Evaluation Measurement and Verification Report for the Time-of-Sale Home Inspection Program #180-02

Prepared for GeoPraxis

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1. Introduction

This report provides the Evaluation, Measurement, and Verification (EM&V) findings for the GeoPraxis Time-of-Sale (TOS) Home Inspection Local Program #180. The GeoPraxis program trained and equipped home inspectors to integrate a streamlined energy audit into the traditional Time-of-Sale home inspection. The program provided Northern California ratepayers with timely access to key information to help them improve the energy efficiency, comfort, and resale value of their homes. This program offered an integrated approach to achieving cost-effective energy savings. The program's long-term goal was to transform the diverse existing home real estate market into one in which consumers demand and the real estate services industry discloses substantially more information on the energy-efficiency characteristics of homes that are sold. The program's primary goal was to achieve peak electricity demand reductions and/or energy savings through the increased adoption of the cost-effective energy efficiency measures recommended in an EnergyCheckup™ Report. Additionally, the program was designed to impact the market so that an increasing number of home inspectors were trained and have the technical capabilities to supply Time-of-Sale energy audit services. In addition to recommending comprehensive whole-house energy efficiency improvements and generating leads to the many rebate programs available, the TOS program also directly provided a free "kit" of energy efficiency measures to participating homeowners.

The ex ante goals and ex post accomplishments are shown in **Table 1.1**. The ex ante program implementation goals were to serve 12,000 single family, multifamily, and mobile home customers in the Pacific Gas and Electric (PG&E) service area. The program performed 205 EnergyCheckup™ audits and directly provided free energy efficiency measures to 18 participating homeowners. The program provided 137,905 marketing pieces (50% more than planned) and trained 128 inspectors and 71 real estate agents on the benefits of EnergyCheckup inspections at time of sale, meeting or exceeding all hard-to-reach goals.

Table 1.1 Ex Ante Goals and Ex Post Accomplishments for the Program

Description	Proposed Ex Ante Goal	Accomplishment Based on Ex Ante	Ex Post Accomplishment
EnergyCheckup™ Audits/Reports	12,000	205	205
Print/Distribute Direct Mail Pieces	57,143	70,905	70,905
Print/Distribute English Brochures	32,214	60,000	60,000
Print/Distribute Spanish Brochures	3,500	7,000	7,000
Attend Home Inspection Conferences	3	5	5
Inspector Training Workshops	16	16	16
Total Inspectors Trained	no goal	128	128
Total Participating Inspectors	no goal	38	38
Total Certified Inspectors	no goal	23	23
Total Real estate agents Trained	48	71	71
Free CFLs	17,000	36	36
Free Faucet Aerators (electric DHW)	1,692	2	2
Free Faucet Aerators (gas DHW)	13,617	25	25
Free Showerheads (electric DHW)	3,383	1	1
Free Showerheads (gas DHW)	6,809	18	18
Free Bath Bar Caps (removed from program)	1,000	0	0
Net Annual Savings (kWh/yr)	2,092,351	89,179	80,889
Net Demand Savings (kW)	1,246	45	40
Net Annual Savings (therms/yr)	264,933	8,721	7,885

Table 1.1 Ex Ante Goals and Ex Post Accomplishments for the Program

Description	Proposed Ex Ante Goal	Accomplishment Based on Ex Ante	Ex Post Accomplishment
Net Lifecycle Savings (kWh)	29,931,567	1,074,749	1,066,988
Net Lifecycle Savings (therms)	2,520,139	136,421	127,446
Total Resource Cost (TRC) Test	**1.27**	**0.093**	**0.088**
TRC Test Benefits	$2,215,019	$94,343	$89,147
TRC Test Costs	$1,741,950	$1,013,543	$1,013,543
TRC Test Net Benefits	$473,069	-$919,201	-$924,396
Participant Test	**2.37**	**0.686**	**0.65**
Participant Test Benefits	$3,177,143	$131,223	$124,007
Participant Test Costs	$1,342,702	$191,393	$191,393
Participant Test Net Benefits	$1,834,440	-$60,171	-$67,386

Program energy savings accomplishments are 95 percent less than the ex ante goals. This is due to: 1) lack of homebuyer and realtor awareness about the benefits of EnergyCheckup™ inspections at time of sale; and 2) inability of participating home inspectors to sell EnergyCheckup™ inspections to home buyers at time of sale. The 2002-2003 program was originally designed to market EnergyCheckup™ audits directly though GeoPraxis' certified EnergyCheckup™ inspectors. According to GeoPraxis many inspectors were enthusiastic about the service and made efforts to promote EnergyCheckup™ audits directly to homebuyers and real estate agents in their local areas. GeoPraxis also made an effort to coordinate with statewide marketing and outreach programs, utility rebate and information programs, and other local non-utility programs. Unfortunately, these marketing efforts did not generate significant homebuyer or real estate agent awareness about the program. Without significant awareness, most inspectors were ineffective in their efforts to sell EnergyCheckup™ inspections to home buyers.[1]

The program ex ante cost effectiveness was 1.27 for the total resource cost (TRC) test and 2.37 for the participant test. The ex-post cost effectiveness is 0.088 for the TRC test and 0.65 for the participant test. While the ex post cost effectiveness is extremely low, the program still has merit as demonstrated by a verified measure adoption ratio of 0.46 and the fact that some inspectors are continuing to pay for and provide EnergyCheckup inspection reports to their customers even though program activities ended March 31, 2004.[2] Ex post accomplishments were verified by randomly calling participating and non-participating homebuyers and inspectors.

Proposed first year net ex ante load impact goals are summarized in **Table 1.2**. The first year net ex ante load impact goals are 1,984,209 kWh per year and 156,460 therms per year.

Table 1.2 Proposed First Year Net Ex Ante Load Impacts for the Program

Description	Total Energy Checkup Recommendation	Ex Ante Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Ante kWh/y	Net Ex Ante kW	Net Ex Ante therm/y
EnergyCheckup™ Recommendations	131,063	0.31	40,629	0.72	1,984,209	1,197	156,460

[1] Consumer purchase behavior decision making models (e.g., Fishbein and Ajzen's "Theory of Reasoned Action", 1980, et al.) stress the critical importance of making consumers pre-aware and favorably pre-disposed toward a new product or service before they can develop an intention to purchase, and ultimately follow though on that intention with action.

[2] GeoPraxis reports that 65 EnergyCheckup inspections were completed between April 1 and November 15, 2004.

Proposed lifecycle net ex ante load impact goals for the program shown in **Table 1.3**. The lifecycle net ex ante load impact goals are 28,620,865 kWh and 2,177,224 therms.

Table 1.3 Proposed Lifecycle Net Ex Ante Load Impacts for the Program

Description	Electricity Measure Average EUL	Lifecycle Net Ex Ante kWh	Gas Measure Average EUL	Lifecycle Net Ex Ante therm
EnergyCheckup™ Recommendations	14.4	28,620,865	13.9	2,177,224

The first year net ex post load impacts for the program are shown in **Table 1.4**. The first year net ex post program savings are 80,889 ± 7,903 kWh/yr, 40 ± 4 kW, and 7,885 ± 770 therm/yr.

Table 1.4 First Year Net Ex Post Load Impacts for the Program

Description	Total Energy Checkup Recommendation	Ex Post Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Post kWh/y	Net Ex Post kW	Net Ex Post therm/y
EnergyCheckup™ Recommendations	2,032	0.46	886	0.72	80,889	40	7,885

The lifecycle net ex post load impacts for the program shown in **Table 1.5**. The lifecycle net ex post program savings are 1,066,988 ± 104,243 kWh, 127,446 ± 12,451 therm. The lifecycle net ex post realization rates are 0.0373 ± 0.0036 for kWh and 0.0585 ± 0.0057 therms.

Table 1.5 Net Lifecycle Load Impacts for the Program

Description	Electricity Measure Average EUL	Lifecycle Net Ex Post kWh	Gas Measure Average EUL	Lifecycle Net Ex Post therm
EnergyCheckup™ Recommendations	13.2	1,066,988	16.2	127,446

Process telephone surveys were conducted with 40 participating homeowners, 10 non-participating homeowners, 10 participating home inspectors, and 10 non-participating home inspectors (the program had 205 participating homeowners and 38 participating inspectors). Process survey results were used to guide the overall process evaluation in terms of investigating operational characteristics of the program and developing specific recommendations to help make the program more cost effective, efficient, and operationally effective. Homeowner and inspector participant satisfaction survey questions and responses are provided in **Table 1.6.**

1.6 Participant Satisfaction Survey Questions and Responses

#	Questions (Responses are based on a scale of 1 to 4)	Homeowner	Inspector
1	Courteousness and professionalism of inspector (or trainer)?	3.9	3.8
2	Knowledge of EnergyCheckup™ program trainers and staff?	n/a	3.8
3	Please rate how easy EnergyCheckup™ training was to understand?	n/a	3.9
4	Please rate ease of explaining EnergyCheckup™ recommendations to home buyers?	n/a	3.9
5	Timeliness of EnergyCheckup™ inspection?	4.0	
6	Applicability of EnergyCheckup™ recommendations to your house?	3.7	
7	Amount of time required to complete EnergyCheckup™ inspection?	4.0	3.9
8	How reasonable were the EnergyCheckup™ recommended energy savings?	3.9	3.9
9	How informative was the EnergyCheckup™ report?	3.8	3.9
10	How easy was the EnergyCheckup™ report to understand?	3.8	3.9
11	Please rate the EnergyCheckup™ report in terms of presentation on a scale from 1 to 4?	3.6	3.5
12	Please provide your overall satisfaction with the EnergyCheckup™ report?	3.5	3.3

Process evaluation findings indicate the program provided valuable energy efficiency services and training to homeowners and inspectors. Inspector participants generally rated the GeoPraxis staff as courteous and professional and found the training easy to understand. Overall service was rated highly and nearly all (90%) of the participating inspectors said they will continue to offer and advertise the EnergyCheckup™ service to their customers. Homeowner participants found the EnergyCheckup™ recommendations informative and applicable to their residence. Homeowners adopted 46% of the measures recommended in the EnergyCheckup™ reports and generally felt it was a "great program." This was verified through the telephone surveys.

Non-participant survey results indicate that more homeowners may have participated if they had known about the program (i.e. information barrier) or if they owned their residence (i.e., renter–misplaced or split incentive). Of the non-participant inspectors surveyed, approximately 70% were unaware of the program, but many stated that they would not have participated even if they had known. This market barrier seems to stem primarily from the belief that customers and real estate agents aren't interested in EnergyCheckup™ inspections (i.e. asymmetric information) and the fact that inspectors feel too busy to introduce a new service and perform additional work, particularly during such an active resale market (i.e. hassle cost).

The EM&V study recommendations include providing a $35 to $40 per audit incentive to home inspectors in order to overcome market barriers to participation and promotion of the program.[3] A similar EnergyCheckup™ program implemented by Inspectech from 1999 through 2001 in Southern California realized more than 27,000 EnergyCheckup audits with a rebate of $35 per inspection. Another recommendation is to develop an "EnergyWise" real estate agent training element that includes the GeoPraxis T-o-S EnergyCheckup™ Report and a kit of energy efficiency products (e.g., CFLs, faucet aerators, showerheads, etc.) that EnergyWise agents could use to sell homes and inspectors could use to help make home buyers more aware of energy efficiency and renewable energy opportunities. Traditionally, real estate agents have not been included in most residential audit program efforts and this recommendation would create a win-win for real estate agents, home inspectors, and California in terms of creating demand for providing increased energy efficiency information at time of sale since this is the time when home buyers are most predisposed to spend money to improve their homes.

The study assessed the continuing need for the program by analyzing cost effectiveness and savings goals depending on how many EnergyCheckup™ inspections might have been completed. For example, if the program had reverted to providing inspector incentives and completed 5,860 EnergyCheckup™ inspections (with the same adoption ratio), then the ex ante savings goals would have been realized and the ex post TRC test would have been 2.58. Future funding should be contingent upon reinstating an inspector incentive, including a real estate agent training and outreach element, and reaching clearly identifiable EnergyCheckup goals. This study confirms that each time-of-sale home inspection audit is worth approximately $208 per home in net present avoided costs given the average realized net savings per home for each EnergyCheckup™ inspection report of 395 kWh/yr, 0.2 kW, 38.5 therm/yr and lifecycle savings of 5,205 and 622 therms.

[3] This recommendation was made in the January 2004 progress report including feedback and corrective or constructive guidance regarding implementation of the program (see **Appendix B**).

The following analysis of inspector costs demonstrates how the program could provide cost-effective energy and demand impacts by returning to the use of inspector incentives. According to the participating inspectors surveyed, each EnergyCheckup™ inspection takes approximately 0.66 hours to complete.[4] At an average rate of $65/hour for their labor, the cost to the inspector was roughly $63 ($43 in time plus the GeoPraxis fee of $19.95) per inspection. If GeoPraxis had provided a rebate of $40 per inspection without a fee, then they should have been able to achieve their goal of completing 12,000 EnergyCheckup™ inspections. Based on the findings of this and other independent studies[5] that have verified the savings from EnergyCheckup inspections, the utilities and/or the CPUC should consider a time-of-sale energy efficiency inspection program with requirements for inspection services companies to follow in training and certifying inspectors and $35 - $70 in direct incentives to inspectors and real estate agents.[6] Under an optimal program design, administrative, marketing, and EM&V expenses would be limited to no more than $25 per inspection, while $70 per inspection would be reserved for direct implementation costs (including a $40 incentive paid to inspectors, plus $25 allocated to providing free energy efficiency measures to real estate agents to distribute as "thank you" gifts at the close of escrow, and $5 dedicated to inspector training and technical support. With net benefits of $208 and total costs of $95 per inspection, the TRC would be approximately 2.1.

The program strategy merits future consideration statewide since it could provide cost effective electricity and natural gas savings to thousands of home buyers at a relatively low cost with support from EnergyWise real estate agents and a coordinated marketing campaign through Flex Your Power, utilities, and local governments. Annual sales of existing homes in California are approximately 616,200.[7] The Time-of-Sale Home Inspection program has the unique potential to cost effectively reach these home buyers just prior to their major appliance and other home improvement purchase decisions whereas other more traditional residential energy audit programs generally do not.

Section 2 describes how the EM&V study addresses the required CPUC Energy Efficiency Policy Manual objectives, including baseline information, energy efficiency measure information, measurement and verification approach, and the evaluation approach. **Section 2** also includes equations used to develop energy savings and the sample design. **Section 3** provides EM&V study findings including load impact results, verification findings, and process evaluation results. **Section 3** also includes process evaluation recommendations regarding what works, what doesn't work, and suggestions to improve the program's services and procedures. **Appendix A** provides the participant and non-participant homeowner and renter survey instruments. **Appendix B** provides the participant and non-participant inspector survey instruments. **Appendix C** provides the EM&V progress report.

[4] GeoPraxis reports that when the program was operated at high volume in Southern California, inspectors became very experienced with the audit process and were thus able to reduce inspection time even more.
[5] Quantum Consulting 2002. *National Energy Efficiency Best Practices Study, Volume R7 – Residential Audit Programs Best Practices Draft Report.* Ridge and Associates, 2002. *Evaluation of Southern California Edison's (2001) Residential Audit Programs: Final Report*. Quantum Consulting 2002. *National Energy Efficiency Best Practices Study, Volume R7 – Residential Audit Programs Best Practices Report*.
[6] Until CEC HERS 2 standards have been completed, Time-of-sale inspection service providers should be required to meet RESNET or other suitable standards.
[7] National Association of Realtors (http://www.realtor.org/Research.nsf/Pages/EHSdata)

2. Required CPUC Objectives and Components

This section discusses how the EM&V study addressed the following research requirements and objectives specified in the CPUC Energy Efficiency Policy Manual:

- Measure the level of energy and peak demand savings achieved;
- Measure cost-effectiveness;
- Provide up-front market assessments and baseline analysis;
- Provide ongoing feedback, and corrective and constructive guidance regarding the implementation of programs;
- Measure indicators of the effectiveness of specific programs, including testing of the assumptions that underlie the program theory and approach;
- Assess the overall levels of performance and success of programs; and
- Help to assess whether there is a continuing need for the program.

This section also discusses how the study addressed the CPUC objectives and components listed in **Table 2.1** including baseline information, energy efficiency measure information, measurement and verification approach, and the evaluation approach.

Table 2.1 Components of an EM&V Plan

Baseline Information ■ Determine whether or not baseline data exist upon which to base energy savings measurement. Existing baseline studies can be found on the California Measurement Advisory Committee website (http://www.calmac.org/) and/or the California Energy Commission website (http://www.energy.ca.gov/). Detailed sources of baseline data should be cited. ■ If baseline data do not exist, the implementer will need to conduct a baseline study (gather baseline energy and operating data) on the operation(s) to be affected by the energy efficiency measures proposed. ■ If the baseline data do not exist and the implementer can show that a baseline study is too difficult, expensive or otherwise impossible to carry out prior to program implementation, the contractor should then provide evidence that baseline data can be produced or acquired during the program implementation. This process should then be detailed in the EM&V Plan.
Energy Efficiency Measure Information ■ Full description of energy efficiency measures included in the program, including assumptions about important variables and unknowns, especially those affecting energy savings. ■ Full description of the intended results of the measures.
Measurement and Verification Approach ■ Reference to appropriate IPMVP option. ■ Description of any deviation from IPMVP approach. ■ Schedule for acquiring project-specific data
Evaluation Approach ■ A list of questions to be answered through the program evaluation. ■ A list of evaluation tasks/activities to be undertaken during the course of program implementation. ■ A description of how evaluation will be used to meet all of the Commission objectives described above.

2.1 Baseline Information

Existing studies will be used to determine whether or not baseline data exist to reference energy and peak demand savings measurements. Existing baseline data will be obtained from prior EM&V studies, California Measurement Advisory Committee (CALMAC, www.calmac.org), and the California Energy Commission (CEC, www.energy.ca.gov). Existing baseline studies for audit programs are provided in **Table 2.2**.

Table 2.2 Existing Baseline Studies for Audit Programs

1	*Evaluation of Southern California Edison's Residential Audit Programs,* prepared for SCE , prepared by Ridge & Associates, September 6, 2002.
2	*Evaluation of SCE's Mail-In Audit Program,* prepared by Regional Economic Research, San Diego, CA, CALMAC Study 528-B, 1997.
3	*Evaluation of SCE's In-Home Energy Audit Program,* prepared by Regional Economic Research, San Diego, CA, CALMAC Study 528-A, 1996.
4	*Filing of Pacific Gas and Electric Company Requesting Approval of Proposed Energy Efficiency Programs and Budgets as Part of the 2002 Energy Efficiency Program Selection Process Required by Rulemaking 01-08-028,* December 2001.
5	*Measure Incentives and Cost Effectiveness for the California Residential Contractor Program,* prepared for SDG&E, SCE, PG&E, and SCG, prepared by Robert Mowris & Associates, Orinda, CA, 1999, 2000, and 2001.
6	*Deemed Savings Estimates for the Summer Initiative Program,* prepared for SDG&E, SCE, PG&E, and SCG, prepared by Regional Economic Research and Robert Mowris & Associates, San Diego, CA, 2001.
7	*2001 DEER Update Study, Final Report,* prepared for the California Energy Commission, Contract Number 300-99-008, prepared by XENERGY Inc., Oakland, California, August 2001.
8	*Deemed Energy Savings for the Residential Standard Performance Contract Program,* prepared for Pacific Gas and Electric Company, prepared by Robert Mowris & Associates, 1998.
9	*California Energy Demand: 1995-2015,* P300-95-008, California Energy Commission, 1516 Ninth Street, Sacramento, CA 95814, 1995.
10	*Residential Energy Survey Report and PG&E RASS Data UECs,* Pacific Gas and Electric Company, 1998.
11	*Final Report for the Evaluation of the California 2002 Home Energy Efficiency Survey Program,* prepared for SCE, prepared by Ridge & Associates, June 1, 2004.
12	*Measurement and Evaluation Study of the 2002 SDG&E Residential In-Home Audits Program,* prepared for SDG&E, prepared by RLW Analytics, November 2003.
13	*Final Report for the Measurement and Evaluation Study of Southern California Edison Company's PY2002 Local In-Home Audit Program,* prepared by KVD Research Consulting, April 2004.

Existing average baseline Unit Energy Consumption (UEC) data for PG&E single-family homes are provided in **Table 2.3**. These UEC data are derived from the PG&E Workpapers for the Single Family Energy Efficiency Rebate Program (**Study 4**, above). The baseline UEC values shown in **Table 2.3** were evaluated and compared to UEC values from the *California Statewide Residential Appliance Saturation Study* (RASS). The study used baseline values from the PG&E RASS study shown in **Table 2.4**.

Table 2.3 Existing Baseline Unit Energy Consumption (UEC) Data

End Use	PG&E Average UEC	Source
Space Cooling UEC (kWh/yr)	2,154	Derived PG&E Workpapers Study 4, **Table 2**
Space Cooling (kW)	3.9	Derived PG&E Workpapers Study 4, **Table 2**
Gas Space Heating UEC (therm/yr)	576	Derived PG&E Workpapers Study 4, **Table 2**
Gas Water Heating UEC (therm/yr)	214	RMA Study 5, **Table 2**
Electric Water Heating UEC (kWhyr)	2,945	RMA Study 5, **Table 2**
Whole House Lighting UEC (kWh/yr)	1,125	RMA Study 5, **Table 2**
Whole House Appliances UEC (kWh/yr)	2,848	RMA Study 5, **Table 2**
Lighting UEC Interior 63W Base kWh/yr	90	RER/RMA Study 6, **Table 2**
Lighting UEC Interior 100W Base kWh/yr	143	RER/RMA Study 6, **Table 2**
Lighting UEC Exterior 63W Base kWh/yr	276	RER/RMA Study 6, **Table 2**
Lighting UEC Exterior 100W Base kWh/yr	438	RER/RMA Study 6, **Table 2**

Table 2.4 Study Baseline UEC Values for PG&E

End Use	PG&E RASS UEC	Notes
All Household Electricity UEC (kWh/yr)	6,255	RASS Study based on 9,265 homes
All Household Gas UEC (therm/yr)	343	RASS Study based on 8,789 homes
Space Cooling UEC (kWh/yr)	1,108	2004 RASS Study, 0.39 Saturation
Space Cooling (kW)	1.3	2004 RASS Study, 0.39 Saturation
Gas Space Heating UEC (therm/yr)	245	2004 RASS Study, 0.74 Saturation
Gas Water Heating UEC (therm/yr)	183	2004 RASS Study, 0.74 Saturation
Electric Water Heating UEC (kWh/yr)	2,585	2004 RASS Study, 0.09 Saturation
Whole House Lighting UEC (kWh/yr)	1,128	2004 RASS Study, 1.0 Saturation
Outdoor Lighting UEC (kWh/yr)	260	2004 RASS Study, 0.56 Saturation
First Refrigerator UEC (kWh/yr)	788	2004 RASS Study, 1.0 Saturation
Second Refrigerator UEC (kWh/yr)	1,201	2004 RASS Study, 0.19 Saturation
NAECA Refrigerator UEC (kWh/yr)	618	NAECA Standard from Energy Star
Clothes Washer UEC (kWh/yr)	97	2004 RASS Study, 0.78 Saturation
Dishwasher UEC (kWh/yr)	77	2004 RASS Study, 0.67 Saturation
Electric Dryer UEC (kWh/yr)	652	2004 RASS Study, 0.45 Saturation
Gas Dryer UEC (therm/yr)	25	2004 RASS Study, 0.22 Saturation
Range Oven UEC (therm/yr)	37	2004 RASS Study, 0.42 Saturation

Estimates of energy consumption by end use, distribution loss, and tank loss are shown in **Table 2.5**. These values can be used to evaluate deemed energy savings estimates for water heater measures.

Table 2.5 Single-Unit Water Heater Energy Consumption[8] by End Use

End Use or Standby Loss	Electric Water Heater Relative Energy Consumption %	Gas Water Heater Relative Energy Consumption %
Shower	26	23
Tub	10	9
Sink	10	9
Clotheswasher	18	16
Dishwasher	8	7
Pilot Loss	-	13
Distribution Loss	16	13
Tank Loss	12	10
Total	**100**	**100**

2.2 Energy Efficiency Measure Information

This section provides energy efficiency measure information including assumptions about important variables and unknowns, especially those affecting energy savings. Deemed energy and peak demand savings for each measure are indicated in **Table 2.6**. The deemed energy and

[8] These values are averages taken from the following studies: *Water Conservation in California*, Bulletin 198-84, California Department of Water Resources, Sacramento, CA, July 1984. *Supply Curves of Conserved Energy: A Tool for Least-Cost Energy Analysis*, A. Meier, T. Usibelli, Proceedings of Energy Technology Conference, Government Institutes Inc., Rockville, MD, pp. 1264-1265, March 1986. *Residential Hot Water Use Patterns*, D. Stevenson, Canadian Electrical Association, Report #111U268, Montreal, July 1983. *Water Heater Innovations*, Progressive Builder, Howard Geller, pp. 24-26, September 1985.

peak demand savings are based on GeoPraxis estimates[9] or existing studies such as the 2001 DEER Update Study (Study 7, **Table 2.2**).

Table 2.6 GeoPraxis Deemed Savings for Measures Installed in the PG&E Service Area

#	Description	Rebate per unit	Demand Savings per unit kW	Annual Hours of Operation per unit	Savings per unit kWh	Savings per unit therm	EUL	NTG Ratio	Units
1	Basic HVAC Tune-up (AC Diag.)				431		10	0.72	493
2	Adv. HVAC Tune-up (Ducts+AC)		0.3100		567	38.29	10	0.72	189
3	Duct Test & Seal		0.3100		311	38.29	20	0.72	440
4	Energy Star Furnace				15	74.37	20	0.72	236
5	Energy Star Heat Pump		0.4400		565		15	0.72	
6	Energy Star Air Conditioner		1.2600		1,241	42.75	15	0.72	169
7	Programmable T-Stat		0.2300		104	15.46	11	0.72	480
8	Wall insulation		0.0636		62	12.69	20	0.72	60
9	Insulation Package (Attic+Walls)				105	79.99	20	0.72	0
10	Energy Star Window/Skylight		0.0601		65	12.88	20	0.72	264
11	High Eff. Gas Wtr Htr					66.55	15	0.72	529
12	Pipe Insulation Gas				1	5.91	15	0.72	838
13	Low-Flow Showerhead-Gas				4	14.70	10	0.72	1,311
14	Kitchen Lighting-CFL		0.1057		169		16	0.72	403
15	Outdoor Lighting-CFL		0.0754		254		16	0.72	198
16	Energy Star Torchiere		0.0251		127		16	0.72	
17	Fluorescent Lights or CFL Hardwired		0.1057		384		16	0.72	1,068
18	Energy Star Clotheswasher				12	27.00	10	0.72	10
19	Energy Star Dishwasher				49	8.80	5	0.72	10
20	Attic insulation		0.0900		73	74.91	20	0.72	295
21	Free Lo-Flow Showerhead-electric	$1.75			179		10	0.72	1,692
22	Free CFL	$4.38	0.0550		60		16	0.72	17,000
23	Free Socket Caps (not in program)								
24	Free Faucet Aerators-electric	$0.25			70		10	0.72	3,383
25	Free Low-Flow Showerhead-gas	$1.75				10.00	10	0.72	6,809
26	Free Faucet Aerators-gas	$0.25				4.00	10	0.72	13,617
27	Energy Star Refrigerator		0.009		68		15	0.72	-
28	Reduce Infiltration/Drafts		0.077		66	12.00	15	0.72	-

2.2.1 Measure Assumptions and Intended Results

Measure assumptions were derived from the GeoPraxis program implementation plan (PIP) and workbook as shown in **Table 2.7**. The EM&V study assessed ex ante measure assumptions and developed ex post measure assumptions based on the PG&E Workpapers for the Single Family Energy Efficiency Rebate Program or other studies such as the *California Statewide RASS Study, 2001 DEER Update Study, or other sources* (see **Table 2.2**, above).

[9] See pages 25-28, GeoPraxis Time-of-Sale Home Inspection Proposal, prepared for California Public Utilities Commission Proceeding R.01-08-028, 2002 Energy Efficiency Program Selection, January 15, 2002.

Table 2.7 Baseline and Energy Efficiency Measure Assumptions

#	Description	Baseline Assumption	Measure Assumption	Annual Hours	Savings Target
1	Basic HVAC Tune-up (AC Diagnostic)	Incorrect Charge	Correct Charge		13% improvement
2	Adv. HVAC Tune-up (Ducts Seal + AC Tune-up)	Incorrect Charge + 29% Duct Leak	Correct Charge + 15% Duct Leak		13% improvement + 14% reduced leakage or 60 cfm/ton
3	Duct Test & Seal	29% Duct Leakage	15% Duct Leakage		Minimum 14% Leakage Reduction or 60 cfm/ton
4	Energy Star Furnace	78%	90%		13% heating
5	Energy Star Heat Pump	10 SEER/6.8 HSPF	12 SEER/8 HSPF		17% cooling, 15% heating
6	Energy Star Air Conditioner	10 SEER	12 SEER		17% cooling
7	Programmable T-Stat	None	Setup/setback		8% cooling, 9% heating
8	Wall insulation	None	R-13		3% cooling, 3% heating
9	Insulation Package (Wall + Attic)	None	R-13 Wall, R-30 Roof		5% cooling, 18% heating
10	Low-e Windows	Single Pane	Low-E		5% cooling, 3% heating
11	Efficient Gas Water Heater	0.53 EF	0.62 EF		15% savings
12	Pipe Insulation Gas	None	5 feet or 1st bend		2.7% annual WH savings
13	Low-Flow Showerhead	3.5 gpm @80 psi	2.5 gpm @80 psi		1.0 gpm reduction @80 psi
14	Kitchen Lighting-CFL	200 W	46 W	1,095	154 W reduction
15	Outdoor Lighting-CFL	75 W	17 W	4,380	58 W reduction
16	Energy Star Torchiere	160 W	45 W	1,095	114 W reduction
17	Fluorescent Lights	468 W	118 W	1,095	350 W reduction
18	Energy Star Clotheswasher	Standard	Energy Star		10% Electric Savings, 12% WH Savings
19	Energy Star Dishwasher	Standard	Energy Star		15% Electric Savings, 4% WH Savings
20	Attic Package	None	R-30 Roof		4% cooling, 17% heating
21	Free Lo-Flow Showerhead-electric	3.5 gpm @80 psi	2.5 gpm @80 psi		1.0 gpm reduction @80 psi
22	Free CFL	70 W	15 W	1,095	55 W reduction
23	Free Socket Caps (not in program)				
24	Free Faucet Aerators-electric	3.3 gpm @80 psi	2.2 gpm @80 psi		1.3 gpm reduction @80 psi
25	Free Low-Flow Showerhead-gas	3.5 gpm @80 psi	2.5 gpm @80 psi		1.0 gpm reduction @80 psi
26	Free Faucet Aerators-gas	3.3 gpm @80 psi	2.2 gpm @80 psi		1.3 gpm reduction @80 psi

The ex ante and ex post energy and peak demand results for GeoPraxis local program #180 are shown in **Table 2.8**.

Table 2.8 Ex Ante and Ex Post Energy and Peak Demand Results

Program	Utility	Net kWh/yr	Net kW	Net therm/yr	Net Lifecycle kWh	Net Lifecycle therm
Ex Ante GeoPraxis TOS #180	PG&E	1,984,209	1,197	156,460	28,620,865	2,177,224
Ex Post GeoPraxis TOS #180	PG&E	80,889	40	7,.885	1,066,988	127,446

2.2.2 Description of Energy Efficiency Measures

This section provides a description of each energy efficiency measure including assumptions about important variables and unknowns, especially those affecting energy savings. Energy efficiency measure assumptions were examined in the EM&V study. Ex post unit savings are based on RASS UEC values and percentage savings from the 2001 DEER Update Study or other sources. Cumulative savings for multiple measures will be less than the sum of the percentage savings (i.e., diminished unit savings occur with multiple measures).

Basic HVAC–AC Diagnostic Tune-up

Basic HVAC (i.e., AC diagnostic) tune-up involves checking and correcting the refrigerant charge and airflow on split-system central air conditioning units (and central heat pump units),

and thereby raising the air conditioning efficiency by approximately 17%.[10] Detection of leaky Schrader valves is performed with leak detection equipment and leaky Schrader valves are replaced with new valves and core repair tools. Average cooling savings are 13% based on the DEER 2001 Update Study. GeoPraxis did not take credit for peak cooling savings for this measure. Measure lifetime is 10 years.[11]

Advanced Diagnostic (Duct Test & Seal + AC Diagnostic)

Advanced Diagnostic is the simply Basic HVAC + Duct test and seal. Average cooling savings are 21% and space heating savings are 11% based on the DEER 2001 Update Study.

Duct Test & Seal

Duct test and seal involves sealing both supply and return ducts to a leakage reduction of 60 cfm/ton or 15 percent of measured system flow at 25 Pascal pressure (supply and return). Baseline duct leakage is 29%. Average cooling savings are 9% and space heating savings are 11% based on the DEER 2001 Update Study. The measure lifetime is 15 years as per the CPUC.

Energy Star® Gas Furnace

Energy Star® gas furnace has a 90% AFUE compared to the baseline furnace with a 78% AFUE. Average space heating savings are 13.3% (i.e., 1-0.78/0.90). The measure lifetime is 20 years.

Energy Star® Heat Pump

Energy Star® heat pump has a 12 SEER/8 HSPF compared to the baseline heat pump with a 10 SEER/6.8 HSPF. Average cooling savings are 16.6% (i.e., 1-10/12) and space heating savings are 15% (i.e., 1-6.8/8). The measure lifetime is 15 years.

Energy Star® Air Conditioner

Energy Star® air conditioner has a 12 SEER compared to the baseline air conditioner with a 10 SEER. Average cooling savings are 16.6% (i.e., 1-10/12). The measure lifetime is 15 years.

Programmable Thermostat

Programmable thermostat involves replacing an existing manual thermostat. The programmable thermostat is setup from 78F to 85F from 9AM to 6PM during summer weekdays while occupants are away. The unit is setback from 78F to 65F during winter nights while occupants are sleeping. Savings are based on utility studies of 8% average cooling savings and 9% average heating savings. Savings are less than manufacturers' estimates based on calibrated DOE-2 baseline where the occupants manually setup/setback or turn off the thermostat during the day while away at work (e.g., 8:00 AM to 6:00 PM). Measure lifetime is 11 years.

Wall Insulation

Wall insulation involves filling walls with R-13 insulation compared to no baseline wall insulation. Average cooling savings are 6% and space heating savings are 20% based on the DEER 2001 Update Study. Measure lifetime is 20 years.

[10] *National Energy Savings Potential from Addressing HVAC Installation Problems*, Chris Neme, Vermont Energy Investment Corporation, prepared for US Environmental Protection Agency, March 1998.
[11] The 10-year lifetime for ac diagnostic tune-up is the CPUC-accepted measure life.

Attic Insulation
Attic insulation involves adding R-30 insulation to ceilings compared to no baseline attic insulation. Average cooling savings are 24% and space heating savings are 30% based on the DEER 2001 Update Study. Measure lifetime is 20 years.

Insulation Package (Wall + Attic)
Insulation package includes wall insulation (adding R-13) plus attic insulation (adding R-30). Average cooling savings are 29% and space heating savings are 44% based on the DEER 2001 Update Study. Measure lifetime is 20 years.

Low-e Windows
Low-e (emissivity) windows include low-e squared coatings, argon gas, and vinyl frames with minimum 0.4 Btu/ft^2-hr-°F U-factor and 0.4 solar heat gain coefficient (SHGC). The baseline windows are single pane and aluminum frame with 1.09 Btu/ft^2-hr-°F U-factor and 0.82 SHGC. Average cooling savings are 30% and space heating savings are 15% based on other studies.[12] Measure lifetime is 20 years.

Efficient Gas Water Heater
Efficient gas water heater has 0.62 energy factor (EF) compared to the baseline 0.54 EF. Average water heating savings are 13%. Measure lifetime is 15 years.

Pipe Insulation
Pipe insulation savings are based on measured data and 2001 DEER Update Study. Pipe wrap is applied on the first 5 feet of pipe or up to the first bend will reduce distribution losses caused by thermal siphoning. Distribution losses represent approximately 16 percent of the annual electric UEC and 13 percent of the annual gas UEC. Pipe wrap reduces distribution losses by about 21 percent. Estimated annual energy savings are based on empirical studies of energy savings from pipe wrap. Average water heating savings are 2.7%. Measure lifetime is 15 years.

Water Saving Showerhead (2.5 gpm)
Water saving showerhead use 2.5 gpm or less at a flowing pressure of 80 psi. Non-conserving showerheads use 3.5 gpm or greater at a flowing pressure of 80 psi (pounds per square inch). Savings are based on engineering estimates and M&V studies and pre- and post-retrofit flow rates. Average water heating savings are 5.5%. Measure lifetime is 10 years.

CFL Measures (i.e., Kitchen, Outdoor, Torchiere, CFL)
Savings from CFL lighting measures are based on four variables:

1. Number of lamps/fixtures (N);
2. Hours of Operation (H);
3. Wattage consumed by pre-existing lamp/fixture (W_{pre}); and
4. Wattage consumed by replacement lamp/fixture (W_{post}).

[12] *Measure Incentives and Cost Effectiveness for the California Residential Contractor Program*, prepared for SDG&E, SCE, PG&E, and SCG, prepared by Robert Mowris & Associates, 1999, 2000, and 2001 and *Deemed Savings Estimates for the Summer Initiative Program*, prepared for SDG&E, SCE, PG&E, and SCG, prepared by Regional Economic Research and Robert Mowris & Associates, 2001.

Deemed savings can be calculated using **Equation 1**.

Eq. 1. Deemed Energy Savings = Number of Lamps × Hours of Operation × (W_{pre} - W_{post})

Annual operation hours for lighting measures are summarized below in **Table 2.9**. Measure lifetime is 8 years for screw-in CFLs and 16 years for hardwired fixtures.

Table 2.9 Lighting Operating Hours by Space Type

Space Type	Operation Hours
Kitchen or Indoor Area	1,095
Exterior Area	4,380

Energy Star® Clotheswasher

Energy Star® clotheswasher saves 47% ± 11% on electricity and water heating. Measure lifetime is 10 years.

Energy Star® Dishwasher

Energy Star® dishwasher saves 27% ± 2.3% on electricity compared to units meeting the minimum standard National Appliance Energy Conservation Act (NAECA). The percentage savings is based on a sample of 297 Energy Star units compared to similar type and size standard units meeting NAECA. Measure lifetime is 5 years.

Energy Star® Refrigerator

Energy Star® refrigerator saves 11% ± 0.1% or 68 kWh/yr and 0.009 kW on electricity compared to units meeting the minimum standard National Appliance Energy Conservation Act (NAECA). The percentage savings is based on a sample of 354 Energy Star units compared to similar type and size standard units meeting NAECA. Incremental cost is $75 for upgrading to an Energy Star refrigerator. Measure lifetime is 15 years.

Water Saving Faucet Aerator (2.2 gpm)

Water saving faucet aerators use 2.2 gpm or less at a flowing pressure of 80 psi. Non-conserving faucet aerators use 3.5 gpm or greater at a flowing pressure of 80 psi. Water saving aerators are assumed to reduce water flow by roughly 37 percent based on empirical studies.[13] Percentage water heating savings are 2.2%. Measure lifetime is 10 years.

Reduce Infiltration/Drafts

This measure includes weatherstripping and caulking to reduce infiltration and drafts around doors, windows, plumbing and electrical penetrations in ceilings, walls, and floors. Percentage space cooling savings are 6% and heating savings are 5% based on the DEER 2001 Update Study. Assumed measure cost is $312 based on the 2001 DEER Update Study (assuming weatherstripping 2 doors and caulking approximately 1,000 feet). Measure lifetime is 15 years.

[13] The following studies are referenced for water heater measures. *Residential Water Heating—Energy Conservation Alternatives*, M. Perlman, Ontario Hydro, 1991. *Domestic Water Heating—Summary Research Findings for Conventional Systems*, J. R. Biemer, C. D. Auburg, C. W. Ek, , pp. J-3 to J-10, Conservation in Buildings: A Northwest Perspective, 19-22 May, 1985.

2.3 Measurement and Verification Approach

The measurement and verification approach for the study is based on *International Performance Measurement & Verification Protocols* (IPMVP) Option A (verified or partially measured retrofit isolation). The four IPMVP Options are defined in the **Table 2.10**.[14]

Table 2.10 IPMVP M&V Options

M&V Option	How Savings Are Calculated	Typical Applications
Option A. Partially Measured Retrofit Isolation Savings are determined by partial field measurement of energy use of system(s) to which a measure was applied, separate from facility energy use. Measurements may be either short-term or continuous. Partial measurement means that some but not all parameters may be stipulated, if total impact of possible stipulation errors is not significant to resultant savings. Careful review of measure design and installation will ensure that stipulated values fairly represent the probable actual value.	Engineering calculations using short term or continuous post-retrofit measurements or stipulations.	Duct sealing where pre- and post-retrofit duct leakage are measured or CFLs where pre- and post-retrofit Watts are measured and operating hours are based on interviews with occupants or stipulated values. Other examples AC diagnostic tune-ups, low-flow showerheads, aerators, programmable t-stats, infiltration measures, and water heater pipe and tank insulation.
Option B. Retrofit Isolation Savings are determined by field measurement of the energy use of the systems to which the measure was applied, separate from the energy use of the rest of the facility. Short-term or continuous measurements are taken throughout the post-retrofit period.	Engineering calculations using short term or continuous measurements	Variable speed controls used on a constant speed pump. . Electricity use is measured with a kWh meter on pump motor. Metering is performed to verify pre-retrofit constant speed operation and post-retrofit variable speed operation.
Option C. Whole Facility Savings are determined by measuring energy use (and production) at the whole facility level. Short-term or continuous measurements are taken throughout the post-retrofit period. Continuous measurements are based on whole-facility billing data.	Analysis of whole facility utility meter or sub-meter data using techniques from simple comparison to regression analysis or conditional demand analysis.	Energy management program affecting many systems in a building. Utility meters measure energy use for 12-month base year and throughout post-retrofit period.
Option D. Calibrated Simulation Savings are determined through simulation of the energy use of components or the whole facility. Simulation routines must be demonstrated to adequately model actual energy performance measured in the facility. This option usually requires considerable skill in calibrated simulation.	Energy use simulation, calibrated with hourly or monthly utility billing data and/or end-use metering.	Project affecting many systems in a building but where base year data are unavailable. Utility meters measure post-retrofit energy use. Base year energy use is determined by simulation using a model calibrated with post-retrofit utility data.

The measurement and verification approach for the load impact evaluation involved assessing ex ante savings estimates for each measure and determining if more appropriate ex post savings estimates are necessary based on the PG&E RASS and other studies. IPMVP Option D was relied upon to evaluate baseline values from the PG&E RASS study (i.e., analysis of whole facility billing data for thousands of residential customer sites using conditional demand analysis). IPMVP Options A, B, C, and D were relied upon from other studies to evaluate percentage savings for each measure and percentages were multiplied by baseline UEC values from the RASS study to evaluate unit savings per measure. GeoPraxis provided a database of participants. Survey results from participating customers were used to develop an estimate of the adoption of recommended measures (including TOS free measures). Gross savings were

[14] See *International Performance Measurement & Verification Protocols*, DOE/GO-102000-1132, October 2000.

calculated as the adoption ratio times ex post unit savings for the program (i.e., kW, kWh/yr, therm/yr). Net savings were calculated as gross savings times the CPUC-accepted 0.72 net-to-gross ratio. The study verified and allocated savings for customers participating in both the TOS Program and one or more other CPUC-funded programs (e.g., rebates, financing, etc.) to assist PG&E in fulfilling its responsibility to ensure no "double dipping" for the same measure from two or more programs. Based on these analyses estimates of energy and peak demand load impacts were developed for the program. This step included an assessment of the relative precision of program-level savings, mean savings estimates, standard deviations, and confidence intervals. This analysis included an assessment of all assumptions used to calculate deemed savings.

The measurement and verification approach for the process evaluation involved conducting surveys with participants and non-participants. Process survey results were used to guide the overall process evaluation in terms of investigating operational characteristics of the program and developing specific recommendations to help make the program more cost effective, efficient, and operationally effective. Survey results were also used to identify what works, what doesn't work, and the level of need for the program. Survey results of participating and non-participating home inspectors were used to evaluate the training efforts. Analysis of interviews included an assessment of market barriers to energy efficiency, participant satisfaction, and suggestions to improve the program.

2.4 Evaluation Approach

The evaluation approach included:

- A list of questions to be answered by the study;
- A list of evaluation tasks to be undertaken by the study; and
- A description of how the study was used to meet all of the Commission objectives described in the CPUC EEPM (page 31).

2.4.1 List of Questions to be Answered by the Study

The following questions were answered by the study.

1. **Are the ex ante measure assumptions appropriate and relevant with respect to actual measures being installed in the program?**
   The study answered this question by evaluating the ex ante baseline and measure assumptions and by conducting telephone surveys regarding adoption of relevant measures.

2. **Are the ex ante energy and peak demand savings estimates per measure appropriate and relevant?**
   The study answered this question by evaluating the ex ante energy and peak demand savings estimates for each measure and determining if more appropriate ex post savings estimates were appropriate and relevant. This was accomplished by reviewing several studies including the PG&E Workpapers for the Single Family Energy Efficiency Rebate Program, 2001 DEER Update Study, and other studies (**Table 2.2**, above).

3. **Are the total program savings estimates accurate?**

The study answered this question by developing ex post energy and peak demand savings for the program based on adoption ratios from the survey responses multiplied by baseline UEC values from the PG&E RASS Study times deemed percentage savings for each measure based on other studies.

4. **Are customers satisfied with the program implementation and are customers satisfied with the measures that were offered and installed in the program?**
   The study answered this question by summarizing customer satisfaction questions from the participant telephone surveys.

5. **Is there a continuing need for the program?**
   The study assessed the continuing need for the program by analyzing cost effectiveness and savings goals depending on how many EnergyCheckup™ inspections might have been completed. For example, if the program had reverted to providing inspector incentives and completed 5,860 EnergyCheckup™ inspections (with the same adoption ratio), then the ex ante savings goals would have been realized and the ex post TRC test would have been 2.58. Future funding should be contingent upon reinstating an inspector incentive, including a real estate agent training and outreach element, and reaching clearly identifiable EnergyCheckup goals. This study verified that each time-of-sale home inspection audit is worth approximately $208 per home in net present avoided costs given the average realized net savings per home for each EnergyCheckup™ inspection report of 395 kWh/yr, 0.2 kW, 38.5 therm/yr and lifecycle savings of 5,205 and 622 therms.

   The following analysis of inspector costs demonstrates how the program could provide cost-effective energy and demand impacts by returning to the use of inspector incentives. According to the participating inspectors surveyed, each EnergyCheckup™ inspection takes approximately 0.66 hours to complete[15]. At an average rate of $65/hour for their labor, the cost to the inspector was roughly $63 ($43 in time plus the GeoPraxis fee of $19.95) per inspection. If GeoPraxis had provided a rebate of $40 per inspection without a fee, then they should have been able to achieve their goal of completing 12,000 EnergyCheckup™ inspections. Based on the findings of this and other independent studies[16] that have verified savings from EnergyCheckup inspections, the utilities and/or the CPUC should consider a time-of-sale energy efficiency inspection program with requirements for inspection services companies to follow in training and certifying[17] inspectors and $35 - $70 in direct incentives to inspectors and real estate agents. Under an optimal program design, administrative, marketing, and EM&V expenses would be limited to no more than $30 per inspection, while $70 per inspection would be reserved for direct implementation costs (including a $40 incentive paid to inspectors, plus $25 allocated to providing free energy efficiency measures to real estate agents to distribute as “thank you” gifts at the close of escrow, and $5 dedicated

[15] GeoPraxis reports that when the program was operated at high volume in Southern California, inspectors became very experienced with the audit process and were thus able to reduce inspection time even more.
[16] Quantum Consulting 2002. *National Energy Efficiency Best Practices Study, Volume R7 – Residential Audit Programs Best Practices Draft Report*. Ridge and Associates, 2002. *Evaluation of Southern California Edison’s (2001) Residential Audit Programs: Final Report*. Quantum Consulting 2002. *National Energy Efficiency Best Practices Study, Volume R7 – Residential Audit Programs Best Practices Report*.
[17] Until CEC HERS 2 standards have been completed, Time-of-sale inspection service providers should be required to meet RESNET or other suitable standards.

to inspector training and technical support. With benefits of $208 and total costs of $95 per inspection, the resulting TRC would be approximately 2.11.

The program strategy merits future consideration statewide since it could provide cost effective electricity and natural gas savings to thousands of home buyers at a relatively low cost with support from EnergyWise real estate agents and a coordinated marketing campaign through Flex Your Power, utilities, and local governments. Annual sales of existing homes in California are approximately 616,200. The Time-of-Sale Home Inspection program has the potential to cost effectively reach these home buyers just prior to their major appliance and home improvement purchase decisions whereas other more traditional residential energy audit programs generally do not.

2.4.2 List of Tasks Undertaken by the Study

Eight tasks were undertaken by the study. The eight tasks are briefly summarized as follows.

Task 1. Project Initiation Meeting

The project initiation meeting refined the research objectives and methods, clarified pertinent issues, discussed data requirements, and discussed the detailed work plan and schedule of project tasks.

Task 2. EM&V Plan

The EM&V plan contained a detailed description of all activities required to complete the study.

Task 3. Data Collection Procedure

The data collection procedure reviewed available load impact studies and the GeoPraxis program tracking data to determine what aspects of the evaluation needed new data collection.

Task 4. Sample Design

A statistical sample design was used to select a sample of customers from the participant population. Samples were selected to obtain a reasonable level of precision and accuracy at the 90 percent level per CPUC Energy Efficiency Policy Manual (EEPM).

Task 5. Data Collection

The first step was to develop survey instruments for the program including data to be collected and the technical approach for analyzing data (i.e., statistical analyses, engineering algorithms, etc.). **The second step was to collect data for the impact evaluation** including an assessment of how many participating customers adopted free and recommended measures. **The third step was to collect data for the process evaluation** by conducting telephone surveys with participating customers to identify what works, what doesn't work, and the level of need for the program as well as renew home occupant interest in the original recommendations.

Task 6. Data Analyses

Data analysis for the impact evaluation was performed using revised ex post unit savings and the estimated adoption ratios based on results from the surveys. Gross kW, kWh and therm savings were developed based on these analyses. The CPUC Policy Manual (V.2) approved net-to-gross factor of 0.72 was applied to determine net impacts.

Data analysis for the process evaluation was based on results of the surveys to identify what works, what doesn't work, and the level of need for the program. Analysis of interviews included an assessment of market barriers to energy efficiency, participant satisfaction, and suggestions to improve the program.

Task 7. Progress, Draft, and Final Reports

The progress, draft, and final reports included a description of the study methodology and all deliverables as per the CPUC EEPM. The reports provided results of the impact evaluation including gross and net energy and peak demand savings for each measure and the program as well as results of the process evaluation including the market assessment and customer satisfaction surveys.

Task 8. Project Management

Project management included management of all personnel required to complete the study, consistent and timely communication, issue resolution, and periodic reporting.

2.4.3 How Study Met CPUC EEPM Objectives

The study met the following Commission objectives described in the CPUC EEPM (pg. 31).

- **Measure the level of energy and peak demand savings achieved.**
  The study met this objective by evaluating the ex ante savings estimates for each measure to determine whether more appropriate ex post savings estimates were necessary. The number of free measures was obtained from GeoPraxis and survey results from participating customers were used to develop an estimate of the adoption of recommended measures and practices. We also measured and allocated savings for customers that may have participated in both the TOS Program and one or more other CPUC-funded programs (e.g., rebates, financing, etc.) to assist PG&E in fulfilling its responsibility to ensure that no "double dipping" for the same measure from two or more programs occurred. Based on these analyses we measured the energy and peak demand savings achieved by the program. This step included an assessment of the relative precision of program-level savings, mean savings estimates, standard deviation, and confidence interval. This analysis included an assessment of all assumptions used to calculate deemed savings.

- **Measure cost-effectiveness.**
  The study met this objective by developing ex post energy and peak demand savings for each measure. Ex post measure savings (i.e., adoption ratio times deemed savings for the program) were used to develop ex post Total Resource Cost (TRC) test values for the program using the CPUC cost effectiveness worksheets. The program ex ante cost effectiveness was 1.27 for the total resource cost (TRC) test and 2.37 for the participant test. The ex-post cost effectiveness is 0.088 for the TRC test and 0.65 for the participant test. While the ex post cost effectiveness is extremely low, the program still has merit as demonstrated by a verified measure adoption ratio of 0.46 and the fact that some inspectors are continuing to pay for EnergyCheckup inspection reports (65 completed since program funding ended March 31, 2004).

- **Provide up-front market assessments and baseline analysis.**
  The study met this objective by performing a market assessment and baseline analysis including an evaluation of the baseline unit energy consumption values for all recommended audit measures. Survey interviews included questions about market barriers to energy

efficiency and the success of the program in meeting the needs of hard-to-reach customers.[18] The annual target market is approximately 616,200 residential homebuyers in California (2003 data).[19] The first year after purchasing a new home is when most homebuyers make improvements. Customized energy efficiency audit information provided during the time of sale home inspection process is important to influence homebuyers to invest in energy efficiency improvements.

- **Provide ongoing feedback and corrective or constructive guidance regarding the implementation of programs.**
  The study met this objective by performing surveys of participants and process evaluations of program activities to verify program efforts were being implemented as per the program implementation plan. Results of surveys and process evaluations were used to provide ongoing feedback and corrective or constructive guidance regarding implementation of the program (see **Appendix B**). This included recommending home inspector incentives to increase the number of EnergyCheckup inspections and recommendations to improve the home inspection training efforts and other program procedures.

- **Measure indicators of the effectiveness of the programs, including testing of the assumptions that underlie the program theory and approach.**
  GeoPraxis provided the following program theory in their implementation plan.

  "The GeoPraxis program theory was to transform the diverse existing home real estate market into one in which consumers demand and the real estate services industry discloses substantially more information on the energy-efficiency characteristics of homes that are sold. The program trained and equipped home inspectors to integrate a streamlined energy audit into the traditional Time-of-Sale home inspection. The program provided Northern California ratepayers with timely access to key information to help them improve the energy efficiency, comfort, and resale value of their homes. This program offered an integrated approach to achieving cost-effective energy savings. The program's primary goal was to achieve peak electricity demand reductions and/or energy savings through the increased adoption of the cost-effective energy efficiency measures recommended in an EnergyCheckup™ Report. Additionally, the program was designed to impact the market so that an increasing number of home inspectors were trained and have the technical capabilities to supply Time-of-Sale energy audit services. In addition to recommending comprehensive whole-house energy efficiency improvements and generating leads to the many rebate programs available, the TOS program also provided a free "kit" of energy efficiency measures to participating homeowners including: efficient showerheads; efficient faucet aerators (2 per house); and compact fluorescent lamps (CFLs) (2 per house). The GeoPraxis local program goal was to serve approximately 12,000 single family, multifamily, and mobile home customers in the Pacific Gas and Electric (PG&E) service area."

  Key performance indicators of program performance are as follows: 1) Number marketing pieces distributed; 2) Number of workshops and home inspectors trained to perform

[18] The CPUC definition of residential hard-to-reach customers are those who do not have easy access to program information or generally do not participate in energy efficiency programs due to language (i.e., primary language non-English), income (less than 400% of federal poverty guidelines), housing type (i.e., mobile home or multi-family), geographic (i.e., outside San Francisco Bay Area, Sacramento, Los Angeles Basin or San Diego), or homeownership (i.e., renter split incentives barrier).
[19] California Home Sale Activity by City for Home Sales Recorded in the Year 2003. Available online at www.dqnews.com.

EnergyCheckup inspections; 3) Number of EnergyCheckup home inspections performed; 4) Number of real estate agent workshops and agents trained and made aware of energy efficiency and EnergyCheckup; 5) Number of free energy efficiency measures given to participating homeowners; 6) program cost effectiveness; and 7) inspector, real estate agent, and customer satisfaction with the program. The EM&V study evaluated whether the program performed in accordance with the program theory by 1) verifying the number of marketing pieces distributed and workshops held to train inspectors and real estate agents; 2) performing engineering analysis of deemed measure savings; 3) conducting telephone process evaluation surveys with participant and non-participant inspectors and homeowners; and 4) evaluating program delivery strategies. EM&V study findings indicate the program generally achieved its marketing and training objectives by analyzing results of approximately 70 telephone process surveys. The program only delivered 205 EnergyCheckup inspections and 18 free "kits" with energy efficiency measures falling far short of the 12,000 EnergyCheckup goal and the 8,500 free "kit" goal. The lifecycle ex-post net lifecycle kWh realization rate was 0.0373 ± 0.0036 for kWh and the net lifecycle therm realization rate was 0.0585 ± 0.0057 therms. The EM&V ex-post total resource cost (TRC) test was 0.088 and the participant test was 0.65. Program energy savings accomplishments are 95 percent less than the ex ante goals. This is due to: 1) lack of homebuyer and realtor awareness about the benefits of EnergyCheckup™ inspections at time of sale; and 2) inability of participating home inspectors to sell EnergyCheckup™ inspections to home buyers at time of sale. The 2002-2003 program was originally designed to market EnergyCheckup™ audits directly though certified energy inspectors. According to GeoPraxis many inspectors were enthusiastic about the service and made efforts to promote EnergyCheckup™ audits directly to homebuyers and real estate agents in their local areas. GeoPraxis also made an effort coordinate with statewide marketing and outreach programs, utility rebate and information programs, and other local non-utility programs. Unfortunately, these marketing efforts did not generate significant homebuyer or real estate agent awareness about the program. Without significant awareness, most inspectors were ineffective in their efforts to sell EnergyCheckup™ inspections to home buyers.[20] Process evaluation findings indicate the program provided valuable energy efficiency services and training to homeowners and inspectors. Inspector participants generally rated the GeoPraxis staff as courteous and professional and found the training easy to understand. Overall service was rated highly and nearly all (90%) of the participating inspectors said they will continue to offer and advertise the EnergyCheckup™ service to their customers. Homeowner participants found the EnergyCheckup™ recommendations informative and applicable to their residence. Homeowners adopted 46% of the measures recommended in the EnergyCheckup™ reports and generally felt it was a great program. This was verified through the telephone surveys.

- **Assess the overall levels of performance and success of the program.**
  The study provided ex post energy and peak demand savings at the 90 percent confidence level as per the CADMAC Protocols. The study determined participant satisfaction and ways to improve the program. Non-participating homebuyers and non-participating home

[20] Consumer purchase behavior decision making models (e.g., Fishbein and Ajzen's "Theory of Reasoned Action", 1980, et al.) stress the critical importance of making consumers pre-aware and favorably pre-disposed toward a new product or service before they can develop an intention to purchase, and ultimately follow though on that intention with action.

inspectors were interviewed to evaluate why they chose not to participate. The number of non-participant surveys included 10 homeowners and 10 inspectors.

- **Help to assess whether there is a continuing need for the program.**
  The study met this objective by assessing cost effectiveness and measure adoption rates (see answer to Question 5 of Section 2.4.1 (above). Ex post measure savings (i.e., adoption ratio times deemed savings for the program) were used to develop ex post Total Resource Cost (TRC) test values for the program using the CPUC cost effectiveness worksheets. Surveys were conducted with participants. Interviews assessed how the program influenced awareness of linkages between efficiency improvements and bill savings and increased comfort for customers. The study also identified what works, what doesn't work, and the level of need for the program.

2.4.4 Sampling Plan

The statistical sample design involved selecting a random sample of participants from the program population. Samples were selected to obtain a reasonable level of precision and accuracy at the 90 percent confidence level per CPUC Energy Efficiency Policy Manual (EEPM). The proposed sample design was based on statistical survey sampling methods to select a sample of participants to meet or exceed the CADMAC Protocols.[21] Sampling methods were used to analyze the data and extrapolate mean savings estimates from the sample measurements to the population of all program participants and to evaluate the statistical precision of the results.[22] Selecting participants for the sample were guided by the statistical sampling plan.

The adoption ratio for a given customer j were calculated using **Equation 1**.

Eq. 1 $$p_j = \text{Adoption Ratio} = \frac{\sum_{i=1}^{a} \text{Measures}_i}{\sum_{i=1}^{m} \text{Measures}_i}$$

Where,

a = Number of measures i adopted for customer j,

m = Number of measures i recommended for customer j, and

p_j = Adoption ratio for customer j.

The gross savings for a given customer site were calculated using **Equation 2**.

[21] See Table 5c, Protocols for the General Approach to Load Impact Measurement, page 14, Evaluation design decisions related to sample design will be determined by the following protocols: if the number of program participants is greater than 200 for residential programs, a sample must be randomly drawn and be sufficiently large to achieve a minimum precision of plus/minus 10% at the 90% confidence level, based on total annual energy use. A minimum of 200 for residential programs must be included in the analysis dataset for each applicable end-use. *Protocols and Procedures for Verification of Costs, Benefits, and Shareholder Earnings from Demand-Side Management Programs,* as adopted by the California Public Utilities Commission Decision 93-05-063, Revised March 1998.

[22] Cochran, William G. *Sampling Techniques*. New York: John Wiley & Sons, 1977, Kish, Leslie. *Survey Sampling*. New York: John Wiley & Sons, 1965. Thompson, Steven K. *Sampling*. New York: John Wiley & Sons, 1992.

Eq. 2 y_j = Savings for customer j $= p_j \times \sum_{i=1}^{m} \text{Savings}_i$

Where,

Savings_i = Savings for "m" measures recommended to customer j.

Mean gross savings for the sample were calculated using **Equation 3**.

Eq. 3 $\bar{y}$ = Mean Savings $= \frac{1}{n} \sum_{j=1}^{n} y_j$

Where,

$\bar{y}$ = Mean savings (i.e., kW, kWh/yr, therm/yr).

The standard error, s_i, of the measure sample mean was calculated using **Equation 4**.[23]

Eq. 4 s_i = Standard Error of the Proportion $= \sqrt{\frac{\hat{p}_i(1-\hat{p}_i)}{n_i}}$

The gross confidence interval for the mean savings were calculated using **Equation 5**.

Eq. 5 Confidence Interval $= \bar{y} \pm t \times s_i$

Where,

t = The value of the normal deviate corresponding to the desired confidence probability of 1.64 at the 90 percent confidence level per CADMAC Protocols.

The coefficient of variation provides a relative measure of the sample size required to satisfy the CADMAC 90/10 confidence level criteria for estimating mean savings of the population, $\bar{y}$. If the coefficient of variation is small, then the required sample is small. If the coefficient of variation is large then the sample size will need to be larger. The coefficient of variation was calculated using **Equation 6**.

Eq. 6 Coefficient of Variation = $C_v = \frac{s_i}{\bar{y}}$

The sample size necessary to obtain a desired level of relative precision for the program mean savings estimate was calculated using **Equation 7**.

Eq. 7 Program Size = $n = \frac{t^2 C_v^2}{r^2}$

Where,

[23] The standard error for all measures was calculated based on the proportion of measures adopted from the on-site surveys as per sampling procedures from *The California Evaluation Framework*, prepared for the CPUC and Project Advisory Committee, prepared by TecMarket Works Framework Team, Chapter 13: Sampling, February 2004.

n = Required sample size without finite population correction, and
r = Desired relative precision, 10% per CADMAC Protocols.

Gross savings for the program were calculated using **Equation 8**.

Eq. 8 $\hat{Y}$ = Program Savings $= N \times \bar{y}$

Where,

N = Number of total participants in the program.

The gross confidence interval for the program was calculated using **Equation 9**.

Eq. 9 Program Confidence Interval $= \pm(N \times t \times s)$

Net program savings and confidence intervals were calculated as gross savings times the net to gross ratio (NTGR). The default NTGR is 0.72 from the CPUC EEPM for residential audit programs. Ex post accomplishments were verified by randomly calling 205 participants and completing 40 telephone surveys or 20 percent of the total participant population in the program. At the 90% confidence level, the achieved statistical precision of the homeowner survey was ± 11.7%.[24] Ex post savings are based on analyses of adopted measures for the sample extrapolated to the participant population.

[24] The inherent difficulty of obtaining valid telephone numbers for homeowners who have recently moved prevented the surveying of an even greater fraction of the program participants.

3. EM&V Findings

This section provides load impact results for the program and for each measure. This section also provides the process evaluation results based on participant and non-participant surveys and recommendations regarding what works, what doesn't work, and the continuing need of the program. Also provided are recommendations for each measure to increase savings, achieve greater persistence of savings, and improve customer satisfaction.

3.1 Load Impact Results

The ex ante program goals and ex post accomplishments are shown in **Table 3.1**. The ex ante program implementation goals were to serve 12,000 single family, multifamily, and mobile home customers in the Pacific Gas and Electric (PG&E) service area. The program performed 205 EnergyCheckup™ audits and directly provided a free "kit" of energy efficiency measures to 18 participating homeowners. The program provided 137,905 marketing pieces (50% more than planned) and trained 128 inspectors and 71 real estate agents on the benefits of EnergyCheckup inspections at time of sale.

Table 3.1 Ex Ante Goals and Ex Post Accomplishments for the Program

Description	Proposed Ex Ante Goal	Accomplishment Based on Ex Ante	Ex Post Accomplishment
EnergyCheckup™ Audits/Reports	12,000	205	205
Print/Distribute Direct Mail Pieces	57,143	70,905	70,905
Print/Distribute English Brochures	32,214	60,000	60,000
Print/Distribute Spanish Brochures	3,500	7,000	7,000
Attend Home Inspection Conferences	3	5	5
Inspector Training Workshops	16	16	16
Total Inspectors Trained	no goal	128	128
Total Participating Inspectors	no goal	38	38
Total Certified Inspectors	no goal	23	23
Total Real estate agents Trained	48	71	71
Free CFLs	17,000	36	36
Free Faucet Aerators (electric DHW)	1,692	2	2
Free Faucet Aerators (gas DHW)	13,617	25	25
Free Showerheads (electric DHW)	3,383	1	1
Free Showerheads (gas DHW)	6,809	18	18
Free Bath Bar Caps (removed from program)	1,000	0	0
Net Annual Savings (kWh/yr)	2,092,351	89,179	80,889
Net Demand Savings (kW)	1,246	45	40
Net Annual Savings (therms/yr)	264,933	8,721	7,885
Net Lifecycle Savings (kWh)	29,931,567	1,074,749	1,066,988
Net Lifecycle Savings (therms)	2,520,139	136,421	127,446
Total Resource Cost (TRC) Test	**1.27**	**0.093**	**0.088**
TRC Test Benefits	$2,215,019	$94,343	$89,147
TRC Test Costs	$1,741,950	$1,013,543	$1,013,543
TRC Test Net Benefits	$473,069	-$919,201	-$924,396
Participant Test	**2.37**	**0.686**	**0.65**
Participant Test Benefits	$3,177,143	$131,223	$124,007
Participant Test Costs	$1,342,702	$191,393	$191,393
Participant Test Net Benefits	$1,834,440	-$60,171	-$67,386

Program energy savings accomplishments are 95 percent less than the ex ante goals. This is due to: 1) lack of homebuyer and realtor awareness about the benefits of EnergyCheckup™

inspections at time of sale; and 2) inability of participating home inspectors to sell EnergyCheckup™ inspections to home buyers at time of sale. The program was originally designed to market EnergyCheckup™ audits directly though certified energy inspectors. According to GeoPraxis many inspectors were enthusiastic about the service and made efforts to promote EnergyCheckup™ audits directly to homebuyers and real estate agents in their local areas. GeoPraxis also made an effort coordinate with statewide marketing and outreach programs, information programs, and other local programs. Unfortunately, these marketing efforts did not generate significant homebuyer or real estate agent awareness about the program. Without significant awareness, most inspectors were ineffective in their efforts to sell EnergyCheckup™ inspections to home buyers.[25]

The program ex ante cost effectiveness was 1.27 for the total resource cost (TRC) test and 2.37 for the participant test. The ex-post cost effectiveness is 0.088 for the TRC test and 0.65 for the participant test. While the ex post cost effectiveness is extremely low, the program still has merit as demonstrated by a verified measure adoption ratio of 0.46 and the fact that some inspectors are continuing to pay for EnergyCheckup inspection reports. Ex post accomplishments were verified by randomly calling participating and non-participating homebuyers and inspectors.

Proposed first year net ex ante load impact goals are summarized in **Table 3.2**. The first year net ex ante load impact goals are 1,984,209 kWh per year and 156,460 therms per year.

Table 3.2 Proposed First Year Net Ex Ante Load Impacts for the Program

#	Description	Total Energy Checkup Recommendation	Ex Ante Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Ante kWh/y	Net Ex Ante kW	Net Ex Ante therm/y
1	Basic HVAC Tune-up (AC Diag.)	1,591	0.31	493.1	0.72	152,963	0.00	0
2	Adv. HVAC Tune-up (Ducts+AC)	610	0.31	189.2	0.72	77,243	42.23	5,217
3	Duct Test & Seal	1,419	0.31	439.9	0.72	98,557	98.19	12,130
4	Energy Star Furnace	760	0.31	235.7	0.72	2,568	0.00	12,622
5	Energy Star Heat Pump	0	0.31	0	0.72	0	0.00	
6	Energy Star Air Conditioner	546	0.31	169.3	0.72	151,272	153.6	5,210
7	Programmable T-Stat	1,550	0.31	480.4	0.72	35,985	79.56	5,347
8	Wall insulation	194	0.31	60.0	0.72	2,684	2.75	548
9	Insulation Package (Attic+Walls)	1	0.31	0.3	0.72	23		17
10	Low-e Windows	852	0.31	264.2	0.72	12,285	11.43	2,449
11	Efficient Gas Water Heater	1,705	0.31	528.6	0.72	0	0.00	25,330
12	Pipe Insulation Gas	2,702	0.31	837.6	0.72	689	0.00	3,567
13	Low-Flow Showerhead	4,229	0.31	1311.0	0.72	4,013	0.00	13,879
14	Kitchen Lighting-CFL	1,301	0.31	403.3	0.72	49,145	30.68	0
15	Outdoor Lighting-CFL	640	0.31	198.4	0.72	36,289	10.77	0
16	Energy Star Torchiere	0	0.31	0.0	0.72	0	0.00	0
17	Fluorescent Lights	3,444	0.31	1067.8	0.72	295,484	81.24	0
18	Energy Star Clotheswasher	32	0.31	10.0	0.72	83	0.00	194
19	Energy Star Dishwasher	32	0.31	10.0	0.72	352	0.00	63
20	Attic insulation	953	0.31	295.5	0.72	15,521	19.15	15,939
21	Lo-Flow Showerhead-electric	4,400	0.31	1364.0	0.72	175,792		
22	CFL	54,342	0.31	16846.0	0.72	730,476	667.1	0
23	Socket Caps (not in program)	0	0.31			0	0.00	0
24	Faucet Aerators-electric	9,139	0.31	2833.0	0.72	142,783		
25	Low-Flow Showerhead-gas	13,203	0.31	4093.0	0.72			29,470
26	Faucet Aerators-gas	27,416	0.31	8499.0	0.72			24,477
27	Energy Star Refrigerator		0.31		0.72			
28	Reduce Infiltration/Drafts		0.31		0.72			

[25] Ibid.

Table 3.2 Proposed First Year Net Ex Ante Load Impacts for the Program

#	Description	Total Energy Checkup Recommendation	Ex Ante Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Ante kWh/y	Net Ex Ante kW	Net Ex Ante therm/y
29	Screw-in CFLs		0.31		0.72			
		131,063		**40,629**		**1,984,209**	**1,197**	**156,460**

Proposed lifecycle net ex ante load impact goals for the program shown in **Table 3.3**. The lifecycle net ex ante load impact goals are 28,620,865 kWh and 2,177,224 therms.

Table 3.3 Proposed Lifecycle Net Ex Ante Load Impacts for the Program

#	Description	EUL	Lifecycle Net Ex Ante kWh	Lifecycle Net Ex Ante therm
1	Basic HVAC Tune-up (AC Diag.)	10	1,529,631	0
2	Adv. HVAC Tune-up (Ducts+AC)	10	772,433	52,171
3	Duct Test & Seal	20	1,971,142	242,597
4	Energy Star Furnace	20	51,366	252,440
5	Energy Star Heat Pump	15	0	
6	Energy Star Air Conditioner	15	2,269,077	78,155
7	Programmable T-Stat	11	395,833	58,816
8	Wall insulation	20	53,686	10,961
9	Insulation Package (Attic+Walls)	20	455	346
10	Low-e Windows	20	245,706	48,988
11	Efficient Gas Water Heater	15	0	379,956
12	Pipe Insulation Gas	15	10,339	53,504
13	Low-Flow Showerhead	10	40,130	138,788
14	Kitchen Lighting-CFL	16	786,315	0
15	Outdoor Lighting-CFL	16	580,618	0
16	Energy Star Torchiere	16	0	0
17	Fluorescent Lights	16	4,727,737	0
18	Energy Star Clotheswasher	10	833	1,944
19	Energy Star Dishwasher	5	1,762	317
20	Attic insulation	20	310,427	318,774
21	Free Lo-Flow Showerhead-electric	10	1,757,923	
22	Free CFL	16	11,687,620	0
23	Free Socket Caps (not in program)	16	0	0
24	Free Faucet Aerators-electric	10	1,427,832	
25	Free Low-Flow Showerhead-gas	10		294,696
26	Free Faucet Aerators-gas	10		244,771
27	Energy Star Refrigerator			
28	Reduce Infiltration/Drafts			
29	Screw-in CFLs			
	Total		**28,620,865**	**2,177,224**

The first year net ex post load impacts for the program are shown in **Table 3.4**. The first year net ex post program savings are 80,889 ± 7,903 kWh/yr, 40 ± 4 kW, and 7,885 ± 770 therm/yr.

Table 3.4 First Year Net Ex Post Load Impacts for the Program

#	Description	Total Energy Checkup Recommendation	Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Post kWh/y	Net Ex Post kW	Net Ex Post therm/y
1	Basic HVAC Tune-up (AC Diag.)	3	0.46	1.4	0.72	144	0.17	
2	Adv. HVAC Tune-up (Ducts+AC)	135	0.44	59.3	0.72	9,948	11.66	1,153
3	Duct Test & Seal	19	0.00	0.0	0.72	0	0.00	0
4	Energy Star Furnace	65	0.44	28.9	0.72			686
5	Energy Star Heat Pump	0		0	0.72	0	0.00	
6	Energy Star Air Conditioner	1	0.46	0.5	0.72	61	0.07	
7	Programmable T-Stat	80	0.53	42.7	0.72	2,734	3.19	676
8	Wall insulation	34	0.20	6.8	0.72	323	0.38	240
9	Insulation Package (Attic+Walls)	48	0.60	28.8	0.72	6,553	7.67	2,239
10	Low-e Windows	95	0.11	10.6	0.72	2,523	2.96	281

Table 3.4 First Year Net Ex Post Load Impacts for the Program

#	Description	Total Energy Checkup Recommendation	Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Post kWh/y	Net Ex Post kW	Net Ex Post therm/y
11	Efficient Gas Water Heater	63	0.19	11.8	0.72			204
12	Pipe Insulation Gas	145	0.64	92.3	0.72			332
13	Low-Flow Showerhead	167	0.17	27.8	0.72			281
14	Kitchen Lighting-CFL	107	0.31	33.4	0.72	4,069	0.65	
15	Outdoor Lighting-CFL	195	0.46	90.3	0.72	16,506		
16	Energy Star Torchiere	1	1.00	1.0	0.72	91	0.01	
17	Fluorescent Lights	202	0.39	78.6	0.72	21,719	3.45	
18	Energy Star Clotheswasher	49	0.10	4.9	0.72	159	0.02	42
19	Energy Star Dishwasher	79	0.25	19.8	0.72	299	0.04	
20	Attic insulation	32	0.33	10.7	0.72	2,043	2.40	568
21	Free Lo-Flow Showerhead-electric	1	1.00	1.0	0.72	102		
22	Free CFL	36	1.00	36.0	0.72	1,555	0.26	
23	Socket Caps (not in program)							
24	Free Faucet Aerators-electric	2	1.00	2.0	0.72	81		
25	Free Low-Flow Showerhead-gas	18	0.83	15.0	0.72			108
26	Free Faucet Aerators-gas	25	0.80	20.0	0.72			58
27	Energy Star Refrigerator	74	0.31	22.8	0.72	1,115	0.15	
28	Reduce Infiltration/Drafts	161	0.73	117.7	0.72	5,591	6.52	1,017
29	Screw-in CFLs	195	0.63	122.0	0.72	5,273	0.88	
	Total	**2,032**		**886**		**80,889**	**40**	**7,885**

The lifecycle net ex post load impacts for the program shown in **Table 3.5**. The lifecycle net ex post program savings are 1,066,988 ± 104,243 kWh, 127,446 ± 12,451 therm. The lifecycle net ex post realization rates are 0.0373 ± 0.0036 for kWh and 0.0585 ± 0.0057 therms.

Table 3.5 Net Lifecycle Load Impacts for the Program

#	Description	EUL	Lifecycle Net Ex Post kWh	Lifecycle Net Ex Post therm
1	Basic HVAC Tune-up (AC Diag.)	10	1,440	
2	Adv. HVAC Tune-up (Ducts+AC)	10	99,485	11,528
3	Duct Test & Seal	20	0	0
4	Energy Star Furnace	20		13,728
5	Energy Star Heat Pump	15	0	
6	Energy Star Air Conditioner	15	920	
7	Programmable T-Stat	11	30,075	7,434
8	Wall insulation	20	6,463	4,798
9	Insulation Package (Attic+Walls)	20	131,052	44,790
10	Low-e Windows	20	50,464	5,624
11	Efficient Gas Water Heater	15		3,062
12	Pipe Insulation Gas	15		4,983
13	Low-Flow Showerhead	10		2,806
14	Kitchen Lighting-CFL	16	65,099	
15	Outdoor Lighting-CFL	8	132,050	
16	Energy Star Torchiere	16	1,463	
17	Fluorescent Lights	16	347,505	
18	Energy Star Clotheswasher	10	1,588	423
19	Energy Star Dishwasher	5	1,493	
20	Attic insulation	20	40,858	11,366
21	Free Lo-Flow Showerhead-electric	10	1,022	
22	Free CFL	8	12,442	
23	Socket Caps (not in program)			
24	Free Faucet Aerators-electric	10	806	
25	Free Low-Flow Showerhead-gas	10		1,080
26	Free Faucet Aerators-gas	10		576
27	Energy Star Refrigerator	15	16,722	
28	Reduce Infiltration/Drafts	15	83,864	15,248
29	Screw-in CFLs	8	42,180	
	Total		**1,066,988**	**127,446**

3.1.1 Verification Findings

Ex post accomplishments were verified using data from the GeoPraxis tracking database and telephone calls with participating inspectors and homeowners. The measure adoption ratios are shown in **Table 3.6**. The net average adoption ratio for all measures was 0.46 ± 0.045 at the 90 percent confidence level. This indicates nearly one half of EnergyCheckup recommended measures were adopted by new home buyers without rebates (from outside the program). This finding is higher than previous EM&V studies of the program where the net adoption ratio was found to be 0.31 (see *Evaluation of Southern California Edison's Residential Audit Programs: Final Report*, Ridge & Associates, September 2002). The overall mean number of recommendations and net adoptions are 8.2 and 3.8, respectively.

Table 3.6 EnergyCheckup Recommendations, Adoptions, and Net Adoption Ratios

#	Description	Goal	Energy Checkup Recommended Measures	Energy Checkup Adopted Measure	Percent Paid by non-ToS Rebates	Net Adopted Measures without rebates	Net Adoption Ratio
1	Basic HVAC Tune-up (AC Tune-up)	493					
2	Adv. HVAC Tune-up (Ducts+AC Tune-up)	189	33	16	9.4%	14.5	0.44
3	Duct Test & Seal	440	1	0	0%	0	0
4	Energy Star Furnace	236	9	4	0%	4	0.44
5	Energy Star Heat Pump						
6	Energy Star Air Conditioner	169					
7	Programmable Thermostat	480	15	8	0%	8	0.53
8	Wall insulation	60	5	1	0%	1	0.20
9	Insulation Package (Wall + Attic)		5	3	0%	3	0.60
10	Energy Star Window/Skylight	264	18	2	0%	2	0.11
11	High Eff. Gas Wtr Htr	529	16	3	0%	3	0.19
12	Pipe Insulation	838	22	14	0%	14	0.64
13	Low-Flow Showerhead-Gas	1,311	18	3	0%	3	0.17
14	Kitchen Fluorescent-CFL	403	16	5	0%	5	0.31
15	Outdoor Lighting-CFL	198					
16	Energy Star Torchiere		1	1	0%	1	1.00
17	Fluorescent Lights or CFL Hardwired	1,068	36	14	0%	14	0.39
18	Energy Star Clothes Washer	10	10	1	0%	1	0.10
19	Energy Star Dishwasher	10	8	2	0%	2	0.25
20	Attic Insulation	295	9	3	0%	3	0.33
21	Free Low-Flow Showerhead-Electric	1,692					
22	Free Screw-in CFLs	17,000	14	14		14	1.00
23	Socket caps (not in program)						
24	Free Faucet Aerators-Electric	3,383					
25	Free Low-Flow Showerhead-Gas	6,809	6	5		5	0.83
26	Free Faucet Aerators-Gas	13,617	10	8		8	0.80
27	Energy Star Refrigerator (EnergyCheckup)		13	4	0%	4	0.31
28	Reduce Infiltration (EnergyCheckup)		26	19	0%	19	0.73
29	Screw-in CFLs (EnergyCheckup)		38	24	0.90%	23.8	0.63
	Total		**329**	**154**		**152**	
	Average		**8.2**	**3.9**		**3.8**	**0.46**

3.1.2 Baseline UEC Values and Ex Post Unit Savings

Load impacts are based on average Unit Energy Consumption (UEC) values per home shown in **Table 3.7**. The UEC values were obtained from the *California Statewide Residential Appliance Saturation Study* (RASS) based on 9,265 homes for electricity and 8,789 homes for gas data.

Table 3.7 Baseline UEC Values for PG&E

End Use	PG&E RASS UEC	Notes
All Household Electricity UEC (kWh/yr)	6,255	RASS Study based on 9,265 homes
All Household Gas UEC (therm/yr)	343	RASS Study based on 8,789 homes
Space Cooling UEC (kWh/yr)	1,108	2004 RASS Study, 0.39 Saturation
Space Cooling (kW)	1.3	2004 RASS Study, 0.39 Saturation
Gas Space Heating UEC (therm/yr)	245	2004 RASS Study, 0.74 Saturation
Gas Water Heating UEC (therm/yr)	183	2004 RASS Study, 0.74 Saturation
Electric Water Heating UEC (kWh/yr)	2,585	2004 RASS Study, 0.09 Saturation
Whole House Lighting UEC (kWh/yr)	1,128	2004 RASS Study, 1.0 Saturation
Outdoor Lighting UEC (kWh/yr)	260	2004 RASS Study, 0.56 Saturation
First Refrigerator UEC (kWh/yr)	788	2004 RASS Study, 1.0 Saturation
Second Refrigerator UEC (kWh/yr)	1,201	2004 RASS Study, 0.19 Saturation
NAECA Refrigerator UEC (kWh/yr)	618	NAECA Standard from Energy Star
Clothes Washer UEC (kWh/yr)	97	2004 RASS Study, 0.78 Saturation
Dishwasher UEC (kWh/yr)	77	2004 RASS Study, 0.67 Saturation
Electric Dryer UEC (kWh/yr)	652	2004 RASS Study, 0.45 Saturation
Gas Dryer UEC (therm/yr)	25	2004 RASS Study, 0.22 Saturation
Range Oven UEC (therm/yr)	37	2004 RASS Study, 0.42 Saturation

The ex post unit savings per unit (gross) are shown in **Table 3.8**. The base UEC values are from the PG&E RASS study and the percentage savings are based on the DEER 2001 Update Study or other studies noted above in **Table 2.2**.

Table 3.8 Ex Post Unit Savings per Measure in the PG&E Service Area

#	Description	PG&E RASS UEC kWh/yr	Percent Electric Savings	PG&E RASS UEC therm/yr	Percent Gas Savings	Ex Post Savings per unit kWh	Ex Post Savings per unit kW	Ex Post Savings per unit therm
1	Basic HVAC Tune-up (AC Diag.)	1,108	13%			144	0.169	
2	Adv. HVAC Tune-up (Ducts+AC)	1,108	21%	245	11%	233	0.273	27
3	Duct Test & Seal	1,108	9%	245	11%	100	0.117	27
4	Energy Star Furnace			245	13%			33
5	Energy Star Heat Pump	1,108	17%	1,310	15%	380	0.216	
6	Energy Star Air Conditioner	1,108	17%			184	0.216	
7	Programmable T-Stat	1,108	8%	245	9%	89	0.104	22
8	Wall insulation	1,108	6%	245	20%	66	0.077	49
9	Insulation Package (Attic+Walls)	1,108	29%	245	44%	316	0.37	108
10	Low-e Windows	1,108	30%	245	15%	332	0.389	37
11	Efficient Gas Water Heater			183	13%			24
12	Pipe Insulation Gas			183	3%			5
13	Low-Flow Showerhead			183	8%			14
14	Kitchen Lighting-CFL					169	0.027	
15	Outdoor Lighting-CFL					254		
16	Energy Star Torchiere					127	0.020	
17	Fluorescent Lights					384	0.061	
18	Energy Star Clotheswasher	97	46%	25	46%	45	0.006	12
19	Energy Star Dishwasher	77	27%			21	0.003	

Table 3.8 Ex Post Unit Savings per Measure in the PG&E Service Area

#	Description	PG&E RASS UEC kWh/yr	Percent Electric Savings	PG&E RASS UEC therm/yr	Percent Gas Savings	Ex Post Savings per unit kWh	Ex Post Savings per unit kW	Ex Post Savings per unit therm
20	Attic insulation	1,108	24%	245	30%	266	0.312	74
21	Free Low-Flow Showerhead-electric	2,585	6%			142		
22	Free CFL					60	0.010	
23	Free Socket Caps (not in program)							
24	Free Faucet Aerators-electric	2,585	2%			56		
25	Free Low-Flow Showerhead-gas			183	6%			10
26	Free Faucet Aerators-gas			183	2%			4
27	Energy Star Refrigerator (Base NAECA)	618	11%			68	0.009	
28	Reduce Infiltration/Drafts	1,108	6%	245	5%	66	0.077	12
29	Screw-in CFLs					60	0.010	
	Total (Per Audit)	**6,255**	**9%**	**343**	**16%**	**548.6**	**0.278**	**53.5**

3.1.3 Program Ex Post Load Impacts

Net first year load impacts for the program shown in **Table 3.9** are based on net adoption ratios from **Table 3.6**, the default 0.72 CPUC net to gross ratio, and savings per unit from **Table 3.7**. The average adoption ratio was used for measures not included in the sample survey population (i.e., Basic AC Diagnostic Tune-up, Energy Star Air Conditioner, and Outdoor Lighting-CFL). Load impact confidence intervals are based on the adoption ratio confidence intervals. Net first year program savings are 80,889 ± 7,903 kWh/yr, 40 ± 4 kW, and 7,885 ± 770 therm/yr.

Table 3.9 Net First Year Load Impacts for the Program

#	Description	Total Energy Checkup Recommendation	Net Adoption Ratio	Net Adopted Energy Checkup Recommendation	Net to Gross Ratio	Net Ex Post kWh/y	Net Ex Post kW	Net Ex Post therm/y
1	Basic HVAC Tune-up (AC Diag.)	3	0.46	1.4	0.72	144	0.17	
2	Adv. HVAC Tune-up (Ducts+AC)	135	0.44	59.3	0.72	9,948	11.66	1,153
3	Duct Test & Seal	19	0.00	0.0	0.72	0	0.00	0
4	Energy Star Furnace	65	0.44	28.9	0.72			686
5	Energy Star Heat Pump	0		0	0.72	0	0.00	
6	Energy Star Air Conditioner	1	0.46	0.5	0.72	61	0.07	
7	Programmable T-Stat	80	0.53	42.7	0.72	2,734	3.19	676
8	Wall insulation	34	0.20	6.8	0.72	323	0.38	240
9	Insulation Package (Attic+Walls)	48	0.60	28.8	0.72	6,553	7.67	2,239
10	Low-e Windows	95	0.11	10.6	0.72	2,523	2.96	281
11	Efficient Gas Water Heater	63	0.19	11.8	0.72			204
12	Pipe Insulation Gas	145	0.64	92.3	0.72			332
13	Low-Flow Showerhead	167	0.17	27.8	0.72			281
14	Kitchen Lighting-CFL	107	0.31	33.4	0.72	4,069	0.65	
15	Outdoor Lighting-CFL	195	0.46	90.3	0.72	16,506		
16	Energy Star Torchiere	1	1.00	1.0	0.72	91	0.01	
17	Fluorescent Lights	202	0.39	78.6	0.72	21,719	3.45	
18	Energy Star Clotheswasher	49	0.10	4.9	0.72	159	0.02	42
19	Energy Star Dishwasher	79	0.25	19.8	0.72	299	0.04	
20	Attic insulation	32	0.33	10.7	0.72	2,043	2.40	568
21	Free Lo-Flow Showerhead-electric	1	1.00	1.0	0.72	102		
22	Free CFL	36	1.00	36.0	0.72	1,555	0.26	
23	Free Socket Caps (not in program)							
24	Free Faucet Aerators-electric	2	1.00	2.0	0.72	81		
25	Free Low-Flow Showerhead-gas	18	0.83	15.0	0.72			108
26	Free Faucet Aerators-gas	25	0.80	20.0	0.72			58
27	Energy Star Refrigerator	74	0.31	22.8	0.72	1,115	0.15	
28	Reduce Infiltration/Drafts	161	0.73	117.7	0.72	5,591	6.52	1,017
29	Screw-in CFLs	195	0.63	122.0	0.72	5,273	0.88	
	Total	**2,032**		**886**		**80,889**	**40**	**7,885**

Net lifecycle load impacts for the program shown in **Table 3.10** are based on effective useful lifetimes from the CPUC EEPM or other sources.[26] Net lifecycle program savings are 1,066,988 ± 104,243 kWh, 127,446 ± 12,451 therm.

Table 3.10 Net Lifecycle Load Impacts for the Program

#	Description	EUL	Lifecycle Net Ex Post kWh	Lifecycle Net Ex Post therm
1	Basic HVAC Tune-up (AC Diag.)	10	1,440	
2	Adv. HVAC Tune-up (Ducts+AC)	10	99,485	11,528
3	Duct Test & Seal	20	0	0
4	Energy Star Furnace	20		13,728
5	Energy Star Heat Pump	15	0	
6	Energy Star Air Conditioner	15	920	
7	Programmable T-Stat	11	30,075	7,434
8	Wall insulation	20	6,463	4,798
9	Insulation Package (Attic+Walls)	20	131,052	44,790
10	Low-e Windows	20	50,464	5,624
11	Efficient Gas Water Heater	15		3,062
12	Pipe Insulation Gas	15		4,983
13	Low-Flow Showerhead	10		2,806
14	Kitchen Lighting-CFL	16	65,099	
15	Outdoor Lighting-CFL	8	132,050	
16	Energy Star Torchiere	16	1,463	
17	Fluorescent Lights	16	347,505	
18	Energy Star Clotheswasher	10	1,588	423
19	Energy Star Dishwasher	5	1,493	
20	Attic insulation	20	40,858	11,366
21	Free Lo-Flow Showerhead-electric	10	1,022	
22	Free CFL	8	12,442	
23	Free Socket Caps (not in program)			
24	Free Faucet Aerators-electric	10	806	
25	Free Low-Flow Showerhead-gas	10		1,080
26	Free Faucet Aerators-gas	10		576
27	Energy Star Refrigerator	15	16,722	
28	Reduce Infiltration/Drafts	15	83,864	15,248
29	Screw-in CFLs	8	42,180	
	Total		**1,066,988**	**127,446**

3.2 Process Evaluation Results

Process evaluation recommendations are based on process telephone surveys conducted with 40 participating, 10 non-participating homebuyers, 10 participating home inspectors, and 10 non-participating home inspectors. Participants were asked why and how they decided to participate in the program. Non-participants were asked why they chose not to participate. The process surveys were used to evaluate participant satisfaction and obtain suggestions to improve the program's services and procedures. Survey results were used to guide the process evaluation in terms of investigating operational characteristics of the program and developing specific recommendations to help make the program more cost effective, efficient, and operationally effective. The process survey instruments are provided in Appendix A and Appendix B.

[26] The outdoor lighting-CFL and screw-in-CFL measure EUL values were reduced from 16 years (ex ante) to 8 years (ex post) to reflect manufacturer lifetime ratings of 10,000 hours.

3.2.1 Participant Home Buyer Survey Results

EnergyCheckup™ inspections were performed at 205 homes and 40 participant homeowners were interviewed for this study. Participant homeowner process survey results are summarized to answer the following questions from the CPUC-approved EM&V plan.

1. **Were the EnergyCheckup™ inspections performed as part of a time-of-sale (TOS) home inspection?**
   - Time-of-Sale Home Inspection including EnergyCheckup™ - 37.5% (i.e., 15 out of 40).
   - Stand alone EnergyCheckup™ Inspection - 62.5% (not at time of sale), and 28% specifically requested the energy inspection.
   - Average move-in date for participants was 12/24/1995. This indicates many inspections were performed for existing homes and not at time of sale.
   - Predisposition of Participating Homeowners
     - Buying Home - 22.5%.
     - Selling Home - 7.5%.
     - Remodeling - 10%.
     - EnergyCheckup™ Inspector Training - 37.5%. Most of these were inspectors (73%) and the rest were friends of inspectors (27%).
     - Referred by Utility - 22.5%.

2. **How were EnergyCheckup™ inspections delivered to homebuyers?**
   - Inspectors delivered 90%.
   - Real estate agents delivered 2.5%.
   - Previous home owners delivered 2.5%.
   - E-mail delivered 5%.

3. **How interested were participants in reading the EnergyCheckup™ reports?**
   All homeowners remembered receiving the EnergyCheckup™ report and reported the following level of interest.
   - Read entire report - 69%
   - Read some of it - 23%
   - Skimmed report - 5%
   - Didn't read report - 3%.

4. **Did home buyers understand and appreciate the EnergyCheckup information?**
   - Easy to understand - 96% ± 0.1%.
   - Recommendations were applicable to their home - 93% ± 0.2%.
   - EnergyCheckup™ report was informative - 95% ± 0.1%.
   - EnergyCheckup™ recommended energy savings were reasonable - 97% ± 0.1%.

5. **Are home buyers satisfied with EnergyCheckup™ inspectors?**
   - Courteous inspector – 98% ± 0.07% satisfaction rating (i.e., average score 3.92 out of 4).
   - Timeliness (i.e., work scheduled and completed within a reasonable timeframe) – 100% satisfaction rating (i.e., average score 4 out of 4).
   - Time required to complete inspection – 99% ± 0.1% satisfaction rating (i.e., average score 3.97 out of 4).

6. Are home buyers satisfied with EnergyCheckup™ reports?

- Overall Presentation of Report – 89% ± 0.3% satisfaction rating (i.e., average score of 3.6 out of 4 points).
- Overall Satisfaction with Report – 88% ± 0.3% satisfaction rating (i.e., average score of 3.5 out of 4 points).

7. What are the EnergyCheckup™ participant demographics?

- Homeownership of participants
  - 97.5% of the participants owned the home where the EnergyCheckup™ inspection was performed and 2.5% were real estate agents.
  - 87.5% of participants lived in the residences where the EnergyCheckup™ inspections were performed. The other 12.5% owned the residences and rented to tenants.
- Number of residents per home - average number per residence was 2.7.
- Household average annual participant income - $83,200.
- Education of participants
  - High school education - 29.6%.
  - Attended college - 3.7%.
  - College graduate - 63.0%.
  - Attended graduate school - 3.7%.
- Ethnicity of participants
  - Hispanic - 3.4%.
  - Caucasian - 86.2%.
  - Other or Refused - 10.3%.

8. Do home buyers have any suggestions to improve the program?

50% of participants provided comments or suggestions to improve the program.

- "Great program" - 65%.
- "Great training program" - 15%.
- "Liked program, but it could be improved" - 20%.

3.2.2 Participant Inspector Survey Results

The ten interviewed inspectors preformed a total of 102 inspections or 50% of the 205 total inspections. EnergyCheckup™ training was provided to 128 inspectors, and 32 inspectors (25%) received supplemental EnergyCheckup™ training. The interviewed inspectors did not receive any supplemental training. Participant inspector process survey results are summarized to answer the following questions from the CPUC-approved EM&V plan.

1. How were EnergyCheckup™ recommendations to save energy delivered to home owners?

- Approximately 86% of the inspectors walked through EnergyCheckup™ reports with home buyers to explain the recommendations, while 14.3% of inspectors did not.
- Of the 85.7% of inspectors that walk through the EnergyCheckup™ report, 83.3% read the entire report and 16.7% only explain summary information.

2. **How much time is required to perform a traditional time-of-sale inspection versus an EnergyCheckup™ inspection and what does it cost?**
   - Traditional time-of-sale home inspection average time requirement - 182 minutes.
   - EnergyCheckup™ inspection average time requirement - 39.7. The average hourly income per inspector is roughly $65 per hour.
   - The EnergyCheckup™ inspection takes 0.66 hours to complete and the cost to the inspectors was roughly $43 in time plus the GeoPraxis fee of $19.95 per inspection.

3. **Are home inspectors satisfied with services or information provided by the program?** Participant satisfaction was very high as indicated by the following survey responses.
   - Courteous and Professional Trainers and Staff – 95% ± 0.22% satisfaction rating (i.e., average score of 3.8 out of 4 points).
   - Knowledgeable Trainers and Staff – 95% ± 0.22% satisfaction rating (i.e., average score of 3.8 out of 4 points).
   - Time Required to Complete Inspection – 97.5% ± 0.16% satisfaction rating (i.e., average score of 3.9 out of 4 points).

4. **Are home inspectors satisfied with the program?**
   - 90% of inspectors plan to continue offering EnergyCheckup inspections while 10% of inspectors are unsure.
   - 90% of inspectors advertise EnergyCheckup to all customers while 10% do not.

5. **Are home inspectors satisfied with EnergyCheckup™ information provided by the program?** Inspector satisfaction with the services or information provided by the program is indicated by the following ratings.
   - EnergyCheckup™ report easy to understand - 97.5% ± 0.16%.
   - EnergyCheckup™ recommendations easy to explain to home buyers - 97.5% ± 0.16%.
   - EnergyCheckup™ report information was useful to home buyers - 97.5% ± 0.16%.
   - EnergyCheckup™ recommended energy savings were reasonable - 97.5% ± 0.16%.
   - Overall presentation of report – 88.0% ± 0.48% satisfaction rating.
   - Overall satisfaction with report – 83.0% ± 0.98% satisfaction rating.

6. **What inspector market barriers exist for the Time-of-Sale Home Inspection Program?** Market barriers to participation include information costs, asymmetric information, performance uncertainty, misplaced or split incentive, hassle cost, and bounded rationality.
   - Information cost barrier - 1.6% of home buyers ask for EnergyCheckup inspections.
   - Asymmetric information - 1.94% of real estate agents recommend EnergyCheckup inspections.
   - Performance uncertainty, misplaced or split incentive, hassle cost, bounded rationality - 100% of inspectors said it would help if real estate agents promoted EnergyCheckup inspections.
   - Information cost - 100% of inspectors said it would help if EnergyCheckup inspections were better advertised to home buyers and real estate agents.

7. **What are the EnergyCheckup inspector demographics?**
   - Average number of homes inspected each year was 311.
   - Average gross annual inspector income - $49,285.
   - Education of participating inspectors:
     - High school education – 37.5%.
     - Attended college - 25%.
     - College graduate - 25%.
     - Attended graduate school – 12.5%.
   - Ethnicity of participating inspectors:
     - Hispanic - 12.5%.
     - Caucasian - 87.5%.

8. **Do home inspectors have any suggestions to improve the program?**
   Suggestions or comments to improve the program were provided by 90% of participating inspectors.
   - "Great program" - 56%.
   - "Program would benefit from some improvements" - 44%.

3.2.3 Non-Participant Homeowner Survey Results

Non-participant process survey results are summarized in order to answer the following questions from the CPUC-approved EM&V plan.

1. **Is there a continuing need for the program?**
   The following process survey responses indicate a continuing need for the program.
   - 100% of non-participant homeowners were unaware of the program.
   - 90% of non-participant homeowners weren't sure if they would have participated even if they knew about the program, and 10% would not have participated even if they knew about the program. These responses indicate a continuing need for better and more advertising to homeowners about the benefits of the EnergyCheckup™ inspections.

2. **Why have home buyers chosen not to participate (i.e., market barriers)?**
   Market barriers to participation include information costs and misplaced or split incentives.
   - Information cost barrier market barrier - 70% didn't know about the program.
   - Misplaced or split incentive market barrier - 10% didn't own the home.
   - Other market barriers - 20%.

3. **What are the non-participant homeowner demographics?**
   - Homeownership of non-participants
     - 90% owned their home.
     - 10% rent.
   - Number of residents per home - 2.8.
   - Household average annual non-participant income - $106,250.
   - Ethnicity of non-participants
     - Hispanic - 12.5%.
     - Caucasian - 50%.
     - Other – 37.5%.

4. **Do non-participants have any suggestions to improve participation?**
   - No suggestions to improve the program were provided by non-participant homeowners.

3.2.4 Non-Participant Inspector Survey Results

Non-participant process survey results are summarized to in order to answer the following questions from the CPUC-approved EM&V plan.

1. **Is there a continuing need for the program?**
   The following process survey responses indicate a continuing need for the program.
   - 70% of non-participant inspectors were unaware of the program.
   - 50% of non-participant inspectors did not know if they would have participated because they did not have enough information about the program, and 50% would not have participated even if they knew about the program. These responses indicate a continuing need for better and more advertising to homeowners, real estate agents, and inspectors about the benefits of EnergyCheckup™ inspections.

2. **Why have inspectors chosen not to participate (i.e., market barriers)?**
   Market barriers to participation include information costs, hassle costs, asymmetric information, and bounded rationality.
   - Information cost barrier - 10% didn't know about the program.
   - Hassle cost barrier - 40% didn't participate because they are too busy or do not have time to perform additional work during traditional inspections.
   - Asymmetric information - 10% didn't participate because customers and real estate agents aren't interested in or don't know about EnergyCheckup™ program.
   - Bounded rationality - 10% didn't participate because real estate agents only recommend traditional inspections.
   - Other reasons - 30%.

3. **What are the non-participant inspector demographics?**
   - Average number of homes inspected each year was 325.
   - Average gross annual inspector income - $101,000.
   - Education of participating inspectors:
     - High school education – 14.3%.
     - Attended college – 57.1%.
     - College graduate – 28.6%.
   - Ethnicity of participating inspectors:
     - Caucasian - 100%.

4. **Do non-participants have any suggestions to improve participation?**
   Non-participants provided the following comments or suggestions to improve the program.
   - "If the interest was there I would have jumped right on it, but customers aren't interested."
   - "I might have participated if I knew more about the program."
   - "I looked into it a few years back, but the interest just isn't there."
   - "It seems like energy conservation work is given to specialists and not ordinary home inspectors."

- "I would do EnergyCheckup™ inspections if someone paid for it."

3.2.5 EnergyCheckup™ Website Evaluation

The EnergyCheckup™ website was evaluated for content including: EnergyCheckup™ Report quality, rebates, referrals, and links to and from other relevant sites. The website was also evaluated for design based on the Yale Web Style Guide.

3.2.5.1 Website Content Evaluations

The EnergyCheckup™ Reports are very informative and nicely laid-out. Each report clearly presents the home's recommendations, including benefits and estimated cost and savings. Homeowners are also able to view current rebate information that applies to the improvements recommended for their particular house. Links to both of these features are easily navigated to from the menu on the left side of each page.

Also on the left-hand menu bar are links that can help you find inspectors, financing, contractors, and products. One problem was noted while evaluating the Find Contractors page (http://www.energycheckup.com/content/findcontractor.asp). No contractors were recommended for any service in any zip code entered. This feature does not seem to be working correctly.

Both EnergyCheckup™ inspections and the energycheckup.com website have been sited in a selection of Internet publications (e.g., Articles by CNN.com and SmartMoney Magazine), and the energycheckup.com website provides a large number of links to outside organizations (including the Contractors State License Board, California Energy Commission, Department of Energy, EPA Energy Star, RESNET, Improvenet.com, Do It Yourself Network, League of California Homeowners, ASHI, CREIA, NACHI, AII, Inspectech, Alliance to Save Energy, ACEEE, Home Energy Magazine, Home Energy Saver Library, National Association of Realtors, REALTOR magazine, Electric & Gas Industries Association, California Building Performance Contractor's Association, Certified Green Building Contractors (NARI), SimplyInsulate.com, Carrier Aeroseal, LLC, H&L Energy Savers, AmericanForests.org, energyefficientmtg.com, The Federal Energy Teem, CREST, the Pacific Energy Center, Greenclips, LBNL newsgroups, LBNL Crossroads, EnergyDesignResources.com, Great Buildings Online, the REDI database, and the California Public Utilities Commission, as well as numerous utilities and other providers of local rebate and financing programs.). More occurrences may exist, but a Google search of the phrase "energycheckup" found links to energycheckup.com from over 500 listings including the California "Flex Your Power" website, several home inspection companies (HomeTeam, HouseCheck, Omni, Clements, etc.), but none from realty companies. However upon looking over each of the websites listed on the Find an Inspector page (http://www.energycheckup.com/content/FindInspector.asp), only two references to the EnergyCheckup program were found, and many sites did not even mention that they provide energy inspection services.

3.2.5.2 Website Design Evaluations

The following design evaluations are based on the Yale Web Style Guide, which can be viewed at http://www.webstyleguide.com/

1. Interface Design

- The site contains clear and consistent navigation aides that allow users to traverse the site easily and find their way back to previously viewed pages if desired.
- The site hierarchy is effectively designed so that all content is only one or two pages away from the main menu; users never have to navigate more than a few clicks to find the information they are searching for.

2. Site Design

- The content is divided into logical units of information; menu options allow users to easily access each topic from any page.
- The website uses a good balance of text and graphical design.

3. Page Design

- Each page contains an appropriate amount of information so readers do not have to scroll very far and are not overwhelmed with too much text.
- The header displayed consistently at the top of each page does not have one main focal point. The page header is inherently the most dominant focus because it is the first thing readers see on each page; therefore the header should display a prominent title and/or logo that is both memorable and descriptive. The current header displays three individual graphics, none of which stands out as the most import.

4. Graphics

- The yellow sun EnergyCheckup™ logo used on each page header does not successfully capture the viewer's attention. The image is fairly small, and the contrast of yellow on white does not help it stand out.
- In general, Web graphic options are limited by the user's display monitor capabilities as well as their bandwidth capacities. The energycheckup.com website contains JPEG images (which have a huge compression ratio that results in faster download speeds), but it does not contain a large quantity of these graphics. As a result, the pages generally load in less than 10 seconds even when using dial-up Internet connections.

5. Typography

- The use of contrasting colors, fonts, and style settings provides a visual hierarchy that is consistently used throughout the website.

The following section provides process evaluation recommendations to improve the program.

3.2.6 Process Evaluation Recommendations

The following process evaluation recommendations are provided as per the CPUC-approved EM&V plan regarding what works, what doesn't work, and suggestions to improve the program's services and procedures.

3.2.6.1 General Program Recommendations

The following general program recommendations are provided to improve the program's services, procedures, and cost effectiveness.

1. Offer a $30 to $35 incentive to home inspectors in order to eliminate market barriers such as information cost, hassle cost, performance uncertainty, organizational practices, and service availability.[27] A similar EnergyCheckup™ program implemented by Inspectech from 1999 through 2001 in Southern California realized more than 27,000 EnergyCheckup audits with a rebate of $35 per inspection.
2. Develop an "EnergyWise Realtor" training element that includes the GeoPraxis T-o-S EnergyCheckup™ Report and a kit of energy efficiency products that EnergyWise real estate agents could use to sell homes and inspectors could use to help make home buyers more aware of energy efficiency and renewable energy opportunities. Traditionally, real estate agents have not been included in most residential audit program efforts and this recommendation would create a win-win for real estate agents, home inspectors, and California in terms of creating demand for providing increased energy efficiency information at time of sale since this is the time when home buyers are most predisposed to spend money to improve their homes.
3. Provide more and better advertising to homebuyers about the importance of having EnergyCheckup™ inspections included in the time of sale inspection.
4. Provide better advertising through telephone, email, mail, newspapers, or television to increase participation. Advertising should explain the benefits of Time-of-Sale EnergyCheckup™ audits offered by the program.
5. Provide better coordination with utility rebate programs and Flex Your Power to gain more support for the program and greater demand and consumer awareness.
6. Provide more local contact information for energy efficiency contractors to help homebuyers implement recommendations.

3.2.6.2 Recommendations for Marketing

The following marketing recommendations are provided to increase demand for the EnergyCheckup™ among homebuyers, real estate agents and inspectors.

1. Define the target market and focus on areas likely to adopt EnergyCheckup™ first, and build upon success to expand to other markets. One of the 4 P's of marketing is "place" (i.e., product, price, place and promotion). For example, Berkeley and San Francisco require energy inspections in the real estate transaction process. It might be helpful to devote attention to these markets. Some areas of the program might have to be compromised to do this, but compromising is essential in developing the business plan.
2. Provide more and better advertising to homebuyers about the importance of having EnergyCheckup™ inspections included in the time of sale inspection.
3. Provide better advertising through telephone, email, mail, newspapers, or television to increase participation. Advertising should explain the benefits of Time-of-Sale EnergyCheckup™ audits offered by the program. See if PG&E might allow EnergyCheckup™ advertising or information in billing inserts.
4. Use consistent EnergyCheckup™ branding in all communications (eliminate references to GeoPraxis on voice mail, marketing material, etc.) since this confuses homebuyers about the brand.
5. Go after real estate agents more aggressively and explain the value and get them on board.

[27] This recommendation was made in the January 2004 progress report including feedback and corrective or constructive guidance regarding implementation of the program (see **Appendix B**).

6. Consider some type of incentives to real estate agents for referrals to trained EnergyCheckup™ inspectors to stimulate demand for the program (e.g., free kits of energy efficient measures for them to give to clients as a "thank you" gift upon close of escrow).
7. As years of experience with CHEERS and other stand-alone HERS rating systems in California and elsewhere have shown, EnergyCheckup is probably not cost effective as a stand-alone service, and it should continue to be marketed as a value-add to a general time-of-sale home inspection.

3.2.6.3 Recommendations for Training

Inspector participants provided the following recommendations to improve training and marketing.

1. Redesign EnergyCheckup™ training for inspectors and realtors. Focus on providing value added energy efficiency services in selling or buying homes. Reduce training time for realtors since they see this as inhibiting the selling process. Realtors spend considerable time getting a house ready to sell or buy. Fundamentally, since EnergyCheckup™ is not a requirement it should be approached as a value added service and realtors have very little to do with the process.
2. Listen to inspectors about issues regarding time required to perform an EnergyCheckup™ inspection and simplify the inspection process.
3. Be sure to follow-up with all the people trained and be persistent; after you present to a group or organization, always follow up or make a second visit.
4. Know your target market... perhaps go to companies to present the idea, not to conventions... these are "good 'ol boys" so buy some drinks and get to know them that way.

3.2.6.4 Recommendations for Website

1. Publish a list of trained inspectors on the website who are experienced EnergyCheckup™ inspectors rather than listing all trained inspectors (regardless of whether they do inspections). Distribute the list to real estate agents through links to realtor websites.
2. Advertise the website better by encouraging more linking from EnergyCheckup™ trained inspector websites.
3. Advertise the website better by encouraging more linking from realtor websites to attract more homebuyers.

Appendix A: Process Survey Instrument for Homeowners and Renters

Interview Instructions for Process Survey

1. Purpose

The purpose of the Process Survey is to evaluate what works, what doesn't work, customer satisfaction, and suggestions for improvement in the program's services and procedures. Survey results from participating customers will be used to develop an estimate of the adoption of recommended measures and practices (including TOS free measures).

2. Selection of Respondent

1. **Participants** must be the person responsible for allowing the EnergyCheckup™ inspection to be performed at the home. If this person is unavailable locate someone who is at least familiar with how that decision was made.
2. **Non-participants** must be a person in the local utility service area who was unaware of the program or decided not to allow an EnergyCheckup™ inspection to be performed at their home (see non-participant survey at end).

3. Two Types of Participants

This survey will be used for two types of participant:

1. **Participant Home Owners**. Home owners that received an EnergyCheckup™ inspection.
2. **Non-participant Home Owners**. Home owners that did not receive an EnergyCheckup™ inspection.

4. How to Start a Survey

Complete the following steps to start one of these surveys:

1. Review GeoPraxis customer file information (for participants).
2. Make sure you understand what GeoPraxis installed prior to initiating the visit or call.
3. Participant Survey Introduction.
   Say: "Hello! My name is [_____], and I am conducting a survey regarding the GeoPraxis Time-of-Sale Home Inspection Program. The program trained the home inspector who provided an EnergyCheckup™ inspection of your home on [Inspection_Date]. After completing the inspection, the inspector provided a report with a list of recommendations for saving energy. Funding for the program came from the California Public Utilities Commission. Would you mind spending 20 minutes to answer a few questions to help us evaluate and improve the program?
4. Non-participant Survey Introduction.
   Say: "Hello! My name is [_____], and I am conducting a survey regarding the GeoPraxis Time-of-Sale Home Inspection Program funded by the California Public Utilities Commission in 2002 and 2003. You didn't participate in the program, but your feedback will help us evaluate and improve the program. The program provided an EnergyCheckup™ inspection within traditional Time-of-Sale home inspections. Would you mind spending 5 minutes to answer a few questions?

EnergyCheckup™ PARTICIPANT HOMEOWNER SURVEY #_____

Participant Last Name _____ First Name _____ Title _____

Address _____ City _____ ZIP _____

Phone Number_____ Survey Date _____Surveyor Initials _____

Participant Survey (Homeowner or Renter)

1. Do you remember an EnergyCheckup™ conducted at this home by [Inspector_Name] on [Inspection_Date], either as part of a complete home inspection or as an energy inspection alone?
   ___ **1** (Yes – Part of a home inspection) ___ **2 (**Yes – EnergyCheckup™ alone➡ **Skip to Q3**) ___ **3** (No ➡ **Stop**)
   98 Don't Know **99** Refused to Answer

2. Do you remember being informed before the inspection that an EnergyCheckup™ was included in your home inspection, or did you specifically request the EnergyCheckup™?
   ___ **1** (Yes – Informed EnergyCheckup™ was included) ___ **2** (Yes – Requested EnergyCheckup™
   ___ **3** (No – Do not remember either being informed or requesting an EnergyCheckup™) **98** DK **99** Refused

3. At the time of the EnergyCheckup™ were you in the process of buying, selling, refinancing, or remodeling the home, or was there some other reason for the inspection?
   __**1** (Buying) __**2** (Selling) __**3** (Refinancing) __ **4** (Remodeling) ___**5** (No - Other reason for EnergyCheckup™)
   98 DK **99** Refused

For the following 3 questions I will ask if you strongly disagree (1), disagree (2), agree (3), or strongly agree (4).

4. The EnergyCheckup™ was scheduled within a reasonable timeframe?
   ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

5. The EnergyCheckup™ inspector who came to my house was courteous?
   ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

6. The amount of time required to complete the EnergyCheckup™ was about right?
   ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

7. Do you remember receiving a report containing a list of recommendations to save energy based on the EnergyCheckup™?
   ___ **1** (Yes) ___ **2** (No ➡ **Stop**) **98** (DK ➡ **Skip to Q16**) **99** (Refused ➡ **Skip to Q16**)

8. Who provided the EnergyCheckup™ report to you?
   __**1** (Inspector) __**2** (Real Estate Agent) __**3** (Previous Owner) __4 (email, report online) **98** DK **99** Refused

9. Did you **READ** …
   __**1** (entire report) __**2** (some) __**3** (Glanced at report) __**4** (Didn't read, ➡ **Skip to Q16**) **98** DK **99** Refused

For the following 4 questions I will ask if you strongly disagree (1), disagree (2), agree (3), or strongly agree (4).

10. The EnergyCheckup™ report was easy to understand?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

11. The EnergyCheckup™ recommendations were applicable to my house?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

12. The information contained in the EnergyCheckup™ report was informative?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

13. In general, the recommended energy savings were reasonable?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

14. How would you rate the EnergyCheckup™ report in terms of presentation on a scale from 1 to 4?
    ___ Response (**1 is low and 4 is high**) **98** Don't Know **99** Refused to Answer

15. Please provide your overall satisfaction with the EnergyCheckup™ report on a scale from 1 to 4?
    ___ Response (**1 is low and 4 is high**) **98** Don't Know **99** Refused to Answer

16. Do you live at this residence year round?
    ___ **1** (Yes) ___ **2** (No)

EnergyCheckup™ PARTICIPANT HOMEOWNER SURVEY (cont'd)#_____

17. When did you move to this address?
_____ 00/00/00 (Month/Day/Year) **98** Don't Know **99** Refused to Answer

18. Do you own or rent the home?
_____ **1** Own _____ **2** Rent **98** Don't Know **99** Refused to Answer

19. Do you pay your own electric bill or is it included in your mortgage or rental payment?
___ **1** (Pay) __ **2** (Incl. in Mortgage/Rent) **98** (DK) **99** (Refused)

20. **If "YES" to Q7.** I understand the EnergyCheckup™ was completed in (Insert date from EnergyCheckup™ spreadsheet and lookup specific list of recommendations). I'm going to read the recommendations and ask you to provide answers to three questions for each recommendation. (It might help to ask the participant to pull out their EnergyCheckup™ report.)
If "NO, DK, or Refused" to Q1 or Q7 ➡ Stop and thank them for doing the survey.

Q.	Report	Description	Do you remember recommendation?	Were you aware recommendation saved energy?	Did you implement recommendation? [1=Yes; 2=In Progress; 3=No; 4=Done Previously; 5=Does Not Apply; 6=DK; 7=Refused]	What Percent of Cost was paid by Rebates or Loans? [1=Utility; 2=Mfgr; 3=Retail; 4=Loan; 5=Other; 6=DK; 7=Refused]
21		Basic HVAC Tune-up (AC Diagnostic Tune-up)				
23		Adv. HVAC Tune-up (Ducts + AC Tune-up)				
22		Duct Test & Seal				
24		E. Star Air Conditioner				
25		E. Star Furnace				
26		E. Star Heat Pump				
27		E. Star Dishwasher				
28		E. Star Refrigerator				
29		E. Star Torchiere				
30		E. Star Clothes Washer				
31		E. Star Window/Skylight				
32		Prog. Thermostat				
33		Wall insulation				
34		Attic Insulation				
35		Insul. Pkg. (Wall + Attic)				
36		Reduce Infiltration/Drafts				
37		Screw-in CFLs				
38		CFL Fixtures (Hardwired)				
39		Kitchen Fluorescent				
40		High Eff. Gas Wtr Htr				
41		Low-Flow Showerhead				
42		Pipe Insulation				

43. Skip this question unless customer requested free measures: Have you received a package in the mail containing free energy efficiency items?
___ **1** (Yes) ___ **2** (No ➡ **Skip to Q49**) **98** (DK ➡ **Skip to Q49**) **99** (Refused ➡ **Skip to Q49**)

44. Did you install any of the free energy efficiency items?
___**1** (2 CFLs) ___**2** (Showerhead) ___**3** (2 Aerators) **98** DK **99** Refused

45. Are you still using the free measures?
___**1** (2 CFLs) ___**2** (Showerhead) ___**3** (2 Aerators) **98** DK **99** Refused

46. How many people live at the residence?
_____ (Number of People) **98** Don't Know **99** Refused to Answer

47. What is the approximate annual household income from all sources before taxes?
_____ (Household Income) **98** Don't Know **99** Refused to Answer

EnergyCheckup™ PARTICIPANT HOMEOWNER SURVEY (cont'd)#_____

48. What is the highest level of education you have completed?
__1 (H.S.) **__2** (Some College) **__3** (College Grad) **__ 4** (Grad. School) **__5** (Grad. Degree) **98** DK **99** Refused

49. Which of the following best describes your racial or ethnic background?
__1 (Hispanic) **__2** (African) **__3** (Caucasian) **__ 4** (Asian) **__5** (Native Amer.) **__6** (_____) **__7** (Decline to state) **98** DK **99** Refused

50. Do you have any suggestions to improve the program?
___ 1 (Yes) **___ 2** (No) **98** Don't Know **99** Refused to Answer
If so, please provide the suggestion(s). _____

EnergyCheckup™ NON-PARTICIPANT HOMEOWNER SURVEY#_____

Participant Last Name _____ First Name_____ Title _____

Address_____ City _____ ZIP _____

Phone Number _____ Survey Date_____ Surveyor Initials _____

Non-Participant Survey (Homeowner or Renter)

I am conducting a survey regarding the GeoPraxis Time-of-Sale Home Inspection Program funded by the California Public Utilities Commission in 2002 and 2003. You didn't participate in the program, but your feedback will help us evaluate and improve the program. The program provided an EnergyCheckup™ inspection within traditional Time-of-Sale home inspections. Would you mind spending 5 minutes to answer a few questions?
[Select sample from recent home sales in matched service area; alternatively, ask EnergyCheckup™ inspectors to suggest typical non-participants to survey].

1. Would you have participated if you knew the program provided an EnergyCheckup™ inspection for your home during the traditional Time-of-Sale inspection of your home?

   ___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer

2. Please tell me why you choose not to participant in the program?
   (Read list – Multiple answers are okay.)

   1 Didn't know about EnergyCheckup™ program (i.e., information cost).

   2 Didn't understand benefits of EnergyCheckup™ inspection (i.e., performance uncertainty).

   3 Don't own the home (i.e., renter–misplaced or split incentive).

   4 Lack of time for inspector to perform work (i.e., hassle cost).

   5 Hired inspector who didn't know about EnergyCheckup™ program (i.e., asymmetric information).

   6 Realtor recommended or hired inspector and I wasn't involved in decision (i.e., bounded rationality).

   7 Didn't want to spend additional money on the EnergyCheckup™ audit.

   8 Other _____

   98 Don't Know **99** Refused to Answer

3. Please provide the following demographic information?

   _____ Floor Area ____#Occupants _____Household Income _____Ethnicity_____Own Rent **99** Refused

4. Do you have any suggestions that might have helped you participate in the program?

   ___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer
   If so, please provide the suggestion(s). _____

   _____

Appendix B: Process Survey Instrument for Inspectors

Interview Instructions for Process Survey

1. Purpose

The purpose of the Process Survey is to evaluate what works, what doesn't work, inspector satisfaction, and suggestions for improvement in the program's services and procedures.

2. Selection of Respondent

3. **Participants** must be the person responsible for providing the EnergyCheckup™ inspection at homes.
4. **Non-participants** must be an inspector who was unaware of the EnergyCheckup™ inspection program or decided not to participate as the EnergyCheckup™ inspection see non-participant survey at end).

3. Two Types of Participants

This survey will be used for two types of participant:

3. **Participant Inspectors**. Inspectors that performed an EnergyCheckup™ inspections.
4. **Non-participant Inspectors**. Inspectors that did not performed EnergyCheckup™ inspections.

4. How to Start a Survey

Complete the following steps to start one of these surveys:

5. Review www.EnergyCheckup.com/findinspector.asp (online database of trained home inspectors) and GeoPraxis customer file information (to identify status of inspector participants).
6. Make sure you understand the inspector's status (Untrained Non-Participant, Trained-Inactive, Trained-Active) with EnergyCheckup™ prior to initiating the visit or call.
7. Participant Survey Introduction.
   Say: "Hello! My name is [_____], and I am conducting a survey regarding the GeoPraxis Time-of-Sale Home Inspection Program. You provided EnergyCheckup™ inspections under the program during traditional Time-of-Sale home inspections. Funding for the program came from the California Public Utilities Commission. Would you mind spending 20 minutes to answer a few questions to help us evaluate and improve the program?
8. Non-participant Survey Introduction.
   Say: "Hello! My name is [_____], and I am conducting a survey regarding the GeoPraxis Time-of-Sale Home Inspection Program funded by the California Public Utilities Commission in 2002 and 2003. You didn't participate in the program, but your feedback will help us evaluate and improve the program. Would you mind spending 5 minutes to answer a few questions?

EnergyCheckup™ PARTICIPANT HOMEOWNER SURVEY #_____

Business Name _____ Last Name _____ First Name _____

Address _____ City _____ ZIP _____

Phone Number _____ Survey Date _____ Surveyor Initials _____

Participant Survey (Inspector)

1. When did you first get trained to perform EnergyCheckup™ inspections as part of traditional home inspections?
   _____ 00/00/00 (Month/Day/Year) **98** Don't Know **99** Refused to Answer
2. Have you received any supplemental EnergyCheckup™ training in 2002-03?
   ___ **1** (Yes) ___ **2** (No) **98** (DK) **99** (Refused)
3. How many EnergyCheckup™ inspections did you provide in 2002-03?
   ___ **Number of Inspections** **98** DK **99** Refused
4. How much time does it take you to perform a traditional home inspection?
   ___ Time (minutes**)** **98** DK **99** Refused
5. How much extra time does it take you to perform an EnergyCheckup™ inspection?
   ___ Time (minutes**)** **98** DK **99** Refused
6. Are you planning to continue offering EnergyCheckup™ inspections in the future?
   ___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer
7. Do you advertise EnergyCheckup™ inspections to all your customers?
   ___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer
8. What percentage of home buyers ask for EnergyCheckup™ inspections?
   ___ **Percentage** **98** Don't Know **99** Refused to Answer
9. What percentage of realtors recommend EnergyCheckup™ inspections?
   ___ **Percentage** **98** Don't Know **99** Refused to Answer
10. Would it help if realtors promoted EnergyCheckup™ inspections?
    ___ **1** (Yes) ___ **2** (No) **98** (DK) **99** (Refused)
11. Would it help if EnergyCheckup™ had better advertising to home buyers and realtors?
    ___ **1** (Yes) ___ **2** (No) **98** (DK) **99** (Refused)

For the following 3 questions I will ask you if you strongly disagree (1), disagree (2), agree (3), or strongly agree (4).

12. The EnergyCheckup™ program trainers and staff are courteous and professional?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused
13. The EnergyCheckup™ program trainers and staff are knowledgeable?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused
14. The amount of time required to complete an EnergyCheckup™ inspection is about right?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused
15. Do you typically provide the home buyer with a list of EnergyCheckup™ recommendations to save energy?
    ___ **1** (Yes) ___ **2** (No) **98** (DK) **99** (Refused)
16. Do you walk through the report with the home buyer to explain the EnergyCheckup™ recommendations?
    ___ **1** (Yes) ___ **2** (No) **98** (DK) **99** (Refused)
17. Do you explain…
    __**1** (Entire report) __**2** (Some portions) __**3** (Summary Info) __**4** (Nothing) **98** DK **99** Refused

For the following 4 questions I will ask you if you strongly disagree (1), disagree (2), agree (3), or strongly agree (4).

18. The EnergyCheckup™ training is easy to understand?
    ___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

EnergyCheckup™ PARTICIPANT INSPECTOR SURVEY #_____

19. The EnergyCheckup™ recommendations are easy to explain to home buyers?
___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

20. The information contained in the EnergyCheckup™ report is informative to home buyers?
___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

21. In general, the recommended energy savings are reasonable?
___ Response (**1=Strongly Disagree; 2=Disagree; 3=Agree; 4=Strongly Agree**) **98** DK **99** Refused

22. How would you rate the EnergyCheckup™ inspection program in terms of presentation on a scale from 1 to 4?
___ Response (**1 is low and 4 is high**) **98** Don't Know **99** Refused to Answer

23. Please provide your overall satisfaction with the EnergyCheckup™ program on a scale from 1 to 4?
___ Response (**1 is low and 4 is high**) **98** Don't Know **99** Refused to Answer

I'm going to read the EnergyCheckup™ recommendations and ask you to provide answers to three questions for each recommendation.

Q.	Description	Do you understand this recommendation? [1=Yes; 2=No; 98=DK 99=Refused]	What percent of time do you offer this recommendation? [0 to 100%]	Do you explain the recommendation to home buyers? [1=Yes; 2=No; 98=DK 99=Refused]
24	Basic HVAC Tune-up (AC Diagnostic Tune-up)			
25	Adv. HVAC Tune-up (Ducts + AC Tune-up)			
26	Duct Test & Seal			
27	E. Star Air Conditioner			
28	E. Star Furnace			
28	E. Star Heat Pump			
30	E. Star Dishwasher			
31	E. Star Refrigerator			
32	E. Star Torchiere			
33	E. Star Clothes Washer			
34	E. Star Window/Skylight			
35	Prog. Thermostat			
36	Wall insulation			
37	Attic Insulation			
38	Insul. Pkg. (Wall + Attic)			
39	Reduce Infiltration/Drafts			
40	Screw-in CFLs			
41	CFL Fixtures (Hardwired)			
42	Kitchen Fluorescent			
43	High Eff. Gas Wtr Htr			
44	Low-Flow Showerhead			
45	Pipe Insulation			

46. How many homes do you inspect per year?
_____ # **Inspections/yr** **98** Don't Know **99** Refused to Answer

47. What is your approximate gross annual income from home inspections?
_____ **Annual Income** **98** Don't Know **99** Refused to Answer

48. What is the highest level of education you have completed?
__**1** (H.S.) __**2** (Some College) __**3** (College Grad) __ **4** (Grad. School) __**5** (Grad. Degree) **98** DK **99** Refused

49. Which of the following best describes your racial or ethnic background?
__**1** (Hispanic) __**2** (African) __**3** (Caucasian) __ **4** (Asian) __**5** (Native Amer.) __**6** (_____) **98** DK **99** Refused

50. Do you have any suggestions to improve the program?
___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer
If so, please provide the suggestion(s). _____

EnergyCheckup™ NON-PARTICIPANT INSPECTOR SURVEY #_____

Business Name _____ Last Name _____ First Name _____

Address_____ City _____ ZIP _____

Phone Number _____ Survey Date_____ Surveyor Initials _____

Use www.CREIA.org list of home inspectors to develop sample of non-participant home inspectors.

Non-Participant Survey (Inspector)

I am conducting a survey regarding the GeoPraxis Time-of-Sale Home Inspection Program funded by the California Public Utilities Commission in 2002 and 2003. You didn't participate in the program, but your feedback will help us evaluate and improve the program. Would you mind spending 5 minutes to answer a few questions? The program provided training and software support to home inspectors to provide EnergyCheckup™ inspections within traditional Time-of-Sale home inspections. Would you mind spending 5 minutes to answer a few questions?

1. Would you have participated if you knew the program provided an easy-to-use EnergyCheckup™ inspection process incorporated within your traditional Time-of-Sale inspections?

   ___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer

2. Please tell me why you choose not to participant in the program?
   (Read list – Multiple answers are okay.)

   1 Didn't know about EnergyCheckup™ program (i.e., information cost).

   2 Didn't understand benefits of EnergyCheckup™ inspection (i.e., performance uncertainty).

   3 Don't own business so I don't make these decisions (i.e., misplaced or split incentive).

   4 Too busy or lack of time to perform additional work during traditional inspections (i.e., hassle cost).

   5 Customers and realtors aren't interested or don't know about EnergyCheckup™ program (i.e., asymmetric information).

   6 Realtor recommends traditional inspections only (i.e., bounded rationality).

   7 Other _____

   98 Don't Know **99** Refused to Answer

3. How many homes do you inspect per year?
   _____ # **Inspections/yr** **98** Don't Know **99** Refused to Answer

4. What is your approximate gross annual income from home inspections?
   _____ **Annual Income** **98** Don't Know **99** Refused to Answer

5. What is the highest level of education you have completed?
   __**1** (H.S.) __**2** (Some College) __**3** (College Grad) __ **4** (Grad. School) __**5** (Grad. Degree) **98** DK **99** Refused

6. Which of the following best describes your racial or ethnic background?
   __**1** (Hispanic) __**2** (African) __**3** (Caucasian) __ **4** (Asian) __**5** (Native Amer.) __**6** (_____) **98** DK **99** Refused

7. Do you have any suggestions that might have helped you participate in the program?

   ___ **1** (Yes) ___ **2** (No) **98** Don't Know **99** Refused to Answer
   If so, please provide the suggestion(s). _____

   _____

Appendix C: RMA EM&V Progress Report for GeoPraxis TOS Program #180-02

Robert Mowris & Associates
P.O. Box 2141, Olympic Valley, CA 96146 ■ (800) 786-4130 ■ Fax (530) 581-4970 ■ rmowris@earthlink.net

Date: February 20, 2004

Re: EM&V Progress Report for GeoPraxis TOS Home Inspection Program #180-02

To: Thomas Conlon
GeoPraxis, Inc.
205 Keller Street, Suite #202
Petaluma, CA 94952

Per our EM&V plan, this report provides feedback and corrective or constructive guidance regarding the implementation of the GeoPraxis Time-of-Sale Home Inspection Local Program #180. In November 2003, GeoPraxis sent us the following progress report.

- 112 audits to date
- 130 inspectors trained to date (130% of goal)
- 34 inspectors re-trained to date (106% of goal)
- 6 of 12 classes held in hard to reach geographic areas
- Adding "Energy Checkup and Report" to Real Estate Standard Authorization Form.

The program implementation plan goals also included serving approximately 12,000 single family, multifamily, and mobile home customers in the Pacific Gas and Electric (PG&E) service area. In addition to recommending comprehensive whole-house energy efficiency improvements and generating leads to the many rebate programs available, the TOS program also planned to provide a free "kit" of energy efficiency measures to participating homeowners:

- 8,500 efficient showerheads;
- 17,000 efficient faucet aerators (2 per house); and
- 17,000 compact fluorescent lamps (CFLs) (2 per house).

Program ex ante net energy savings goals from the free kits were 2,092,351 kWh/year, 1,246 kW and 190,752 therm/year.

In November and December 2003 RMA sent email messages to Tom Conlon of GeoPraxis and also conducted telephone discussions with Mr. Conlon to suggest ideas to improve the program and meet the program goals. The most important recommendation was to offer a $30 to $35 incentive to home inspectors to realize 400 to 600 home inspections per month for the remainder of the program. If implemented this recommendation would result in roughly 1,200 to 1,800 inspections by end of the first quarter of 2004 (closer to the PIP goal). Another recommendation was to develop a "Green Realtor/Home Inspector" training element that includes the GeoPraxis T-o-S EnergyCheckup™ Report and a kit of energy efficiency products that Green realtors use to sell homes and inspectors can use to help make home buyers more aware of energy efficiency and renewable energy opportunities. This recommendation is intended to create a win-win for Realtors, Home Inspectors, and California in terms of creating demand for increased energy efficiency at Time of Sale.