Percent
Frequency
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
160
140
120
100
80
60
40
20
0
0%
5%
10%
15%
20%
25%
30%
Percent Above Minimum Efficiency
Incentive Tier Break
Cumulative %
Frequency
7

Slide 8

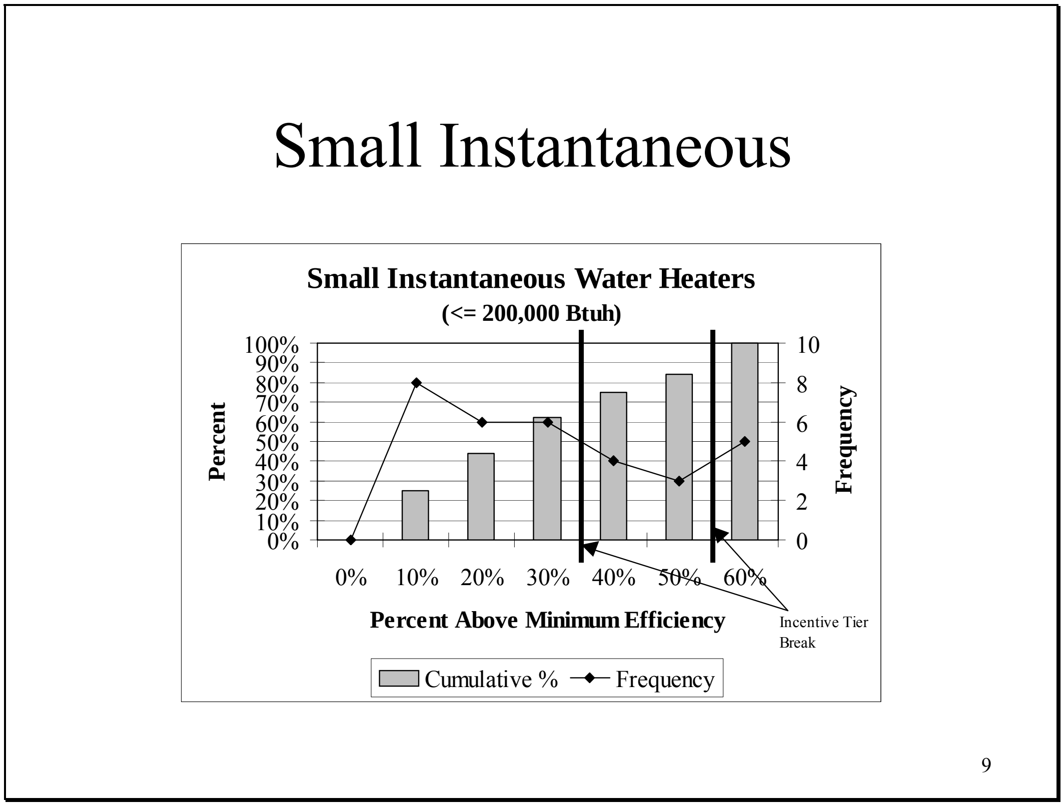
Large Type 2 Storage



Not planned for incentive.

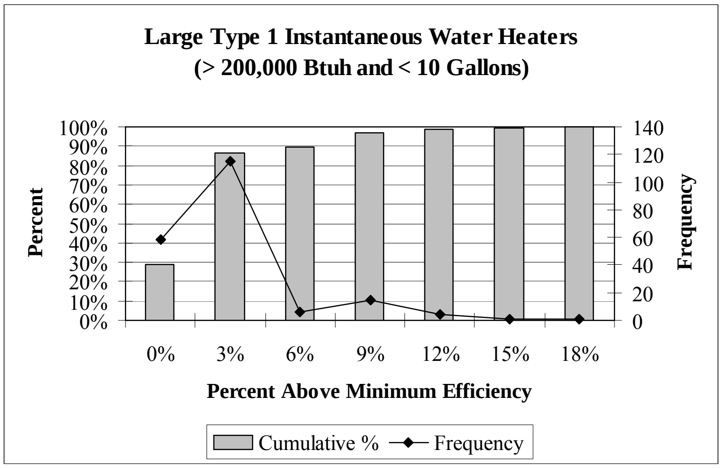
8

Slide 9


Small Instantaneous
Small Instantaneous Water Heaters
(<= 200,000 Btuh)
Percent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Frequency
10
8
6
4
2
0
0%
10%
20%
30%
40%
50%
60%
Percent Above Minimum Efficiency
Incentive Tier Break
Cumulative %
Frequency
9

Slide 10

Large Type 1 Instantaneous

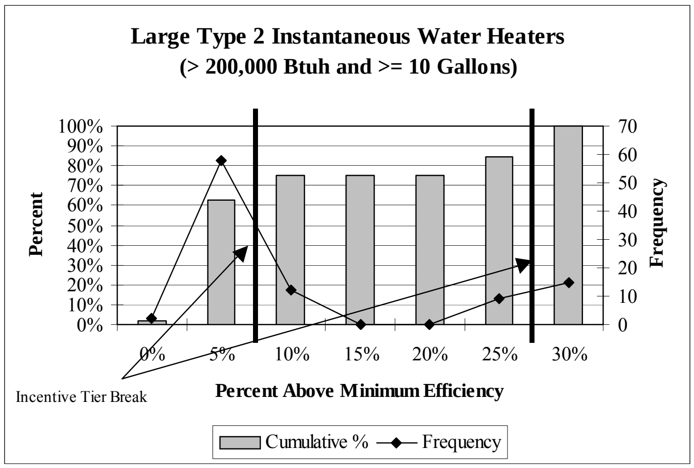


Not planned for incentive.

10

Slide 11

Large Type 2 Instantaneous



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Slide 12

Potential EEM's

EEM #	End Use	Energy Efficient Measure	Efficiency minimum for incentive	Description of EEM	Number of Manufacturers this represents
1	SHW	Small Storage Water Heaters	EF + 10%	Energy factor at least 10% over minimum required based on volume	7
2	SHW	Medium Storage Water Heaters	82.0%	Thermal efficiency at least 5% over minimum required efficiency	5
3	SHW	Large Type 1 Storage Water Heaters	81.6%	Thermal efficiency at least 5% over minimum required efficiency	9
4A	SHW	Small Instantaneous Water Heaters	EF + 30%	Energy factor at least 30% over minimum required based on volume	5
4B	SHW	Small Instantaneous Water Heaters	EF + 50%	Energy factor at least 50% over minimum required based on volume	2
5A	SHW	Large Type 2 Instantaneous Water Heaters	80.6%	Thermal efficiency at least 5% over minimum required efficiency	4
5B	SHW	Large Type 2 Instantaneous Water Heaters	96.0%	Thermal efficiency at least 25% over minimum required efficiency	2

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Slide 13

Where to Incent EEM’s

- Prototypes
  - 19 prototype buildings (multiple occupancy schedules in some)
  - Some type of gas water heater potentially in all prototypes
- Baseline
  - Assume baseline is Title 24 efficiency level

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Slide 14

Prototypes

					Storage			***Instantaneous***	
Prototype	***Square Foot***	***# of People***	***Gallons Needed***	***HVAC***	Small	Medium	Large	Small	Large
Small Office	25,000	250	357	Air Cooled Unitary	X	X		X	
Large Office	250,000	2,500	3,571	VAV with Central Plant	X	X	X	X	
Small Retail	25,000	682	39	PSZ	X	X		X	
Multi Story Large Retail	150,000	4,348	248	VAV with Central Plant	X	X		X	
Single Story Large Retail	131,000	3,797	217	Air Cooled Unitary	X	X		X	
Medium Chain Grocery	59,000	1,710	500	Air Cooled Unitary	X	X		X	
Quick Service Restaurant	2,800	124	250	PSZ	X	X		X	
Full Service Restaurant	5,300	268	500	PSZ	X	X		X	
Hotel	180,000	956	13,660	PTAC / PSZ			X	X	
Conditioned Storage	502,000	100	144	PSZ	X			X	
Unconditioned Storage	502,000	100	144	PSZ	X			X	
Small Public School	24,000	894	766	PTAC / PSZ	X	X		X	
Large Public School	127,000	5,146	2,941	FPFC / VAVS (Central Plant	X	X	X	X	
Community College	120,000	5,191	2,966	VAVS (Central Plant)	X	X	X	X	
Large University	1,000,000	16,900	9,657	VAVS (Central Plant)	X	X	X	X	
Assembly	34,000	1,978	2,825	PSZ	X	X	X	X	
Hospital	250,000	2,500	-	VAV with Central Plant			X		
Small (Light) Manufacturing	100,000	830	1,186	PSZ	X	X	X	X	X
Bio-Tech	200,000	800	1,143	PSZ	X	X	X	X	X

(shaded) Probably should not include these for estimates based on model and how they would be used.

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Slide 15

The Next Step

- Write up current decisions and steps to those decisions
- Create spreadsheet analysis for therm savings of decided upon EEM’s by prototypes
- Coordinate with SCE for inclusion of results into database
- Present results to group

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Slide 16

Whole Building Approach

- Integrated approach - similar to current kWh incentives.
- No change in current SBD standards for source energy use.
- Pay incentive on site therms for space and water heating that are less than standard building.
- Sliding incentive planned ($0.34 for 10% to $0.80 for 30% and above).

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Thrasher, W.H. and DeWerth, D.W. *New Hot-Water Use Data for Commercial Buildings.* ASHRAE Journal, September 1994, Vol. 36, No. 9, 24-30.

Internet addresses of the following sites: American Standard Commercial Water Heaters; Kemco Systems; Bradford White; GlowCore Inc.; RECO; State Industries; Rheem; Controlled Energy Corporation; U.S. Department of Energy, Energy Efficiency and Renewable Energy Network; U.S. Department of Energy, Office of Industrial Technologies; ACEEE; Burkay.

Appendix C – Memo on Whole Building Update

Memo

Date: 10/9/00

To: Mary Sutter

From: Martyn C Dodd, Gabel Dodd/EnergySoft

Re: Task 4, Southern California Gas Company Savings By Design - EnergyPro UTIL-1 Component

This memo is provided as final work completion for Task 4 specified in the scope of work for the Southern California Gas Company Savings By Design - EnergyPro UTIL-1 Component contract. Included here is a description of the basic modifications that have been made to the source code of the EnergyPro 2.1 software to accommodate both SBD Whole Building natural gas incentives, and reports specific to the Southern California Gas Company. This memo also provides a brief overview of the basic calculation process that the typical software user would follow to provide the necessary report (UTIL-1) for the Savings By Design program.

1. Utility – The first piece of information required by EnergyPro to perform the Utility Incentive calculation is the utility identifier that will determine which of the four participating utilities will be paying the incentive. As part of this activity, the EnergyPro Location Library has previously been populated with identifiers for the three other utilities. Additional information has been added for locations that have been identified by SCG as locations within their service area. This library is shipped to users pre-populated with this data so no additional work is required here on the user's part. Example – the location information in the library for Los Angeles contains the identifier SoCalGas. This identifier can be modified by the user, should a location be served by two participating utilities.
2. Energy Use – The next piece of information required is the energy use estimate for the building. In the case of the SCG estimate, we implemented the same approach as used by SDG&E and SCE. The user has two options as to how they calculate the energy use estimate:

   The user bases the total energy use estimate used for incentive purposes upon the Title 24 Compliance based energy simulation. Under this scenario the user merely performs the normal calculations used for Title 24 permit submittal purposes. No additional work is required on the user's part, and the Standard and Proposed energy use form the basis of the incentive.

   The user bases the total energy use estimate as in option a, but also chooses to perform a more realistic "Non-compliance" analysis. Under this scenario, the user includes additional information to the software that relates to actual building operational profiles. Example – a 24 hour occupancy building under option a will operate only 12 hours, per Title 24 guidelines; under option b, the noncompliance runs will show a 24 hour operation, and hence a larger potential energy savings.

It is important to note that PG&E does not allow option b, and hence the software will ignore results from the non-compliance analysis when the user has selected a PG&E location. PG&E, however, does pay an additional $0.07 per kWh saved to compensate for this fact.

3. The energy use estimates in step 2 are obtained from the DOE-2.1E simulation engine version 093. Version 110 is slated for release in February with EnergyPro version 2.5. These estimates are extracted automatically by EnergyPro, and the user has no control over this process, per ACM rules and requirements. EnergyPro reads the results from the DOE-2 BEPS report. BEPS is an acronym for Building Energy Performance Summary, and provides breakdowns in energy by fuel source and end-use. Included on the BEPS are two columns of data, one for Electricity and one for Natural Gas with a row for energy end-use as follows:

   - Heating
   - Cooling
   - Lighting
   - Receptacle
   - Fans
   - Heat Rejection
   - Pumps & Miscellaneous
   - Process
   - Domestic Hot Water
   - Total

   The end-uses reported by DOE-2 are in annual Site Energy Consumption units of Mbtu (Mbtu in this case is one million). EnergyPro converts these units to the more recognized (in California) Source Energy units of kBtu/sqft and stores the values for reporting on the PERF-1 and UTIL-1 forms.

4. The user now selects the reports that they would like to view. Included in the list of options is a Form Util-1.

5. EnergyPro produces a Util-1, specific to the utility identified in step 1. Added to the Util-1 are two new calculations that pertain to Natural Gas based incentives. Those calculations proceed as follows:

   Step 1 – Determination of total energy savings for the building. Using a basic comparison between the Title 24 Standard and Proposed buildings, the Title 24 based <u>Source</u> energy savings for the project is determined. Values shown here in the report will be in kBtu/sqft of annual energy use.

Step 2 – The Percent Below Title 24 is now calculated. This step requires that we remove and process load from the Standard Building energy use, so the divisor will be smaller. Without this step, buildings with large process loads would take a penalty in achieving the 10% minimum requirement for program participation. Using the Percent Below Title 24, the program determines eligibility for the 10% minimum threshold on Owner Incentives, and the 15% threshold for the Design Team Incentives. This information is then indicated on the Util-1, and the Percent Below will always be rounded to one decimal place. eg 28.6%.

Step 3 – The actual energy savings for the project is determined. This calculation either uses approach 2a or approach 2b as listed above in this memo as the basis for energy reported in these columns. This step utilizes Site energy use as the basis for the calculations and reporting of savings. Values shown here in the report will be in the units of therms per year of energy use for Natural Gas, and kWh per year for Electricity.

Step 4 – Calculation of the Incentives. Before any incentives are calculated, the software applies a limit to the calculated Percent Below Title 24. SBD program rules limit this value to 30% for the purposes of incentive calculation and the value is always rounded off to the nearest whole percent. The Natural Gas portion of the Incentives will now be calculated using this Percent below Title 24 value in the following formulas:

Owner Incentive Rate = 34 + (PercentBelow – 10) x 2.3

Design Team Incentive Rate = 15.2 + (PercentBelow – 15) x 0.78

The Natural Gas Incentive Rate is now rounded to one decimal place, and reported on the UTIL-1. Using the therm savings estimate developed in Step 3, the program multiples the Incentive Rate times the therm savings to determine the incentive. The incentive reported is rounded to the nearest dollar. In no case will the software allow the total incentive for Natural Gas plus Electricity exceed the $250,000 Owner Incentive limit, or the $50,000 Design Team Incentive limit, as specified in SBD program rules.

6. The UTIL-1 shown below provides an example of the calculations documented here:

SAVINGS BY DESIGN

UTILITY INCENTIVE WORK

In Step 2, we always subtract Process Energy from the numbers (they are the same in the Standard and Proposed) otherwise the divisor will increase, and the Percent Below will decrease unfairly when the user includes Process Energy

PROJECT NAME
Office Building

Step 1 ANNUAL SOURCE ENERGY USE (kBtu/sqft-yr)

Values here are always obtained from the Title 24 based Compliance analysis.

ENERGY COMPONENT	Standard	Proposed	Margin
Space Heating	20.63	15.79	4.84
Space Cooling	66.80	25.70	41.11
Indoor Fans	14.83	7.77	7.06
Heat Rejection	7.07	3.14	3.92
	4.20	2.08	2.13
	3.64	3.61	0.03
	35.34	29.04	6.30
	22.70	22.70	0.00
Process	50.82	50.82	0.00
TOTALS:	226.02	160.64	65.39

Step 2

Adjusted S
(Excludes Process

Standard Design		Proposed Design		Margin
175.21	-	109.82	=	65.39

Margin		Standard Design		% Below Title 24*
65.39	/	175.21	=	37.3%

* % Below Title 24 is limited to a maximum of 30% in the incentive rate calculation.

Project Eligibility — **Yes**

Owner Incentive (>=10%): X

Designer Incentive (>=15%): X

Conditioned Floor Area = 29,200 s

Thresholds for Gas and Electric Incentives.

Step 3

In this example, the user has chosen approach 2b outlined above. This is clearly denoted so the reviewer is aware to check these inputs.

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The values shown here are based upon the results of an EnergyPro Noncompliance energy analysis that incorporates building operating profile information supplied by the user.

ENERGY COMPONENT	Electricity (kWh)	Natural Gas (therms)	Proposed Electricity (kWh)	Proposed Natural Gas (therms)	Margin Electricity (kWh)	Margin Natural Gas (therms)
Space Heating	0	4,643	0	1,285	0	3,358
Space Cooling	188,397	0	71,110	0	117,287	0
Indoor Fans	43,657	0	22,063	0	21,594	0
Heat Rejection	19,748	0	8,409	0	11,339	0
Pumps	10,870	0	4,571			0
Domestic Hot Water	0	1,087	0			10
Lighting	103,399	0	85,174			0
Receptacle	66,100	0	66,100			0
Process	144,536	0	144,536			0
TOTALS:	576,707	5,730	401,963			3,368

Our Actual Savings will be based upon our Noncompliance runs, if we have chosen this option.

Step 4 POTENTIAL INCENTIVE CALCULATION

Our % Below Title 24 will always be based upon our compliance analysis.

The Gas Company

A Sempra Energy company

	% BelowTitle 24* (from step 2)	SCG Constant		Incentive Rate		Savings (From Step 3)		Subtotal
	30.0%	x 60	=	18.0 ¢/kWh	X	174,743 kWh	=	$ 31,454 +
	34.0¢+ [(30.0% - 10%) x 2.3]		=	80.0 ¢/therm	X	3,368 therm	=	$ 2,694
Owner Incentive						($250,000 max)	=	$ 34,148
Electricity	30.0%	x 20	=	6.0 ¢/kWh	X	174,743 kWh	=	$ 10,485 +
Natural Gas	15.2¢+ [(30.0% - 15%)x 0.78		=	26.9 ¢/therm	X	3,368 therm	=	$ 906
Design Team Incentive						($50,000 max)	=	$ 11,391

This worksheet is for estimating potential incentives only. Contact Southern California Gas Company regarding the Nonresidential New Construction Program for eligibility and participation requirements.

* % Below in this equation is limited to 30%

Total Incentive $ 45,539

Run Initiation Time: 09/14/00 13:56:26 Run Code: 968964986