INTERACTIVE CONSUMPTION AND COST INFORMATION FOR SMALL CUSTOMERS – PROGRAM PROCESS/CUSTOMER RESPONSE EVALUATION – PROGRAM YEAR 2003

FINAL

APPENDICES

Prepared for

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P965-00

February 3, 2004

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WEB USER/ NON-USER SURVEY

PG&E

PG&E User/Non User Survey

Final Report

January 2004

Prepared for:

PG&E

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Background and Methodology

Overview

- **PG&E wished to receive feedback from respondents in order to further improve their California Energy Connection Web site.**
- **PG&E commissioned Socratic Technologies, a market research firm specializing in Web-based research, to conduct this survey.**
  - Specifically, Socratic Technologies surveyed both Users and Non Users of the californiaenergyconnection.com Web site.

Study Objectives

- **Understand user reaction to various parts of the Web site;**
- **Determine how often and which areas of the Web site users had visited;**
- **Measure the influence of the site in adoption of energy efficiency measures;**
- **Understand the level of awareness of the Californiaenergyconnection.com Web site among Non Users;**
- **Determine which energy efficiency measure have been adopted by Non Users;**
- **Gain insight to the level of interest in a Web site devoted to energy efficiency; and,**
- **Evaluate any changes in the objectives relative to last year's assessment.**

Questionnaire

- **Socratic Technologies developed the survey instrument in close conjunction with Quantum Consulting and PG&E. The survey instrument can be found in the appendix of this report.**
- **Socratic programmed all questionnaires, screeners and other research materials for online survey administration.**

Sampling Methodology

- **Sample was selected from Socratic Technologies' Forum[SM] and partnership panels, pre-recruited panels of online users that are representative of the online population as a whole.**

PG&E Users and Non Users Research

- **In addition, PG&E provided sample of known Web site Users.**
  - Because all the desired target audience were Web users, the Socratic Web Survey™ online research technology was used in this study.

Online Data Collection

- Data collection began on December 11, 2003 and was completed on January 2, 2004.
- Californiaenergyconnection.com Web site Users who completed the entire questionnaire received a $10 Amazon.com gift certificate and Non Users of Californiaenergyconnection.com received $3.
- A total of 478 respondents participated in this study.

Residential Users 150
Commercial Users 27
Total Users 177

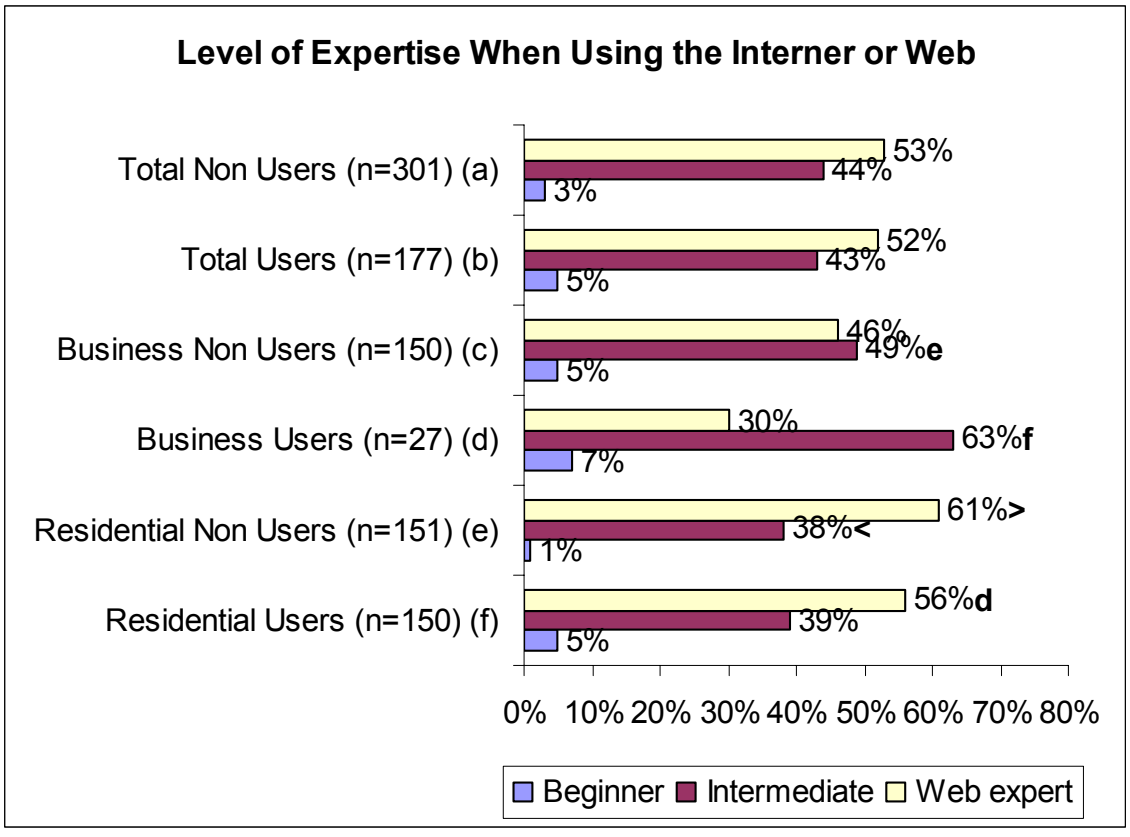
Residential Non Users 151
Commercial Non Users 150
Total Non Users 301

Detailed Findings

Demographics

Internet/Web Usage

- **Users and Non Users of Californiaenergyconnection.com are very similar in terms of their Web expertise.**
  - Approximately half of each User group consider themselves to be "Web Experts" (53% of Users and 52% of Non Users).
  - Business Non Users are more inclined to describe themselves as "intermediate Web users" than are Residential Non Users.
  - However, Residential Non Users are increasingly "Web Experts" when compared to the previous wave.

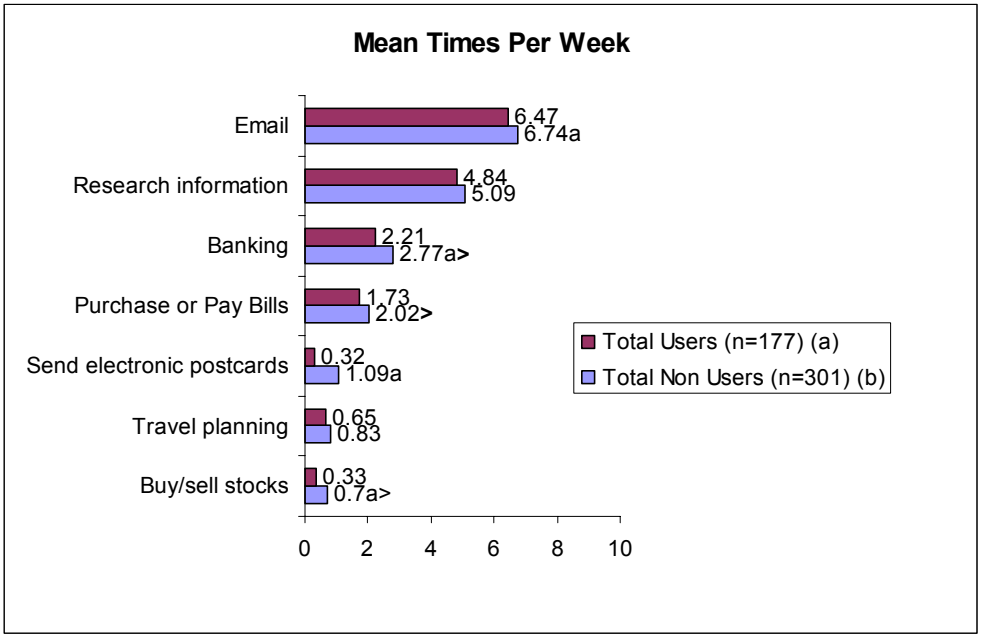


Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase.)

Demographics, continued

Online Activities

- **By far, email is the most pervasive Internet activity conducted on a weekly basis for both Users and Non Users of Californiaenergyconnection.com.**
- **In addition, both groups are equally inclined to use the Internet/Web to conduct online research, purchase items or pay bills, make travel plans and buy or sell stock.**
- **Interestingly, Non Users of Californiaenergyconnection.com are <u>more</u> inclined to use email, online banking and send electronic postcards than are Californiaenergyconnection.com Users.**
  - In addition, while Users are unchanged from the previous wave, Non Users are increasingly using online baking and using the Internet/Web to make purchases and pay bills.



Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase.)

Demographics, continued

Age

- **Overall, Users of Californiaenergyconnection.com are older than are Non Users. The approximated average age of Users is 47 while the Non Users average 42 years.**
- **Generally, most users are between 35 and 44 years of age.**
- **Residential Non Users definitely skew younger with nearly two-fifths with ages between 18 and 24 years.**
- **Users in this wave of research are older than those participating in last year's research.**

Respondent Age	Mean Age	Under 18	18-24	25-34	35-44	45-54	55-65	Over 65
Residential Users (n=150)	48	0%	1%	5%	29%	41%	17%	4%
Residential Non Users (n=151)	39	1%	5%	38%	26%	23%	5%	3%
Business Users (n=27)	46	0%	11%	4%	22%	37%	26%	0%
Business Non Users (n=150)	44	0%	1%	18%	31%	31%	14%	3%
Total Users (n=177)	47	0%	2%	5%	28%	40%	18%	3%
Total Non Users (n=301)	42	*	3%	28%	28%	27%	10%	3%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase.

Educational Background

- **At least two-fifths of respondents indicate having graduated college.**
  - However, as with last wave's findings, Users tend toward higher education levels.

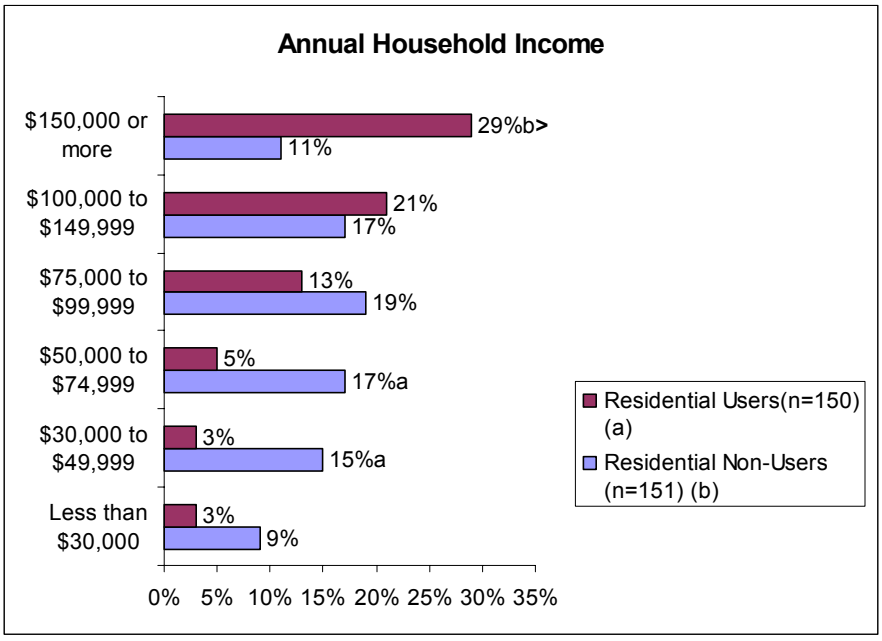
Respondent Highest Level of Education	Graduated High School	Trade or Technical School	Some College	Graduated College	Graduate School
Residential Users (n=150)	3%	0%	13%	41%	41%
Residential Non Users (n=151)	9%	4%	22%	44%	19%
Business Users (n=27)	0%	4%	33%	41%	22%
Business Non Users (n=150)	5%	4%	29%	42%	19%
Total Users (n=177)	2%	1%	16%	41%	38%
Total Non Users (n=301)	7%	4%	26%	43%	19%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase.)

Demographics, continued

Household Income

- **While the average household income among Non Users is significantly higher this wave than last ($84,000 current wave vs. $65,000 previously), it continues to lag significantly behind that of Users ($84,000 for Non User households vs. $120,000 for User households).**
  - This is a significant increase in household income when compared to the previous wave of research.
- **Non Users are more inclined to report household income levels below $75,000.**



Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase.)

Demographics, continued

Home Ownership

- **Nearly all of Californiaenergyconnection.com Users reside in single family homes (93%). While slightly more than two-thirds (69%) of Non Users reside in single family homes.**
- **More than two out of ten Non Users indicate residing in an apartment or condo (either with more or less than 4 units).**
- **These data are consistent with the previous wave's finding.**

Home Ownership	Residential Users (n=150) (a)	Residential Non Users (n=151) (b)
Single Family Home	93% b	69%
Apartment or condo in building with 4 or fewer units	1%	11% a
Apartment or condo in building with more than 4 units	2%	13% a
Town home	1%	5%
Trailer/mobile home	1%	2%
Other	1%	0%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave(< decrease, > increase.)

Awareness and Sponsorship of Californiaenergyconnection.com

Source of Californiaenergyconnection.com Awareness

- **Consistent with last year's research, more than one-third of all Users indicate being made aware of Californiaenergyconnection.com via a notice other than their electric bill received in the mail. Again, Business Users are more inclined to report this than are Residential Users.**
- **Residential Users are more likely to have been made aware of Californiaenergyconnection.com via their utility bill than are Business Users.**

Sources of Awareness	Residential Users (n=150) (a)	Business Users (n=27) (b)	Total Users (177)
Received notice in mail	33%	59% a	37%
Printed on utility bill	17% b	4%	15%
PGE.com	12%	7%	11%
A print advertisement	7%	7%	7%
A friend, colleague or family member recommer	2%	0%	2%
Internet search engine	2%	0%	2%
A link or banner ad on another website	1%	0%	1%
Other	5%	7%	5%
I'm not sure/Don't remember	21%	15%	20%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave(< decrease, > increase)

Awareness and Sponsorship of Californiaenergyconnection.com, continued

Sponsorship of Californiaenergyconnection.com

- **Awareness of PG&E as the sponsor of the Californiaenergyconnection.com Web site has increased significantly since 2002, 64% currently vs. 42% last wave.**
  - This increase in sponsorship awareness is driven entirely by Residential Users.
- **While the sponsorship communication has clearly improved, nearly one-quarter of Users continue to believe that the State of California is the Web site sponsor.**

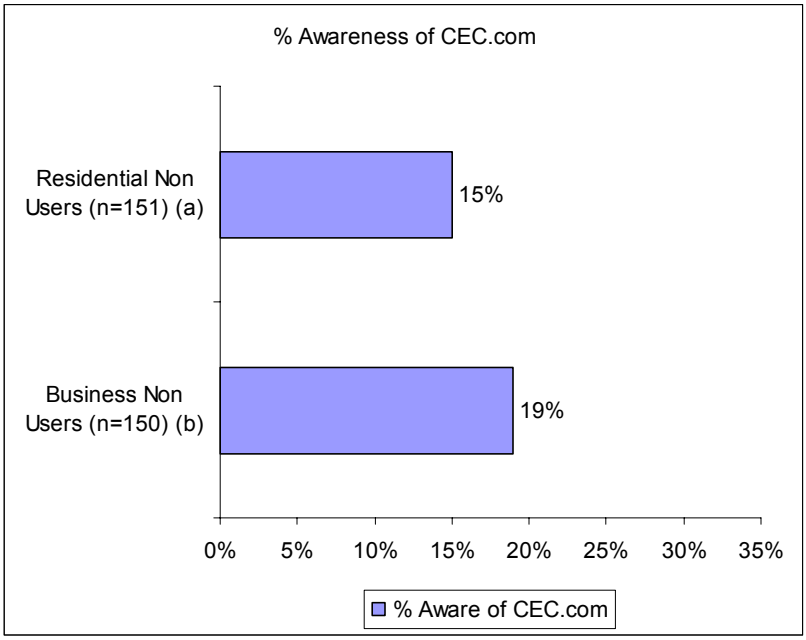
Sponsorship Awareness	Residential Users (n=150) (a)	Business Users (n=27) (b)	Total Users (177)
Pacific Gas & Electric	67% b >	44%	64% >
California Public Utility Commission	22%	37%	24%
The State of California	5%	11%	6%
A consumer watchdog group	3%	0%	2%
A for-profit energy services company	1%	4%	2%
Southern California Edison	1%	4%	1%
Someone else	1%	0%	1%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave(< decrease, > increase.)

Non Users of Californiaenergyconnection.com

Awareness

- **Awareness of Californiaenergyconnection.com among Non Users is quite low.**
- **Residential and Commercial Non Users are equally likely to be aware of the Californiaenergyconnection.com Web site.**



Energy Efficiency Attitudes Among Non Users

- **Overall, those Non Users who report being aware of the Californiaenergyconnection.com Web site appear to be more attuned to energy efficiency issues and concerns.**
  - Specifically, those aware of the site feel they are “well informed about how to save energy”, “aware of information about energy efficient products offered” feel that “credible information about energy is easy to find” and feel that the “media has effected their energy conservation” than are those who report being unaware of the Web site.
- **Compared to the previous wave, those aware also feel the “media coverage… made them use energy more carefully” has increased significantly.**
- **In addition, those unaware of the Californiaenergyconnection.com Web site agree less with the statement “I am aware of information about energy efficient products offered” than last year.**

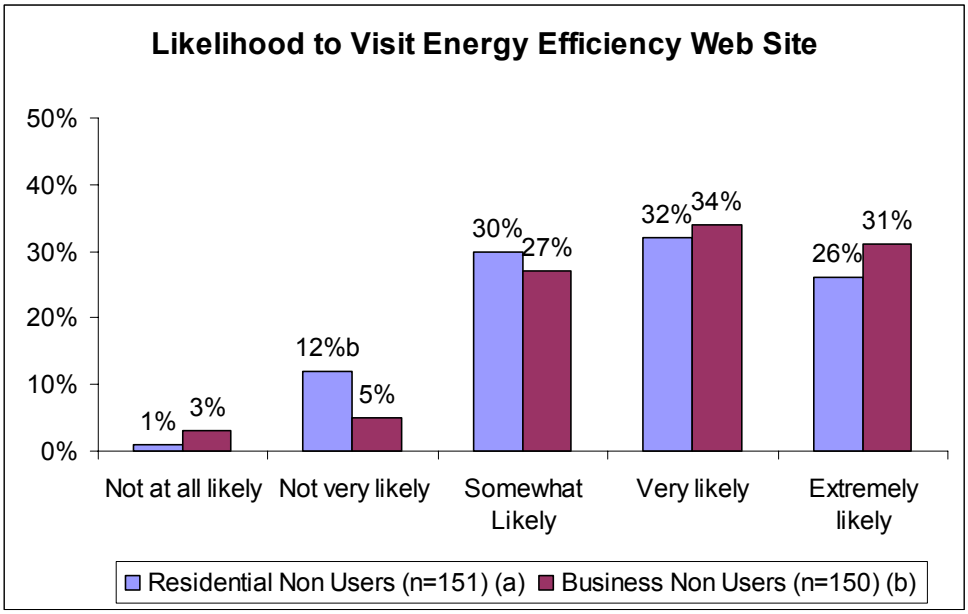
Non Users of Californiaenergyconnection.com, continued

Mean Agreement on 5-point agreement scale	Non Users Aware of Site (n=51) (a)	Non Users Unaware of Site (n=250) (b)
I am aware of information about energy efficient products offered by manufacturers	4.27 b	3.83 <
I am well-informed about how to save energy in my home/business	4.14 b	3.88
PG&E is a useful source of energy efficiency information	4.02	3.83
I've known all this conservation stuff for a long time	4.02	3.76
Media coverage of the energy crisis made me use energy more carefully	4.02 b >	3.67
Credible information about energy is easy to find	3.98 b	3.68
All this conservation stuff is common sense	3.82	3.75

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase)

Non User's Likelihood to Visit Energy Efficiency Web Site

- **More than one-quarter of both Residential and Business Non Users report being <u>Extremely likely</u> to visit energy efficiency Web sites.**
- **In addition, around one-third of Non Users indicate being <u>very likely</u> to visit a Web site of this type in the future.**
- **Virtually none of the Non Users indicate full rejection of the idea of Web sites dedicated to energy efficiency.**



Non Users of Californiaenergyconnection.com, continued

Attitudes Among Those Likely and Unlikely to Visit Energy Sites

- **Overall, there are few discernable differences in attitudes towards energy efficiency between those likely or unlikely to visit energy efficiency Web sites.**
- **The one difference is the pro PG&E statement "PG&E is a useful source of energy efficiency information".**
  - Those likely to use an energy efficiency Web site are more inclined to agree with this statement than are their counterparts.

Mean Agreement on 5-point agreement scale	Non Users Likely to use (n=270) (a)	Non Users Unlikely to use (n=31) (b)
PG&E is a useful source of energy efficiency information	3.91 b	3.39
I am well-informed about how to save energy in my home/business	3.91	4.00
I am aware of information about energy efficient products offered by manufacture	3.90	3.97
I've known all this conservation stuff for a long time	3.81	3.71
All this conservation stuff is common sense	3.75	3.87
Media coverage of the energy crisis made me use energy more carefully	3.79	3.26
Credible information about energy is easy to find	3.75	3.61

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase)

Sources of Energy Efficiency Information Among Non Users

- **Consistently, online searches, specifically the Google engine and Yahoo! engine, are mentioned most frequently as the method used to gather information about energy efficiency among both Residential and Business Non Users.**
- **The PG&E Web site is the next most frequently mentioned source with around one-quarter mentioning it.**

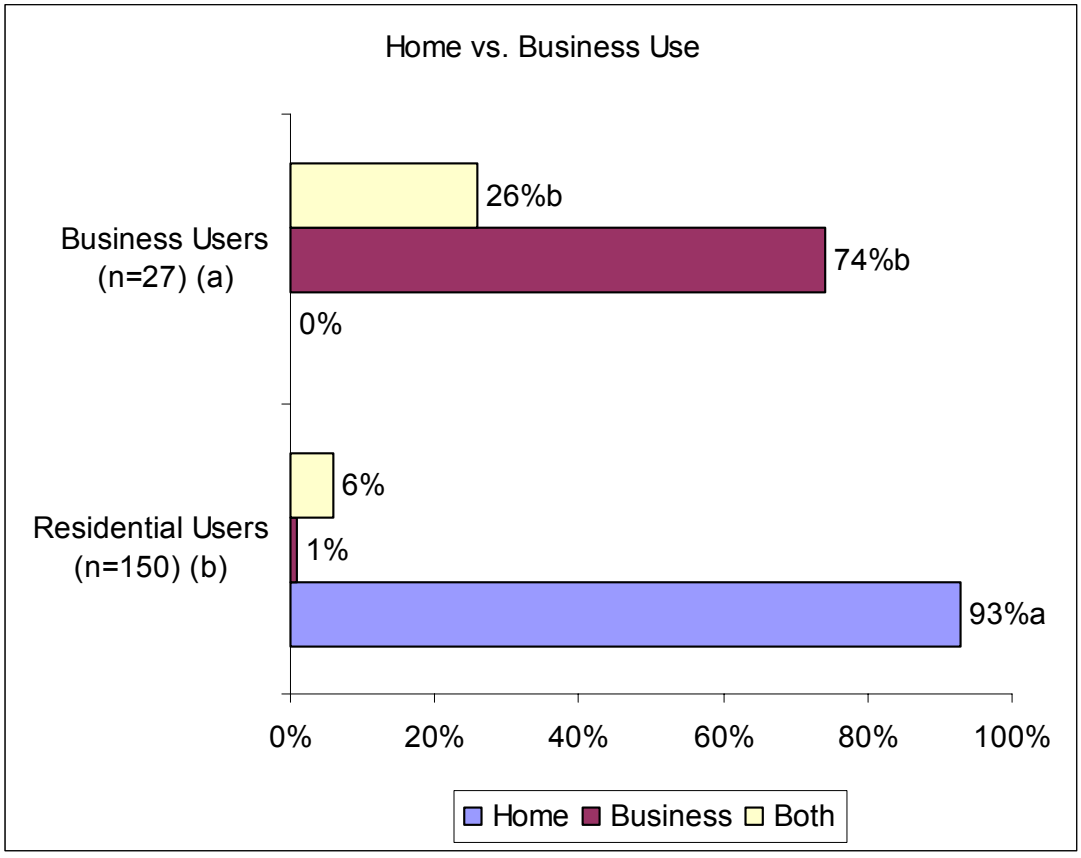
Sources of Information	Residential Non Users (n=144) (a)	Business Non Users (n=145) (b)	Total Non Users (289)
Online/Internet/Google/Yahoo	56%	51%	54%
PG&E Website	24%	23%	24%
PG&E (Non specific)	15%	18%	17%
Californiaenergyconnection.com	3%	3%	3%
Utility bill/stuffers/flyers included with my bill	1%	5%	3%

Coded open ended responses. Only responses with 3% or greater shown for brevity.

Californiaenergyconnection.com User Experience

Home vs. Business Users

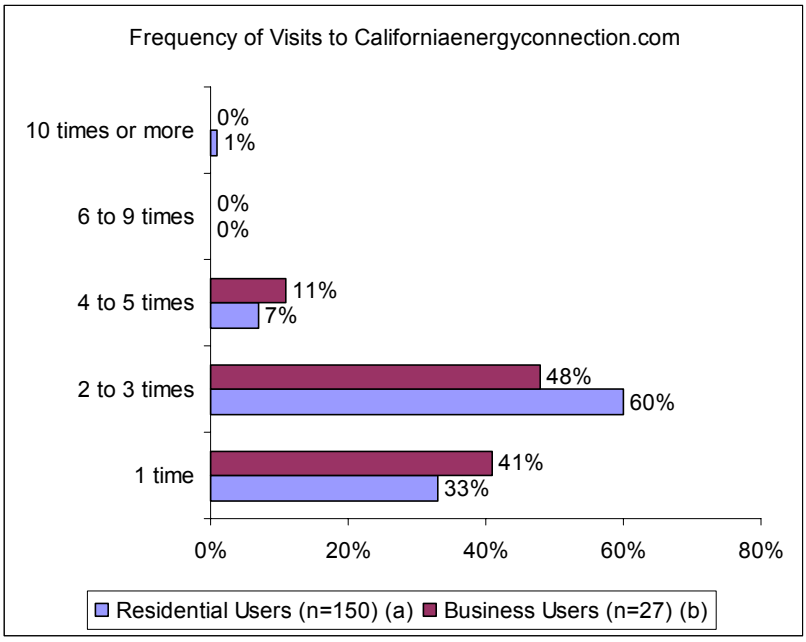
- **Nearly all Residential Users came to the Californiaenergyconnection.com Web site seeking information on home use (93%).**
- **Among Business Users, the vast majority (74%) were seeking information on business use. The remaining one-quarter (26%) were accessing efficiency information for their homes as well as their businesses.**



Californiaenergyconnection.com User Experience, continued

Frequency of Visits

- On average, Users visited the Californiaenergyconnection.com Web site twice in total.
- At least one-third of each User type indicate only visiting the Californiaenergyconnection.com Web site once.
- There are no statistical differences in visitation frequency between the two User types. However, Business Users do indicate higher frequency of visitation, directionally speaking.



Reason for Visits to Californiaenergyconnection.com

- More than half of Users of Californiaenergyconnection.com (53%) visited the site to get information on energy saving. This is an especially strong reason among Business Users with more than two-thirds mentioning it (70%).
- In addition, rebate opportunity information was also reported as a key reason for visiting the Web site.

Californiaenergyconnection.com User Experience, continued

Reasons for Visits vs. Most Important Reason	Reasons			Most Important Reason		
	Residential Users (n=150) (a)	Business Users (n=27) (b)	Total Users (n=177)	Residential Users (n=150) (a)	Business Users (n=27) (b)	Total Users (n=177)
Received a free gift from Amazon.com	57%	74%	59%	27%	19%	26%
Get tips on energy saving	49%	70% a	53%	15%	41% a	19%
Look for rebate opportunities	52%	37%	50%	14%	11%	14%
Learn about energy-saving products	40%	48%	41%	6%	4%	6%
Look at my energy usage history	38%	48%	40%	11%	15%	11%
Get an energy analysis	27%	30%	27%	6%	0%	5%
Use energy calculators to see the costs of various appliances	28% b	11%	25%	7%	0%	6%
Find out about renewable energy sources	19%	11%	18%	5%	7%	5%
See current news about energy	19%	7%	17%	3%	0%	2%
Use the Bill Analyzer to find out why my energy bill may have changec	9%	15%	10%	1%	0%	1%
Get information about the California energy market	9%	11%	9%	3%	0%	2%
Other	3%	4%	3%	2%	4%	2%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase)

Most and Least Visited Areas of Californiaenergyconnection.com

- **The Amazon.com free gift was the most visited area of Californiaenergyconnection.com.**
  - Other areas commonly visited include tips on energy savings, and rebate opportunities.
- **Return visitors are more likely to visit the energy history, energy analysis, current news and Bill Analyzer than are one-time visitors.**
- **Overall, the least visited areas of Californiaenergyconnection.com for both one-time and return visitors are the "current California energy market news" and "Bill Analyzer" areas.**

Most Visited Areas	One Time Visitors	Return Visitors
Receive a free gift from Amazon.com	63%	57%
Get tips on energy savings	48%	55%
Look for rebate opportunites	42%	54%
Learn about energy saving products	32%	46%
Look at my energy usage history	23%	**48% a**
Get an energy analysis	15%	**33% a**
Use energy calculators to see the costs of various appliances	20%	28%
Fin out about renewable energy sources	12%	21%
See current news about energy	8%	**21% a**
Use the Bill Analyzer to find out why my energy bill may have changed	3%	**13% a**
Get information about the California energy market	5%	11%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase)

Californiaenergyconnection.com User Experience, continued

Visibility of Areas Not Visited on Californiaenergyconnection.com

- **Energy saving tips, education about saving energy and rebate opportunities remain the most utilized sections of the Californiaenergyconnection.com Web site, however, usage has declined from levels observed in the previous wave.**
- **Nearly half of all Users indicate not noticing the "My Home Page" section of the Californiaenergyconnection.com Web site.**
- **Just less than one-third (29%) also indicate not observing the "Bill Analyzer" or "information about the California energy market" Web site features.**

Summary of Areas Visited on Californiaenergyconnection.com	Used (n=177)	Noticed But Did Not Use (n=177)	Did Not Notice (n=177)	Attractiveness Ratio@
Get tips on energy savings	75% <	10%	15%	7.8
Learn about energy savings	68% <	14%	18%	4.8
Look for rebate opportunities	63% <	18%	19%	3.6
See current news about energy	50% <	25%	25%	2.0
Look at my energy usage history	48% <	26%	26%	1.8
Use energy calculators to see the costs of various appliances	44% <	28%	28%	1.6
Find out about renewable energy sources	44% <	24%	32%	1.9
Get an energy analysis and customer savings recommendations	40% <	34%	26%	1.2
Get information about the California energy market	38% <	26%	36%	1.5
Use the Bill Analyzer to find out why my energy bill may have changed	29%	34%	37%	0.8
Use "My Home Page" to customize my Web site account	11%	36%	53%	0.3

Did Not Notice	Residential Users (n=150) (a)	Business Users (n=27) (b)	Total Users (n=177)
Use "My Home Page" to customize my Web site account	48%	30%	45%
Use the Bill Analyzer to find out why my energy bill may have changed	29%	30%	29%
Get information about the California energy market	29%	30%	29%
Fin out about renewable energy sources	23%	41%	26%
Use energy calculators to see the costs of various appliances	18%	30%	20%
See current news about energy	17%	26%	18%
Look at my energy usage history	18%	19%	18%
Get an energy analysis	17%	22%	18%
Look for rebate opportunities	11%	22%	13%
Learn about energy saving products	9%	15%	10%
Get tips on energy savings	7%	15%	8%

Letters indicate differences between sub-groups indicated. < and > indicate differences from previous wave (< decrease, > increase)

Californiaenergyconnection.com Usability

Ease of Use

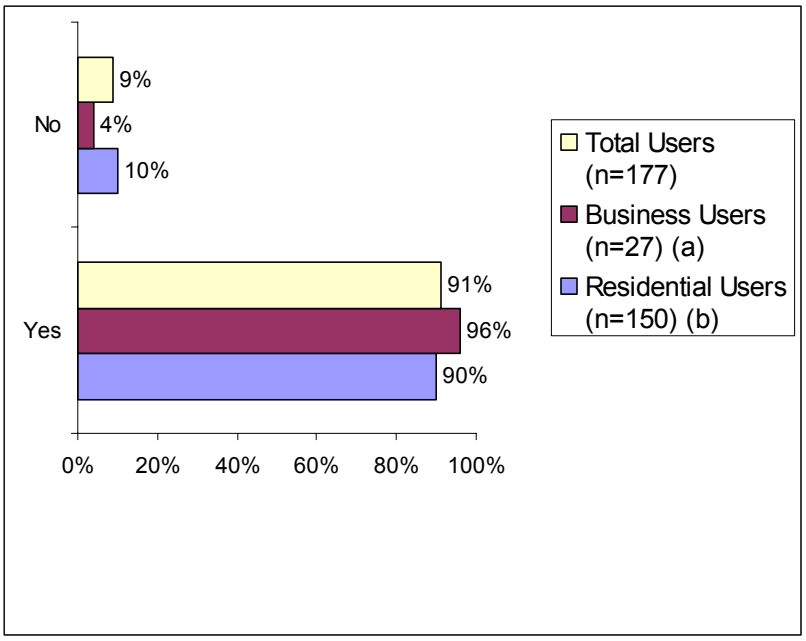
- **Users of the Californiaenergyconnection.com Web site evaluate the site as being easy to use with average ratings around 4 where a 5 meant "Extremely easy" to use.**
- **The "My Home Page" and "Bill Analyzer" surface as the least easy to use with mean ratings around 3.**

Mean Rating on a 5-Point Ease of Use Scale	Residential Users		Business Users		Total Users	
	Rating	Sample Size	Rating	Sample Size	Rating	Sample Size
Get tips on energy savings	3.99	112	4.00	19	3.99	131
Learn about energy-saving products	3.88	101	3.89	18	3.88	119
Look for rebate opportunities	3.85	93	4.00	15	3.87	108
See current news about energy	3.76	70	4.19	16	3.86	86
Use energy calculators to see the costs of various appliances	3.83	66	3.91	11	3.84	77
Look at my energy usage history	3.70	71	4.00	13	3.75	84
Get an energy analysis	3.75	59	3.58	12	3.72	71
Find out about renewable energy sources	3.67	67	4.14	7	3.72	74
Get information about the California energy market	3.73	52	3.69	13	3.72	65
Use "My Home Page" to customize my Web site account	3.43	14	3.80	5	3.53	19
Use the Bill Analyzer to find out why my energy bill may have changed	3.38	40	3.22	9	3.35	49

Californiaenergyconnection.com Future Use

Intention to Return to Californiaenergyconnection.com

- **The preponderance of Californiaenergyconnection.com Users, both Residential and Business, indicate they intend to visit the site again in the future (90% Residential and 96% Business).**
- **The most attractive aspects of the Californiaenergyconnection.com Web site in terms of intended future use include rebate opportunities, energy saving tips and Usage history.**

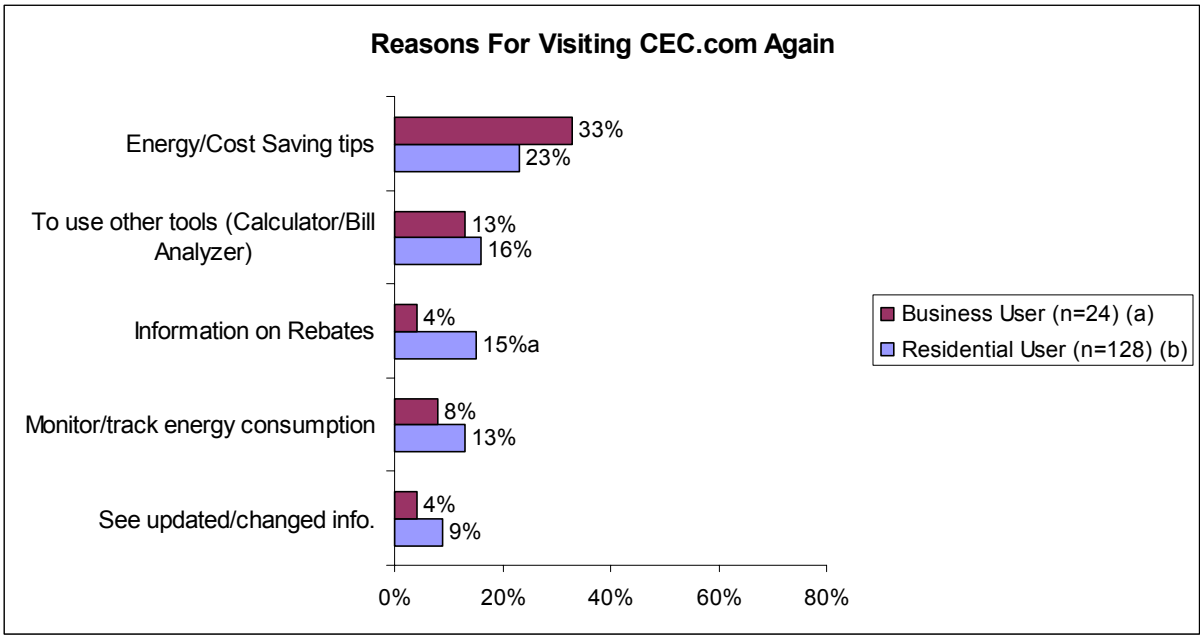


Areas of Califoniaenergyconnection.com intended for Future Visits by Users	Residential Users (n=135) (a)	Business Users (n=26) (b)	Total Users (n=161)
Look for rebate opportunities	81%	73% <	80%
Get tips on energy savings	68%	73%	69%
Look at my energy usage history	70%	62%	69%
Learn about energy saving products	64%	73% >	65%
Use energy calculators to see the costs of various appliances	62% b	38%	58%
Get an energy analysis	56%	54%	55%
Use the Bill Analyzer to find out why my energy bill may be changed	47%	35%	45%
See current news about energy	31%	35%	32%
Fin out about renewable energy sources	31%	35%	32%
Get information about the California energy market	25%	23%	25%
Use "My Home Page" to customize my Web site account	13%	12%	12%
Not sure	4%	4%	4%

Californiaenergyconnection.com Future Use, continued

Reasons for Future Visitation

- **Predictably, access to energy saving tips is the most prevalent reason for both Residential and Business User future Web site use.**
- **Interestingly, though use of other tools like the Calculator and Bill Analyzer were quite low, these tools are key reasons for future use.**
- **It is important to point out that these tools were not highly noticed when the Web site was being utilized. The most logical explanation for these reasons being stated is that the survey instrument introduced respondent to these tools.**



Opinions about Californiaenergyconnection.com

Attributes Describing Californiaenergyconnection.com

- **Both types of Users agree that the Californiaenergyconnection.com Web site is appealing, credible, technologically sound (loads quickly) and is well laid out.**
- **Business Users are more inclined to feel the lay out of the Web site is well done this year than previously.**
- **As with last year, Users continue to rate the Web site soft on being helpful in getting them to manage their energy usage or being helpful in getting them to make decision regarding purchasing energy efficient equipment.**
- **Return visitors evaluate every aspect of the Web site more positively than do one-time visitors. It is impossible to assess whether a higher satisfaction with a one-time visit drove the second visit or if multiple visits drive evaluations higher.**
- **Importantly, return visitors do <u>not</u> evaluate the Web site higher on being helpful in getting them to make decisions regarding purchasing energy efficient equipment.**

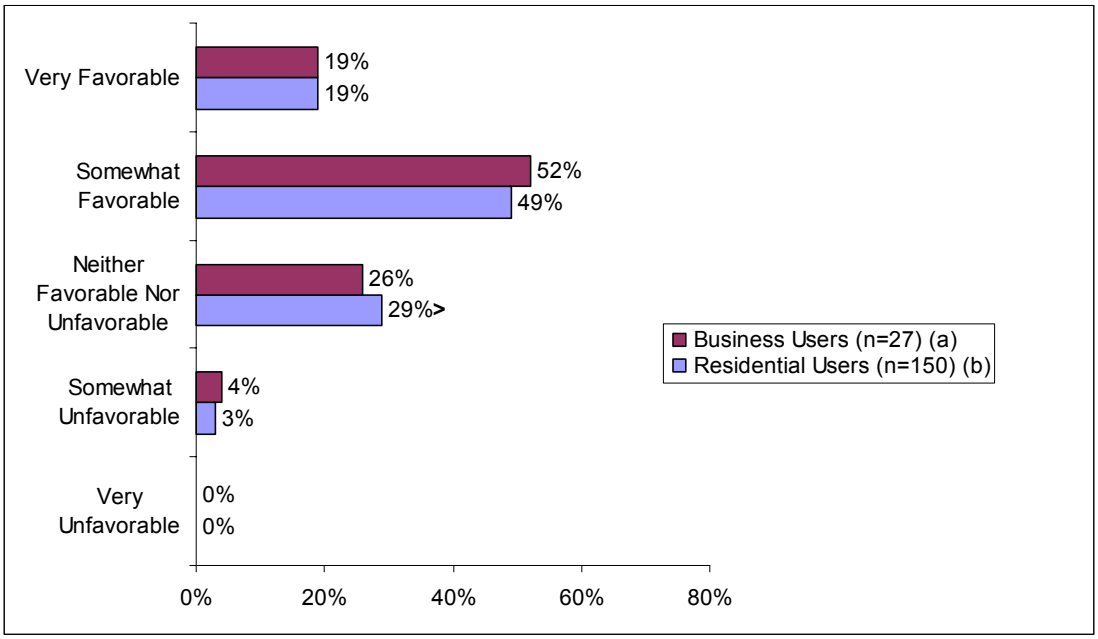
Mean Rating on a 5-Point Agreement Scale	Residential Users (n=150) (a)	Business Users (n=27) (b)	Total Users (n=177)
This Web site looks appealing	3.79	3.85	3.80
The energy-saving tips and recommendations are credible information	3.80	3.70	3.79
This Web site loads quickly and easily	3.75	3.85	3.77
The Web site is laid out well	3.75	3.74 >	3.75
ThisWeb site is interesting	3.73	3.74	3.73
This Web site is useful to me	3.70	3.63	3.69
This web site is easty to navigate	3.67	3.70	3.68
I would recommend this site to others	3.65	3.52	3.63
I would bookmark this site	3.48	3.67	3.51
Overall, the Web site was helpful in getting me to manage my energy usage	3.35	3.41	3.36
This Web site was helpful in getting me to make decisions regarding purchasing energy efficient equipment	3.26	3.04	3.23
It was hard to get the information I was looking for	2.57	2.59	2.57
This Web site is hard to understand	2.31	2.44	2.33

Opinions about Californiaenergyconnection.com, continued

Mean Rating on a 5-Point Agreement Scale	One-Time Visitors (n=60) (a)	Return Visitors (n=117) (b)
This Web site looks appealing	3.58	3.91 a
The energy-saving tips and recommendations are credible information	3.57	3.90 a
This Web site loads quickly and easily	3.53	3.89 a
The Web site is laid out well	3.48	3.88 a
ThisWeb site is interesting	3.45	3.88 a
This Web site is useful to me	3.38	3.85 a
This web site is easty to navigate	3.35	3.85 a
I would recommend this site to others	3.32	3.79 a
I would bookmark this site	3.32	3.61
Overall, the Web site was helpful in getting me to manage my energy usage	3.08	3.50 a
This Web site was helpful in getting me to make decisions regarding purchasing energy efficient equipment	3.05	3.32
It was hard to get the information I was looking for	2.75	2.48
This Web site is hard to understand	2.45	2.26

Overall Assessment

- **The majority of Users (~70%) assess the Californiaenergyconnection.com Web site favorably (Somewhat or Very).**
- **More than one-quarter of Users were unable to commit to evaluating the site as favorable or unfavorable. This is a marked increase for Residential Users over last wave.**
- **No Users found the Web site to be Very Unfavorable.**



Opinions about Californiaenergyconnection.com, continued

Reasons for Assessment

- **Highest evaluations of the Californiaenergyconnection.com Web site were driven by the usefulness of the information/suggestions provided and ease of use of the Web site.**
- **Lack of experience with the Web site is the primary reason cited for being unable to assess favorability towards the Web site.**

Reasons for Postive / Neutral Web Site Evaluation Among Users	Very Favorable (n=28)	Somewhat Favorable (n=75)	Neither Favorable Nor Unfavorable (n=44)
Informative/Userful information / suggestions	64%	49%	--
Easy / Quick to use	29%	19%	--
Complicated / hard to use / takes too much time	--	11%	7%
Information was not useful / current	--	8%	9%
Not enough use to evaluate / been too long to evaluate other	--	8%	59%
Needs link to other information (usage / billings)	--	7%	7%
Technical issues (load time / broken links)	--	3%	7%

Coded open end responses. Select mentions shown for brevity.

Usefulness of Activities on Californiaenergyconnection.com

Usefulness and Satisfaction with Features

- **With the exception of the "My Home Page" feature, most aspects of the Web site are evaluated as being fairly helpful.**
- **Repeat visitors are significantly more likely to assess several features as being more useful than are one-time visitors:**
  - Energy Calculators;
  - The site overall;
  - Energy saving tips;
  - Bill Analyzer; and,
  - Energy analysis and custom savings recommendations.
- **However, satisfaction with features remains consistent between User types with the exception if getting energy saving tips.**

Usefulness of Activities on Californiaenergyconnection.com, continued

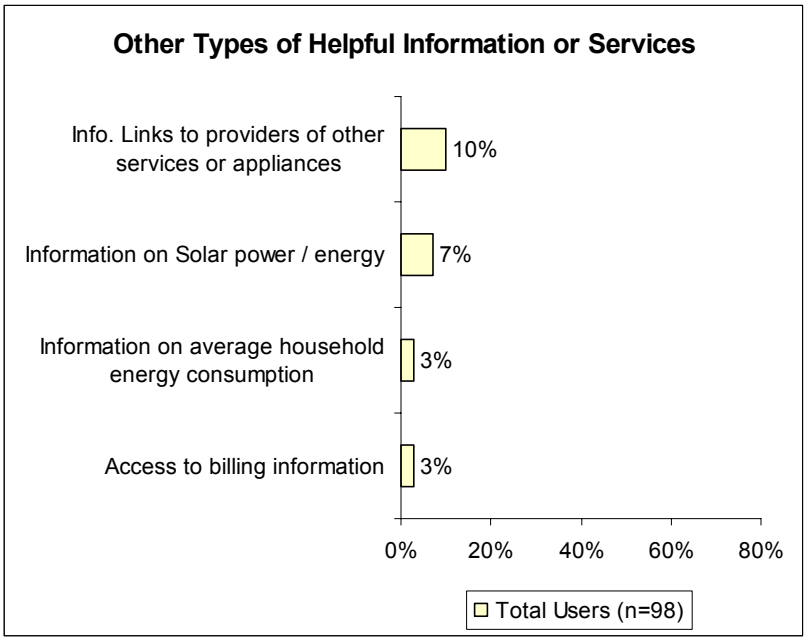
Usefulness of Activities	One-Time Visitors (n=60) (a)	Return Visitors (n=117) (b)
Use energy calculators to see the costs of various appliances	3.29	3.82 a
Look for rebate opportunites	3.50	3.74
Look at my energy usage history	3.06 <	3.70
The site overall	3.22	3.72 a
Get tips on energy savings	3.21	3.69 a
Learn about energy-saving products	3.30	3.55
Use the Bill Analyzer to find out why my energy bill may have changed	2.80	3.63 a
Get an energy analysis and custom savings recommendations	2.89 <	3.54 a
See current news about energy	3.05	3.36
Find out about renewable energy sources	2.94	3.34
Get information about the California energy market	2.64	3.14
Use "My Home Page" to customize my Web site account	2.38	3.17

Level of Satisfaction with Information Obtained @CEC.com	One-Time Visitors (n=60) (a)	Return Visitors (n=117) (b)
Look for rebate opportunites	3.52	3.92
Use energy calculators to see the costs of various appliances	3.69	3.87
Get tips on energy savings	3.51	3.93 a
Learn about energy-saving products	3.63	3.87
Look at my energy usage history	3.69	3.82
See current news about energy	3.71 >	3.69
Get an energy analysis	3.42	3.73
Find out about renewable energy sources	3.40	3.63
Get information about the California energy market	3.45	3.57
Use the Bill Analyzer to find out why my energy bill may have changed	3.00	3.62
Use "My Home Page" to customize my Web site account	3.29	3.50

Suggestions for Californiaenergyconnection.com

Suggestions

- **The majority of Users had no suggestions for additional information or services needed on the Web site.**
- **Among those who did make suggestions, links to services providers and information on solar power were most prevalent.**



Savings

Quantum does this section

Findings and Recommendations

Findings	Recommendations
As seen in the previous wave, Users of Californiaenergyconnection.com are more likely to be older, better educated and have higher income levels. In addition, Users are much more likely to reside in single family homes than are Non Users. As with last year, this is consistent with other energy efficiency research findings. Since last year's research, the average age of a User of Californiaenergyconnection.com has increased significantly.	Continue and elaborate any marketing efforts directed at these demographics. The increase in age of Users (to 47) may be a result of marketing efforts directed at these groups.
Mailings and utility bill information are effective at increasing awareness of the Californiaenergyconnection.com program as well as PG&E's sponsorship.	Continue utilizing these channels for accessing and attracting new users.
Among all Non Users, around 11% report being aware of the Californiaenergyconnection.com Web site but not yet accessing it. These Aware Non Users are predisposed to believing they are aware of energy efficiency information from manufacturers, the are well-informed about how to save energy, and feel that credible information about efficiency is easy to find.	Marketing efforts will need to break through the attitudinal barrier these Non Users have in order to create interest in using the Californiaenergyconnection.com Web site.
Non Users in general have a high likelihood to use energy efficiency Web sites in addition to considering PG&E to be a useful source of energy efficiency information.	Marketing efforts need to capitalize on the strengths of the Califorania Energy Connection Web site as a source or useful information to attract the "low hanging fruit" among Non Users.
The majority of Non Users indicated using Yahoo! or Google to find information on energy efficiency.	Be certain that these search engines cross reference PG&E as a source of information on energy efficiency.
Users come to Californiaenergyconnection.com for energy saving tips and rebate offers more so than any other reason. They are separately motivated to do so via the Amazon gift.	Continue incentives, perhaps broader rebates to increase visitation. As a bi-product of happily rewarded customers, word of mouth may prove advantageous to the Web site traffic as well.
Repeat customers continue to be more likely to utilize features of the site. In addition, there is positive momentum towards repeat visitation.	By keeping the site updated with current (seasonal) information as well as new rebates and links to other energy efficiency sites return usage should increase.
The more advanced features of the Web site (i.e., Bill Analyzer) has a soft impact when Users view the Web site however, interest in these features is fairly high.	Emphasize these tools on the Web site to increase their use, either at the initial visit or at a future visit.
Perhaps due to decreased sensitivity to the energy crisis, usage of almost all of the Web site features has declined since last year.	Use marketing effort to keep energy users informed about the need to conserve energy.
The Web site continues to fall short in convincing Users they have learned enough to actually decrease their energy efficiency. The statement, "This Web site was helpful in getting me to make decisions regarding purchasing energy efficient	The Web site needs to address a measure of success for this aspect of its offering.

equipment" continues to be rated very low by Users.	

Questionnaire

PG&E User/Non-User Survey

[ALL DIRECTIONS IN CAPITAL LETTERS ARE PROGRAMMING AND LOGIC INSTRUCTIONS. THESE WILL NOT BE VISIBLE TO SURVEY RESPONDENTS]

Survey Name: Energy Efficiency Survey **[NAME TO APPEAR ON ALL SCREENS]**

[FORCE RESPONSES TO ALL QUESTIONS UNLESS OTHERWISE SPECIFIED]

[ADD STATUS BAR TO EACH PAGE]

Quota:	600 Completed Interviews
Sample Cells:	Cell 1: Residential users (150) Cell 2: Residential non-users (150) Cell 3: Commercial users (150) Cell 4: Commercial non-users (150)
Sample Source:	Client list and Forum

Introduction Screen

Thank you for taking the time to participate in this survey. This survey is easy to complete and should take no more than 20 minutes of your time. As a thank you for participating, everyone who completes the survey will receive a $10 gift certificate from Amazon.com.

All Information Will Remain Confidential

Socratic Technologies, Inc., a market research firm that specializes in Web-based research, is conducting this survey. Your answers will be kept strictly confidential. Your name will not be given, sold, or traded to anyone, and no information about you will be released to anyone. Your answers will be combined with hundreds of other people's answers and only reported in total. We are simply interested in hearing your opinions

How to Complete the Survey

To record your responses, either type your answer in the space provided or select/click on the box (using your mouse) that corresponds to your answer choice. When the answer choices have a box next to them, you may "check" all that apply. When the answer choices have round buttons next to them, you will only be able to select one answer. Other questions require you to type a number or a text response into the space provided.

Whom to Contact with Questions

If at any point you have questions about the survey, please contact the Project Director, Ryan Hill at Socratic Technologies. Ryan's email address is ryan.hill@al.sotech.com. He can also be

reached Monday-Friday, 9am-5pm (Pacific Standard Time) at 1-800-5-SOCRATIC (1-800-576-2728) or 1-415-430-2200. When responding, please refer to the project number 466-002.

WE HOPE THAT YOU ENJOY THE SURVEY!

Begin the survey and record your participation by entering your email address. Please note that your email address will only be used for the purpose of sending you the gift certificate. You will not be contacted for any other reason.

Email: _____

[SEEDED DATABASE FROM CLIENT LIST]

----------*Screen Break*----------

QUESTIONNAIRE

[IF CELL = 2 OR 4, SKIP TO Q19, ELSE ASK Q1]

Q1 How did you find out about californiaenergyconnection.com?

Please select only one.

Printed on utility bill 1
A print advertisement 2
A friend, colleague or family member recommendation 3
A link or banner ad on another Web site 4
Internet search engine 5
PGE.com 6
Received notice in mail 7
Other, please specify **[TEXT BOX]** 8
I'm not sure/Don't remember 9

----------*Screen Break*----------

Q2 Approximately how many times have you visited californiaenergyconnection.com?

Please select only one.

1 time 1
2-3 times 2
4-5 times 3
6-9 times 4
10 times or more 5

Q3 Did you visit californiaenergyconnection.com to seek information for your home or business?

Please select only one.

Home 1
Business 2
Both 3

----------*Screen Break*----------

Q4 Which of the following statements describes your reason(s) for visiting californiaenergyconnection.com?

Please select all that apply.

[RANDOMIZE LIST]

_1 Look at my energy usage history
_2 Get an energy analysis
_3 Use energy calculators to see the costs of various appliances
_4 Get tips on energy savings
_5 Look for rebate opportunities
_6 Find out about renewable energy sources
_7 Learn about energy-saving products
_8 Get information about the California energy market
_9 See current news about energy
_10 Receive a free gift from Amazon.com
_11 Other, please specify **[TEXT BOX]**
_12 Use the Bill Analyzer to find out why my energy bill may have changed

.....

[IF COUNT Q4=1 THEN SKIP TO Q6 & WRITE CODE TO Q5; ELSE CONTINUE]

----------*Screen Break*----------

Q5 Of these reasons, which one is the most important reason for your visit to Web site?

Please select only one.

[PIPE Q4 RESPONSES]

[RANDOMIZE LIST]

Look at my energy usage history 1
Get an energy analysis 2
Use energy calculators to see the costs of various appliances 3
Get tips on energy savings 4
Look for rebate opportunities 5
Find out about renewable energy sources 6
Learn about energy-saving products 7
Get information about the California energy market 8
See current news about energy 9
Receive a free gift from Amazon.com 10
[PIPE TEXT FROM Q4_11] 11
Use the Bill Analyzer 12

----------*Screen Break*----------

Q6 How would you rate your overall impression of californiaenergyconnection.com?

Please select only one.

Very Favorable 5
Somewhat Favorable 4
Neither Favorable Nor Unfavorable 3
Somewhat Unfavorable 2
Very Unfavorable 1

Q7 Why did you say that?

Please be as specific as possible.

[TEXT BOX; DO NOT FORCE]

----------*Screen Break*----------

Q8a Using a scale of 1 to 5, where a 1 means "not at all useful" and a 5 means "extremely useful," please **rate how useful you found these activities**. If you did not perform a particular activity, select "Did not do this" for that activity.

Please select one for each item.

[SHOW SCALE VALUES]

Extremely useful				Not at all useful	Did not do this
5	4	3	2	1	6

[RANDOMIZE. ALWAYS KEEP _1 FIRST]

_1 The site overall
_2 Look at my energy usage history
_3 Get an energy analysis and custom savings recommendations
_4 Use energy calculators to see the costs of various appliances
_5 Get tips on energy savings
_6 Look for rebate opportunities
_7 Find out about renewable energy sources
_8 Learn about energy-saving products
_9 Get information about the California energy market
_10 See current news about energy
_11 Use the Bill Analyzer to find out why my energy bill may have changed
_12 Use "My Home Page" to customize my Web site account

[IF COUNT (Q8A=6)=12, SKIP TO 10B, ELSE CONTINUE]

[IF Q8A_1 = 6 SKIP TO Q10B]

----------Screen Break----------

Q8b Using a scale of 1 to 5, where a 1 means "not at all easy" and a 5 means "extremely easy," please **rate your level of difficulty completing** each of the following activities

Please select one for each item.

[SHOW SCALE VALUES]

Extremely easy				Not at all easy
5	4	3	2	1

[RANDOMIZE LIST]

_2 Look at my energy usage history **[PIPE IF Q8A_2<6]**
_3 Get an energy analysis **[PIPE IF Q8A_3<6]**
_4 Use energy calculators to see the costs of various appliances **[PIPE IF Q8A_4<6]**
_5 Get tips on energy savings **[PIPE IF Q8A_5<6]**
_6 Look for rebate opportunities **[PIPE IF Q8A_6<6]**
_7 Find out about renewable energy sources **[PIPE IF Q8A_7<6]**
_8 Learn about energy-saving products **[PIPE IF Q8A_8<6]**
_9 Get information about the California energy market **[PIPE IF Q8A_9<6]**
_10 See current news about energy **[PIPE IF Q8A_10<6]**
_11 Use the Bill Analyzer to find out why my energy bill may have changed **[PIPE IF Q8A_11<6]**
_12 Use "My Home Page" to customize my Web site account **[PIPE IF Q8A_12<6]**

----------*Screen Break*----------

Q9 Using a scale of 1 to 5, where a 1 means "very dissatisfied" and a 5 means "very satisfied," how satisfied were you with **the information you obtained** from each of the following:

Please select one for each item.

[DO NOT SHOW SCALE VALUES]

Very Satisfied	Somewhat Satisfied	Neither Satisfied nor Dissatisfied	Somewhat Dissatisfied	Very Dissatisfied
5	4	3	2	1

[RANDOMIZE LIST]

_2 Look at my energy usage history **[PIPE IF Q8A_2<6]**
_3 Get an energy analysis **[PIPE IF Q8A_3<6]**
_4 Use energy calculators to see the costs of various appliances **[PIPE IF Q8A_4<6]**
_5 Get tips on energy savings **[PIPE IF Q8A_5<6]**

_6 Look for rebate opportunities **[PIPE IF Q8A_6<6]**
_7 Find out about renewable energy sources **[PIPE IF Q8A_7<6]**
_8 Learn about energy-saving products **[PIPE IF Q8A_8<6]**
_9 Get information about the California energy market **[PIPE IF Q8A_9<6]**
_10 See current news about energy **[PIPE IF Q8A_10<6]**
_11 Use the Bill Analyzer to find out why my energy bill may have changed **[PIPE IF Q8A_11<6]**
_12 Use "My Home Page" to customize my Web site account **[PIPE IF Q8A_12<6]**

[ASK Q9a IF Q8A_11<6]

Q9a You mentioned that you used the Bill Analyzer (also called Bill Wizard) to help you understand why your usage may have changed. Did the Bill Analyzer help answer your questions on why your usage changed?

Please select only one.

Yes 1
No 2

[IF ANY OF Q8a_2 THROUGH Q8a_12<6, ASK Q10A; OTHERWISE SKIP TO Q10B]

----------*Screen Break*----------

Q10a You mentioned that you did not use the following functions on the Web site. Did you **notice these items** on the Web site?

Please select one for each item.

[RANDOMIZE LIST]

[DO NOT SHOW SCALE VALUES]

Noticed	Didn't Notice
1	2

_2 Look at my energy usage history **[PIPE IF Q8a_2=6]**
_3 Get an energy analysis **[PIPE IF Q8a_3=6]**
_4 Use energy calculators to see the costs of various appliances **[PIPE IF Q8a_4=6]**
_5 Get tips on energy savings **[PIPE IF Q8a_5=6]**
_6 Look for rebate opportunities **[PIPE IF Q8a_6=6]**
_7 Find out about renewable energy sources **[PIPE IF Q8a_7=6]**
_8 Learn about energy-saving products **[PIPE IF Q8a_8=6]**
_9 Get information about the California energy market **[PIPE IF Q8a_9=6]**
_10 See current news about energy **[PIPE IF Q8a_10=6]**
_11 Use the Bill Analyzer to find out why my energy bill may have changed **[PIPE IF Q8a_11=6]**
_12 Use "My Home Page" to customize my Web site account **[PIPE IF Q8a_12=6]**

----------*Screen Break*----------

Q10b Do you plan to visit this site again?

Please select only one.

Yes 1
No 2

Q10c Why or why not?

Please be as specific as possible.

[TEXT BOX; DO NOT FORCE]

[IF Q10B = 2 THEN SKIP TO Q12a, ELSE CONTINUE]

----------*Screen Break*----------

Q11 Which parts of the site will you return to?

Please select all that apply.

[DO NOT ALLOW _11 AND ANY OTHER RESPONSE]

[RANDOMIZE LIST]

_2 Look at my energy usage history
_3 Get an energy analysis
_4 Use energy calculators to see the costs of various appliances
_5 Get tips on energy savings
_6 Look for rebate opportunities
_7 Find out about renewable energy sources
_8 Learn about energy-saving products
_9 Get information about the California energy market
_10 See current news about energy
_12 Use the Bill Analyzer to find out why my energy bill may have changed
_13 Use "My Home Page" to customize my Web site account
_11 Not sure

----------*Screen Break*----------

Q12a Please indicate how strongly you agree or disagree with the following statements regarding californiaenergyconnection.com.

Please select one for each item.

[DO NOT SHOW SCALE VALUES]

Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
5	4	3	2	1

[RANDOMIZE]

_1 This Web site is interesting
_2 This Web site is easy to navigate
_3 This Web site is hard to understand
_4 This Web site looks appealing
_5 This Web site is useful to me
_6 This Web site loads quickly and easily
_7 I would recommend this site to others
_8 I would bookmark this site
_9 It was hard to get the information I was looking for
_10 The Web site is laid out well
_11 The energy-saving tips and recommendations are credible information
_12 Overall, the Web site was helpful in getting me to manage my energy usage
_13 This Web site was helpful in getting me to make decisions regarding purchasing energy efficiency equipment

----------*Screen Break*----------

Q12b Who do you think sponsors this Web site?

Please select only one.

[RANDOMIZE]

The State of California 1
Southern California Edison 2
Pacific Gas & Electric 3
Manufacturers of appliances or industrial equipment 4
San Diego Gas & Electric Company 5
A consumer watchdog group 6
California Public Utility Commission 7
A for-profit energy services company 8
Someone else 9

----------*Screen Break*----------

Q13 Are there any other types of information or services that would be helpful to you that you would like to see on this Web site?

Type your response in the space provided; please be as specific as possible.

[TEXT BOX; DO NOT FORCE]

[IF USER GOT RECS, CONTINUE

ELSE IF Q8A_5<>6, SKIP TO Q17A
ELSE IF Q8A_5 = 6 AND Q8A_6<6 SKIP TO Q18A
ELSE SKIP TO Q18B]

----------*Screen Break*----------

[ASK Q13a IF Q8A_11<6]

Q13A Our records indicate that you performed the Web energy audit. How useful would it have been to have a printable checklist of information you needed to input into the audit tool (such as type of appliances in your home) before doing the audit?

Please select one number between 1 and 5.

[DO NOT SHOW SCALE VALUES]

Very useful				Not at all useful
5	**4**	**3**	**2**	**1**

----------*Screen Break*----------

Q14a Now, we'd like to ask you about the recommendations you received from the Web energy audit. For each of the recommendations listed, please select the most appropriate response.

Please select only one for each item.

I already implemented this recommendation before visiting the Web site	I have implemented this Recommendation	I plan to implement this recommendation in the next 6 months	I plan to implement this recommendation in the next 6 to 12 months	I do not plan to implement this recommendation
5	**4**	**3**	**2**	**1**

_1 Avoid cooling unoccupied areas **[PIPE IF CL1=1]**
_2 Raise your thermostat settings of your air conditioner **[PIPE IF CL2=1]**
_3 Close drapes and shades during the cooling season to reduce the heat from the sun **[PIPE IF CL3=1]**
_4 Properly maintain your central air conditioning system **[PIPE IF CL6=1]**
_5 Use whole house fan more **[PIPE IF CL8=1]**
_6 Use your attic fan more **[PIPE IF CL9=1]**

_7 Replace your central air conditioner with a more efficient system **[PIPE IF CL10=1]**
_8 Regularly maintain your room air conditioner(s) **[PIPE IF CL12=1]**
_9 Replace your room air conditioner with a more efficient unit **[PIPE IF CL14=1]**
_10 Raise the temperature setting of your room air conditioner **[PIPE IF CL15=1]**
_11 Manually defrost your freezer on a regular basis **[PIPE IF FS1=1]**
_12 Replace your freezer with a more efficient freezer **[PIPE IF FS2=1]**
_13 Mover your freezer to a cooler temperature room **[PIPE IF FS3=1]**
_14 Regularly maintain your freezer and clean the coils **[PIPE IF FS4=1]**
_15 Raise temperature setting of your freezer **[PIPE IF FS5=1]**
_16 Turn off the moisture control heater of your freezer **[PIPE IF FS6=1]**
_17 Manually defrost your refrigerator on a regular basis **[PIPE IF FS7=1]**
_18 Properly maintain your refrigerator and clean the coils **[PIPE IF FS8=1]**
_19 Raise the temperature setting of your refrigerator **[PIPE IF FS9=1]**
_20 Turn off your second refrigerator when you're not using it or eliminate it **[PIPE IF FS10=1]**
_21 Move your spare refrigerator to a cooler location **[PIPE IF FS11=1]**
_22 Replace your refrigerator with a more efficient model **[PIPE IF FS13=1]**
_23 Lower the thermostat setting of your heater **[PIPE IF HT1=1]**
_24 Avoid heating unoccupied areas **[PIPE IF HT2=1]**
_25 Turn off pilot light of your heater during summer **[PIPE IF HT4=1]**
_26 Regularly maintain your heating system **[PIPE IF HT5=1]**
_27 Insulate pipes used to heat your home **[PIPE IF HT13=1]**
_28 Upgrade heating system **[PIPE IF HT15=1]**
_29 Replace your heating system with a more efficient system **[PIPE IF HT16=1]**
_30 Install Flue Damper on your furnace **[PIPE IF HT20=1]**
_31 Install Electronic Ignition on your furnace **[PIPE IF HT21=1]**
_32 Replace Oil Nozzle on your furnace **[PIPE IF HT22=1]**
_33 Replace Oil Burner on your furnace **[PIPE IF HT23=1]**
_34 Install Outdoor Reset Control on your water heater **[PIPE IF HT24=1]**
_35 Install a circulating fan control on your heater **[PIPE IF HT25=1]**
_36 Install an add-on hydro-air system on your heater **[PIPE IF HT26=1]**
_37 Install an Add-on Heat Pump **[PIPE IF HT27=1]**
_38 Turn lights off when you're not using them **[PIPE IF LT1=1]**
_39 Use compact fluorescent lamps in high-use lamps **[PIPE IF LT3=1]**
_40 Replace halogen torchiere with compact fluorescent torchiere **[PIPE IF LT4=1]**
_41 Use compact fluorescent lamps in recessed fixtures **[PIPE IF LT7=1]**
_42 Make up your waterbed every day **[PIPE IF OA6=1]**
_43 Lower the temperature of your waterbed **[PIPE IF OA7=1]**
_44 Insulate the sides and bottom of your waterbed **[PIPE IF OA8=1]**
_45 Replace your waterbed with a non-heated conventional bed **[PIPE IF OA9=1]**
_46 Turn off your computer when not in use **[PIPE IF OA10=1]**
_47 Lower the water temperature of your hot tub **[PIPE IF PS1=1]**
_48 Use your hot tub cover regularly **[PIPE IF PS2=1]**
_49 Lower the temperature of your pool **[PIPE IF PS4=1]**
_50 Run your pool pump less **[PIPE IF PS5=1]**

_51 Replace the pump motor with a more efficient unit **[PIPE IF PS6=1]**
_52 Install a solar heating loop for your pool **[PIPE IF PS7=1]**
_53 Use your pool cover more often **[PIPE IF PS8=1]**
_54 Use your pool cover regularly **[PIPE IF PS9=1]**
_55 Replace the windows in your home with energy efficient windows **[PIPE IF WE1=1]**
_56 Caulk windows and doors to prevent drafts **[PIPE IF WE3=1]**
_57 Insulate your air ducts **[PIPE IF WE4=1]**
_58 Improve attic, wall or foundation insulation **[PIPE IF WE5=1]**
_59 Seal leaks in air ducts **[PIPE IF WE6=1]**
_60 Install exterior solar screens on windows **[PIPE IF WE7=1]**
_61 Wash full loads of clothes when possible **[PIPE IF WH1=1]**
_62 When not washing full loads of clothes match the load setting to the size of the load **[PIPE IF WH2=1]**
_63 Use cooler temperature water for clothes wash and rinse **[PIPE IF WH3=1]**
_64 Replace your clothes washer with a horizontal axis (side loading) **[PIPE IF WH4=1]**
_65 Wash full loads of dishes when possible **[PIPE IF WH5=1]**
_66 Air dry dishes **[PIPE IF WH7=1]**
_67 Replace dishwasher with a more efficient unit **[PIPE IF WH9=1]**
_68 Lower the temperature setting of your water heater **[PIPE IF WH10=1]**
_69 Wrap your water heater with an insulating blanket **[PIPE IF WH11=1]**
_70 Install efficient faucet heads (aerators) on bathroom and kitchen sinks **[PIPE IF WH12=1]**
_71 Install low flow showerheads **[PIPE IF WH13=1]**
_72 Take shorter showers **[PIPE IF WH14=1]**
_73 Turn off the water heater when away from home for a week or more **[PIPE IF WH15=1]**
_74 Properly maintain your water heater **[PIPE IF WH16=1]**
_75 Install heat traps for your water heater **[PIPE IF WH17=1]**
_76 Insulate hot water pipes for your water heater **[PIPE IF WH19=1]**
_77 Replace your water heater with a more Efficient model **[PIPE IF WH22=1]**
_78 Control your water heater with a timer **[PIPE IF WH23=1]**
_79 Install a heat recovery water heating system **[PIPE IF WH24=1]**
_80 Dry full loads of clothes when possible **[PIPE IF WH91=1]**
_81 Avoid over drying clothes **[PIPE IF WH92=1]**
_82 Replace dryer with more efficient model **[PIPE IF WH94=1]**
_83 Reduce the amount of time you water your lawn **[PIPE IF WT1=1]**
_84 Repair your leaking faucets **[PIPE IF WT2=1]**
_85 Repair your leaking shower heads **[PIPE IF WT3=1]**
_86 Use your evaporative cooler "bleed off" water **[PIPE IF WT4=1]**
_87 Use soaker hoses on your garden **[PIPE IF WT5=1]**
_88 Replace grass with low-water use plants **[PIPE IF WT6=1]**
_89 Repair your leaking toilets **[PIPE IF WT7=1]**
_90 Install low flush toilets **[PIPE IF WT8=1]**
_91 Replace electric oven with a convection oven **[PIPE IF COOK1=1]**
_92 Use electric induction cooktops **[PIPE IF COOK2=1]**
_93 Use instant heat electric char-broilers **[PIPE IF COOK3=1]**

_94 Use infrared power burner fryers **[PIPE IF COOK4 =1]**
_95 Raise thermostat in summer when cooling and/or install programmable thermostat **[PIPE IF COOL1=1]**
_96 Install evaporative condensers **[PIPE IF COOL10=1]**
_97 Remove VAV inlet guide vanes and install variable speed drives **[PIPE IF COOL11=1]**
_98 Install a variable air volume (VAV) system **[PIPE IF COOL12=1]**
_99 Implement Differential Enthalpy Controls for Economizers **[PIPE IF COOL13=1]**
_100 Check for compressed air system leaks **[PIPE IF COOL14=1]**
_101 Install compressor demand controls **[PIPE IF COOL15=1]**
_102 Regularly service your cooling system **[PIPE IF COOL2=1]**
_103 Reduce cooling loads when unoccupied **[PIPE IF COOL3=1]**
_104 Replace air filters every season **[PIPE IF COOL4=1]**
_105 Install high efficiency chillers **[PIPE IF COOL5=1]**
_106 Install high efficiency air conditioner **[PIPE IF COOL6=1]**
_107 Replace your HVAC fan motor **[PIPE IF COOL7=1]**
_108 Implement a variable speed drive for your chiller **[PIPE IF COOL8=1]**
_109 Install Economizers for your air conditioner **[PIPE IF COOL9=1]**
_110 Decrease the temperature of your water heater **[PIPE IF DWH1=1]**
_111 Install Time Clocks with water heaters **[PIPE IF DWH2=1]**
_112 Insulate your water heater **[PIPE IF DWH3=1]**
_113 Install a heat pump water heater **[PIPE IF DWH4=1**]
_114 Use waste heat recovery strategy **[PIPE IF DWH5=1]**
_115 Use a water temperature booster for dishwashing **[PIPE IF DWH6=1]**
_116 Turn off equipment when not in use **[PIPE IF EQUIP1=1]**
_117 Use equipment with the Energy Star® logo **[PIPE IF EQUIP2=1]**
_118 Use power-down cash registers **[PIPE IF EQUIP3=1]**
_119 Use automatic power-down and power-up product scanners **[PIPE IF EQUIP4=1]**
_120 Lower thermostat in winter to heat and/or install programmable thermostat **[PIPE IF HEAT1=1]**
_121 Reduce heating load during unoccupied hours **[PIPE IF HEAT2=1]**
_122 Replace your old furnace with a pulse-fired furnace **[PIPE IF HEAT3=1]**
_123 Check for leaking ducts and seal them **[PIPE IF HEAT5=1]**
_124 Regularly service your heating system **[PIPE IF HEAT6=1]**
_125 Install high efficiency heating units **[PIPE IF HEAT7=1]**
_126 Install heat pumps **[PIPE IF HEAT8 =1]**
_127 Install controls to optimize start/stop cycles **[PIPE IF HEAT9=1]**
_128 Retrofit with T-8 Fluorescent Lighting **[PIPE IF LT1=1]**
_129 Replace incandescent lamps with compact fluorescent lamps **[PIPE IF LT3=1]**
_130 Retrofit with HID (high intensity discharge) exterior lights **[PIPE IF LT4=1]**
_131 Replace mercury vapor lamps with metal halide lamps **[PIPE IF LT5=1]**
_132 Retrofit your exit signs with energy-efficient light sources **[PIPE IF LT6=1]**
_133 Use fluorescent lamps in task light fixtures **[PIPE IF LT7=1]**
_134 Use day lighting on peripheral areas exposed to outside light **[PIPE IF LT8=1]**
_135 Use discharge lamps for display lighting **[PIPE IF LT9=1]**
_136 Use energy-efficient motors in refrigeration display cases **[PIPE IF REF1=1]**

_137 Use Gas defrost instead of Electric defrost **[PIPE IF REF2=1]**
_138 Clean heat exchanger coils regularly **[PIPE IF REF3=1]**
_139 Use Protocol Refrigeration Units **[PIPE IF REF4=1]**
_140 Install variable speed compressors **[PIPE IF REF5=1]**
_141 Install an integrated refrigeration/HVAC system with Heat Recovery **[PIPE IF REF6=1]**
_142 Utilize refrigeration case covers **[PIPE IF REF7=1]**
_143 Check for and seal cracks around windows and doors **[PIPE IF SHELL1=1]**
_144 Add Rigid Insulation to reduce heating and cooling demand **[PIPE IF SHELL2=1]**
_145 Add Attic Insulation to reduce heating and cooling demand **[PIPE IF SHELL3=1]**
_146 Install insulation above a dropped ceiling **[PIPE IF SHELL4=1]**
_147 Decrease summer heat gain by installing window film **[PIPE IF SHELL5=1]**
_148 Install exterior shading devices **[PIPE IF SHELL6=1]**
_149 Install air infiltration barriers or loading-dock seals **[PIPE IF SHELL7=1]**

[IF COUNT Q14a=2, 3 OR 4>0 CONTINUE]
[ELSE IF COUNT Q14A=1>0 SKIP TO Q15A]
[ELSE IF Q14A=5>0 SKIP TO Q15B]

----------*Screen Break*----------

Q14b Please tell me on a 1 to 10 scale, how much the website influenced your decision to implement each recommendation, where 1 means "not at all influential", and 10 is "very influential".

Not at All Influential									Very Influential
1	2	3	4	5	6	7	8	9	10

[PIPE ALL Q14a ITEMS <> 1 or<>5]

[IF COUNT Q14a=1 = 0 SKIP TO Q15B, ELSE CONTINUE]

----------*Screen Break*----------

Q15a Why don't you plan to implement these recommendations?

Please select only one for each item.

Too expensive	Too much hassle	I don't know enough about the equipment/technology	I have already done this	Some other reason
1	2	3	4	5

[PIPE ALL Q14a ITEMS=1]

----------*Screen Break*----------

Q15b Please tell us how much you agree or disagree with the following statements about the recommendations you received.

Please select one for each item.

[DO NOT SHOW SCALE VALUES]

Strongly Agree	Somewhat Agree	Neither Agree nor Disagree	Somewhat Disagree	Strongly Disagree
5	4	3	2	1

_1 Overall, these recommendations were very helpful
_2 The recommendations were too generic
_3 I was very satisfied with the recommendations
_4 I already know to do these recommendations
_5 I've already done most of the recommendations
_6 The measures/technologies recommended are produced by companies I know
_7 I know where I can purchase the recommended measures/technologies
_8 Implementing the recommendations will be straight forward/easy

[IF COUNT Q14A=4 OR 5 > 0 CONTINUE]
[ELSE IF Q8A_5 < 6 SKIP TO Q17A]
[ELSE IF Q8A_6 < 6 SKIP TO Q18A]
[ELSE SKIP TO Q18B]

----------*Screen Break*----------

Q16 Have the savings you have achieved on your energy bill as a result of implementing the recommendations…

Please select only one for each statement.

Exceed expectations	Meet expectations	Not meet expectations	Too soon to tell
3	2	1	4

[PIPE Q14a=4 or 5]

[IF Q8A_5 < 6 CONTINUE]
[ELSE IF Q8A_6 < 6 SKIP TO Q18A]
[ELSE SKIP TO Q18B]

----------*Screen Break*----------

Q17A Now, we'd like to ask you about the 10 Simple Tips you read on the web site. For each of the tips listed, please select the most appropriate response.

Please select only one for each item.

I already implemented this tip before visiting the Web site	I have implemented this tip	I plan to implement this tip in the next 6 months	I plan to implement this tip in the next 6 to 12 months	I do not plan to implement this tip
5	4	3	2	1

[IF CELL = 1 DISPLAY ITEMS _1 THROUGH _10, ELSE DISPLAY ITEMS _11 THROUGH _20]

_1 In the winter, turn your thermostat down when your home is unoccupied
_2 In the summer, turn your thermostat up when you leave your home
_3 Consider installing an Energy Star® programmable thermostat
_4 Consider installing an attic whole house fan
_5 To heat your home, keep the shutters, drapes, and blinds on south-facing windows open during the day
_6 During the cold winter months, close all shutters, drapes, and/or blinds at night
_7 Move your refrigerator-freezer out from the wall for good air circulation and vacuum its condenser coils once a year
_8 Use latex or silicone caulk to fill holes and cracks around windows
_9 Consider using fluorescent light bulbs
_10 Use photo sensors to ensure outdoor lighting is not on in the daytime
_11 In the summer, turn your thermostat up or off when you close your business at night
_12 Consider installing an Energy Star® programmable thermostat in your business
_13 Have a licensed service technician perform regular maintenance on your business's air conditioning system
_14 Turn off idle PCs in your business
_15 Purchase energy-efficient printers
_16 Purchase photocopiers with an energy-saver feature
_17 Move your business's refrigerator-freezer out from the wall for good air circulation and vacuum its condenser coils once a year
_18 Replace your business's existing incandescent and mercury vapor light fixtures and lamps with metal halide or high pressure sodium High Intensity Discharge (HID) ones
_19 Consider using fluorescent light bulbs in your business
_20 Use natural daylight

[IF COUNT Q17A=4,3, OR 2>0 THEN CONTINUE]

[ELSE IF COUNT Q17A=1>0 OR Q17A=4, 3 OR 2 IS 0 OR IF Q17A=5>0 THEN SKIP TO Q17C]
[ELSE IF COUNT Q17A=1>0 OR Q17A=4, 3 OR 2 IS 0 OR IF Q17A=5>0 AND Q8A_6=6 THEN SKIP TO Q17C]

----------*Screen Break*----------

Q17b Please tell me on a 1 to 10 scale, how much the website influenced your decision to implement each tip, where 1 means "not at all influential", and 10 is "very influential".

Not at All Influential									Very Influential
1	2	3	4	5	6	7	8	9	10

[PIPE ALL Q17A ITEMS <> 1 OR 5]

----------*Screen Break*----------

Q17C In general, would you say that the 10 Simple Tips are:

Please select only one.

[RANDOMIZE 1 & 2]

Too generic 1
Too specific 2
Just right 3

[IF Q8a_6 <> 6, CONTINUE]
[ELSE IF Q8a_6= 6 SKIP TO Q18B]

----------*Screen Break*----------

Q18A What, if any, energy saving products with rebates did you buy?

[TEXT BOX; DO NOT FORCE]

Q18AA Did you actually receive any rebates after using the rebate finder tool?

Yes 1
No 2

----------*Screen Break*----------

Q18B Did the product information and manufacturer links featured on the site influence you to purchase a product?

Please select only one.

Yes 1
No 2

[IF Q18B = 2 THEN SKIP TO Q19, ELSE CONTINUE]

----------*Screen Break*----------

Q18C What energy saving products did you buy?

[TEXT BOX; DO NOT FORCE]

----------*Screen Break*----------

Q18D Was enough information provided by californiaenergyconnection.com for you to select a product without using any other information sources?

Please select only one.

Yes 1
No 2

----------*Screen Break*----------

Q19 Please tell us how much you agree with the following statements about energy use.

Please select only one for each statement.

Agree Strongly	Agree Somewhat	Neither agree nor disagree	Disagree somewhat	Disagree strongly

5	4	3	2	1

[RANDOMIZE]

_1 Credible information about saving energy is easy to find
_2 I am well-informed about how to save energy in my home/business
_3 I am aware of information about energy efficient products offered by manufacturers
_4 All this conservation stuff is just common sense
_5 I've known all this conservation stuff for a long time
_6 PG&E is a useful source of energy efficiency information
_7 Media coverage of the energy crisis made me use energy more carefully

----------*Screen Break*----------

Q20aa On a scale of 1 to 10, with 1 being not at all knowledgeable and 10 being very knowledgeable, how would you rate your knowledge of conservation and energy efficiency **today**?

Not at All Knowledgeable									Very Knowledgeable
1	2	3	4	5	6	7	8	9	10

[IF CELL 1 OR 3, CONTINUE, ELSE SKIP TO Q20B]

----------*Screen Break*----------

Q20ab On a scale of 1 to 10, with 1 being not at all knowledgeable and 10 being very knowledgeable, how would you rate your knowledge of conservation and energy efficiency **prior to visiting the web site**?

Not at All Knowledgeable									Very Knowledgeable
1	2	3	4	5	6	7	8	9	10

[SKIP TO D1]

----------*Screen Break*----------

Q20b Which, if any, of the following energy saving activities have you done at your **[IF CELL = 2 THEN PIPE "HOME" ELSE PIPE "BUSINESS"]** in the past 12 months?

Please select only one for each item.

I have done this	I plan to do this in the next 6 months	I plan to do this in the next 6 to 12 months	I do not plan to do this
4	3	2	1

_1 Caulk windows and doors to prevent drafts **[PIPE IF CELL=2]**
[_2 DELETED]
[_3 DELETED]
[_4 DELETED]
_5 Install an Energy Star® programmable thermostat **[PIPE IF CELL=2]**
_6 Use compact fluorescent lamps in high-use lamps **[PIPE IF CELL=2]**
[_7 DELETED]
[_8 DELETED]
[_9 DELETED]
_10 Properly maintain your refrigerator and clean the coils **[PIPE IF CELL=2]**
[_11 DELETED]
_12 Improve insulation in your attic, walls or foundation **[PIPE IF CELL=2]**
_13 Seal leaks in air ducts
_14 Replace your refrigerator with an Energy Star® energy efficient model **[PIPE IF CELL=2]**
_15 Replace your clothes washer with a horizontal axis (side-loading) washer **[PIPE IF CELL=2]**
_16 Replace the windows in your home with dual pane, storm, or other energy efficient windows **[PIPE IF CELL=2]**
_27 In the winter, turn your thermostat down when your home is unoccupied **[PIPE IF CELL=2]**
_28 In the summer, turn your thermostat up when you leave your home **[PIPE IF CELL=2]**
_29 To heat your home, keep the shutters, drapes, and blinds on south-facing windows open during the day **[PIPE IF CELL=2]**
_30 During the cold winter months, close all shutters, drapes, and/or blinds at night **[PIPE IF CELL=2]**
_31 Use photo sensors to ensure outdoor lighting is not on in the daytime **[PIPE IF CELL=2]**
_32 Install an attic whole house fan **[PIPE IF CELL=2]**

_17 Regularly service your heating and air conditioning systems **[PIPE IF CELL=4]**
[_18 DELETED]
[_19 DELETED]
_20 Use day lighting on peripheral areas exposed to outside light **[PIPE IF CELL=4]**
_21 Replace incandescent bulbs or T-12 fluorescent tube lights with energy efficient T-8 fluorescent tube lighting **[PIPE IF CELL=4]**
_22 Replace incandescent lamps with compact fluorescent lamps **[PIPE IF CELL=4]**
_23 Replace existing incandescent and mercury vapor light fixtures and lamps with metal halide or HID lamps **[PIPE IF CELL=4]**
_24 Install high efficiency air conditioner **[PIPE IF CELL=4]**
_25 Retrofit your exit signs with energy-efficient light sources, such as LED exit signs **[PIPE IF CELL=4]**
_26 Replace your old furnace with a high efficiency heating unit **[PIPE IF CELL=4]**
_33 In the summer, turn your thermostat up or off when you close your business at night **[PIPE IF CELL=4]**
_34 Install an Energy Star® programmable thermostat in your business **[PIPE IF CELL=4]**
_35 Turn off idle PCs in your business **[PIPE IF CELL=4]**
_36 Purchase energy-efficient printers, with the Energy Star® logo **[PIPE IF CELL=4]**
_37 Purchase photocopiers with an energy-saver feature, with the Energy Star® logo **[PIPE IF CELL=4]**
_38 Move your business's refrigerator-freezer out from the wall for good air circulation and vacuum its condenser coils once a year **[PIPE IF CELL=4]**

----------*Screen Break*----------

Q20c Have you ever heard of californiaenergyconnection.com, a web site where you can get energy efficiency recommendations for your home or business?

Please select only one.

Yes 1
No 2

Q21 How likely are you to visit a site where you can get customized energy efficiency recommendations for your home or business, energy saving tips, and learn about rebates and energy saving products?

Please select only one.

Extremely likely 5
Very likely 4
Somewhat likely 3
Not very likely 2

Not at all likely 1

----------*Screen Break*----------

Q22 If you wanted information on how to reduce energy usage, where would you look?

[TEXT BOX; DO NOT FORCE]

----------*Screen Break*----------

Demographics

Now we would like to get a little information about you. Remember, all of your responses are completely confidential. Your answers will be combined with the answers of hundreds of other people's answers and reported only in aggregate.

D1 Which of the following statements best describes your level of expertise when it comes to using the Internet or the Web? Would you say…?

Please select only one.

I consider myself a beginner, just starting to figure out how to navigate the Internet or the Web 1
I consider myself to be at the intermediate level and have a good working knowledge of how to navigate the Internet or Web 2
I consider myself to be a "Web expert" when it comes to navigating the Internet or Web 3

----------*Screen Break*----------

D2 How frequently would you say that you do the following activities?

Please select one for each item.

[RANDOMIZE LIST]

	Daily 5	A few times a week 4	A few times a month 3	A few times a year 2	Never 1
_1 Purchase or pay bills online					

_2 Research information online
_3 Do travel planning online
_4 Do your banking online
_5 Buy or sell stocks online
_6 Send electronic postcards such as birthday cards
_7 Email

----------*Screen Break*----------

D3 Are you…

Please select only one.

Male.....1
Female 2
Prefer not to say.....3

D4 Which of the following groups includes your age?

Please select only one.

Under 18 1
18 - 24 2
25 - 34 3
35 - 44 4
45 - 54 5
55 - 65 6
Over 65 7
Prefer not to say 8

D5 What is the highest level you completed in school?

Please select only one.

Elementary school 1
Some high school 2
Graduated high school 3
Trade or technical school 4
Some college 5
Graduated college 6
Graduate/professional school 7
Prefer not to say 8

[IF CELL 3 OR 4, SKIP TO D8, ELSE CONTINUE]

----------*Screen Break*----------

D7 Which of the following ranges includes your total annual household income before taxes?

Please select only one.

Less than $30,000 1
$30,000 – $49,999 2
$50,000 – $74,999 3
$75,000 - $99,999 4
$100,000 - $149,999 5
$150,000 or more 6
Prefer not to say 7

D7A Which of the following best describes your home?

Single family home 1
Apartment or condo in building with 4 or fewer units 2
Apartment or condo in building with more than 4 units 3
Townhome 4
Trailer/mobile home 5

Other 6

[SKIP TO CLOSE]

----------*Screen Break*----------

D8 Which of the following categories describes the number of employees your firm has at this location?

1 to 5 1
6 to 10 2
11 to 20 3
21 to 50 4
51 to 100 5
Or, over 100 6

D9 What is the approximate total square footage of your facility at this location to be …?

Less than 2,500 square feet 1
2,500 but less than 5,000 square feet..... 2
5,000 but less than 10,000 square feet..... 3
10,000 but less than 20,000 square feet..... 4
20,000 but less than 50,000 square feet..... 5
50,000 but less than 100,000 square feet..... 6
Ag/Non-facility – Outdoors 7
Don't know 8

D10 What is the main activity at your business?

Please select only one.

Office..... 1
Retail (non-food) 2
College/university..... 3
School 4
Grocery store 5
Convenience store 6
Restaurant..... 7
Health care/hospital 8
Hotel or motel..... 9
Warehouse..... 10
Personal Service 11
Community Service/Church/Temple/Municipality 12
Industrial Process/Manufacturing/Assembly..... 13
Condo Assoc/Apartment Mgmt 14
Industrial Process/Manufacturing/Assembly..... 16
Other, please specify [TEXT BOX] 15

----------*Screen Break*----------

CLOSING

[CLOSING SCREEN – CLIENT SAMPLE]

Those are all of the questions we have for you today. Your responses have been recorded, and your participation in this survey is now complete. You will receive the gift certificate at the email address you provided in approximately 3 to 4 weeks. To redeem, simply follow the instructions on Amazon.com.

[BUTTON TO CLOSE WINDOW: "THANK YOU"]

----------*Screen Break*----------

[CLOSING SCREEN – FORUM]

Those are all of the questions we have for you today. Your responses have been recorded, and your participation in this survey is now complete.

Your Reward Account has been credited!

To check the balance in Your Reward Account or update your contact information, visit our panel Web site and login with your current Username and Password by clicking on the button below.

We look forward to your participation in future surveys!

[BUTTON TEXT: Visit The Socratic Forum] [LINK TO: www.socraticforum.com]

----------*Screen Break*----------

APPENDIX B.
BENCHMARKING STUDIES

Home Energy Analysis Software Study

Final Report

November 2001

Prepared for

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California Energy Commission
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Table of Contents

Executive Summary--The objective of this project was to conduct an analysis of residential energy softwaretools to determine the need in the market place for new or improved tools that will helphomeowners make decisions regarding their energy use. The study found that many agencies provide software tools for homeowners. Specifically in California, PG&E, SCE, SDG&E and SMUD provide on-line tools for their customers. Two online tools provided by federal agencies were also identified and reviewed. In addition, two stand-alone software programs were identified and evaluated under this study. A total of 8 software tools were evaluated in terms of their the capabilities, functionality and usefulness. The tools evaluated are as follows:

- Home Improvement Tool (HIT)
- Home Energy Saver (HES)
- HomeEnergy Software - Home Owner (HS)
- Home Energy Efficiency Design (HEED)
- SMUD's Home Energy Analysis (SMUD)
- SDG&E's On-Line Energy Profile (SDG&E)
- SCE's On-Line Home Energy Survey (SCE)
- PG&E's Home Energy Survey (PG&E)

Although there are several software tools for California homeowners to use as a resource for learning about energy uses and appropriate actions for increasing energy efficiency, no tool was all encompassing. The most comprehensive and useful tool was the Home Improvement Tool provided by the US EPA. This tool requires only a general level of knowledge by the user and provides ranked results through a limited number of user inputs (34 questions). The favorable features provided by the tool are as follows:

1. Graphic Representation of the annual energy cost for the house modeled and the house modeled with the top 5 energy upgrades

2. A table presenting a breakdown of annual energy use for the house modeled and the house modeled with the top 5 energy upgrades with the following categories:
   - Heating
   - Cooling
   - Water Heating
   - Appliances
   - Lighting
   - Miscellaneous

3. Listing of the Top 5 recommended upgrades in order of the highest return on investment.

4. Detailed Upgrade Report
   - Upgrade Title

- Economic Benefits
  - Annual Cost Savings
  - Lifetime Energy Cost Savings
  - Upgrade Cost
  - Return on Investment
  - Simple payback (years)
- Additional Benefits
- Upgrade Description
- Purchasing Tips
- More Information (Web links)

The features that are not present in the Home Improvement Tool but considered desirable are as follows:

1. Benchmarking energy costs

2. Ability to address additional home features
   - Pool/Spa
   - Plug Loads
   - Skylights

3. Ability to identify and recommend upgrades in high usage lighting systems verses all lights in the residence

4. Recommendations on no cost actions (focuses on new purchases)

5. How to get the best impact from the use of a programmable thermostat

6. Identifying the impact of replacing old appliances with new state-of-the-art appliances (i.e. non Energy Star)

7. Reference to applicable incentive and rebate programs

In general, the software tools do not educate the homeowner on methods for systematically managing their energy consumption. The tools that provide recommendations provide the homeowner with lists of options and some information to support the recommendation. The typical recommendations are vague in terms of the level of savings, cost of implementation and equipment selection. For instance, the level of savings and cost of implementation are presented as a range without a discussion what the range means. Other recommendations may consist of purchasing new energy efficient versions of an appliance. While these may be appropriate recommendations, the information provided does not define the efficiency rating that the homeowner should purchase or provide information on the level of savings for various efficiency levels. Information that summarizes the efficiencies and equipment costs would be helpful for the consumer.

The software programs with the least extensive and informative reports are the Home Energy Software (Homeowner version) and the Home Energy Efficiency Design which provide summaries of annual energy costs as the report. These software packages do not provide benchmarking, recommendations or economics of specific measures.

Moving Forward

The objective of this project is to determine the need in the market place for new or improved tools that will help homeowners improve energy efficiency. The study found that most of the desired attributes of a home energy evaluation software tool are available but no single tool contains all the features. In order to provide a comprehensive tool the following options are presented:

Option #1: Create new tool from scratch
Option #2: Modify and enhance existing tools
Option #3: Integration of existing information and resources

Option #1 is the most costly and longest lead-time option. This approach would focus on developing an improved software tool that would be the most comprehensive and easy to use evaluation tool available. Option #2 is the next less costly approach, which focuses on leveraging prior investments, and augmenting previously funded software projects. A similar approach is to team with one of the software tool vendors who have a tool that is closest to meeting the desired functionality and customizing it to be a California specific version with some additional attributes. Option #3 focuses on utilizing existing information and tools developed by the CEC and others by developing a single point of access on a CEC web site. The CEC has already developed informational and educational tools that are available through the internet. Combining the CEC information with the already available tools will go a long way toward providing a comprehensive single point of access for California homeowners to address their energy issues.

Recommendation

It is recommended that the CEC move forward with the Option #3 approach that focuses on leveraging existing tools and resources. This approach is anticipated to be the most cost effective and can be implemented in the shortest time period. It is proposed that the CEC implement a page on the existing web site that provides educational aspects of residential energy management. The functionality of the web site would include a brief description and attributes of the available free on-line tools as well as a links to access them. For example, if a user is interested in understanding his own energy usage patterns, he would be referred to his utility's on-line tool. But if the user were going to replace a major appliance and wanted to investigate the level of savings and equipment options, he would be referred to the HIT or HES sites. If the user wanted to evaluate opportunities associated with a pool/spa he would be referred to the HES site. The proposed web site would also be integrated with the existing CEC tool that provides users with applicable rebate or incentive programs for specific improvements as well as information on California programs (i.e. 20/20). This approach also has the added advantage to be easily modified and updated. There is a potential to develop mini analysis tools for users who want to analyze a specific opportunity such as lighting, air conditioning, water heaters or laundry appliances.

I: Market Overview

California has more than 11 million residential customers. The utilities with the largest number of residential customers are PG&E, SCE, LADWP, SDG&E and SMUD. Residential energy consumption represents 35% of the total electric consumption for the State.

Utilities were not willing to provide information on details of customer usage or effectiveness of their on-line residential energy tools. An article that was published in Home Energy Magazine, November/December 1998 investigated customer use and found that utilities with on-line audits had a customer usage rates that ranged from less than 1% to 3%.

In light of the recent developments in the electric utility market in the state of California and the increase in electric costs, residential customers have an incentive to reduce energy consumption. Residential customers need tools that will allow them to evaluate the appropriate actions and investments to make in order to implement energy reduction measures that have a reasonable payback.

II: The Energy Efficiency Adoption Model

A model of the stages that a homeowner would typically take to reduce energy in the home is presented in Figure1.

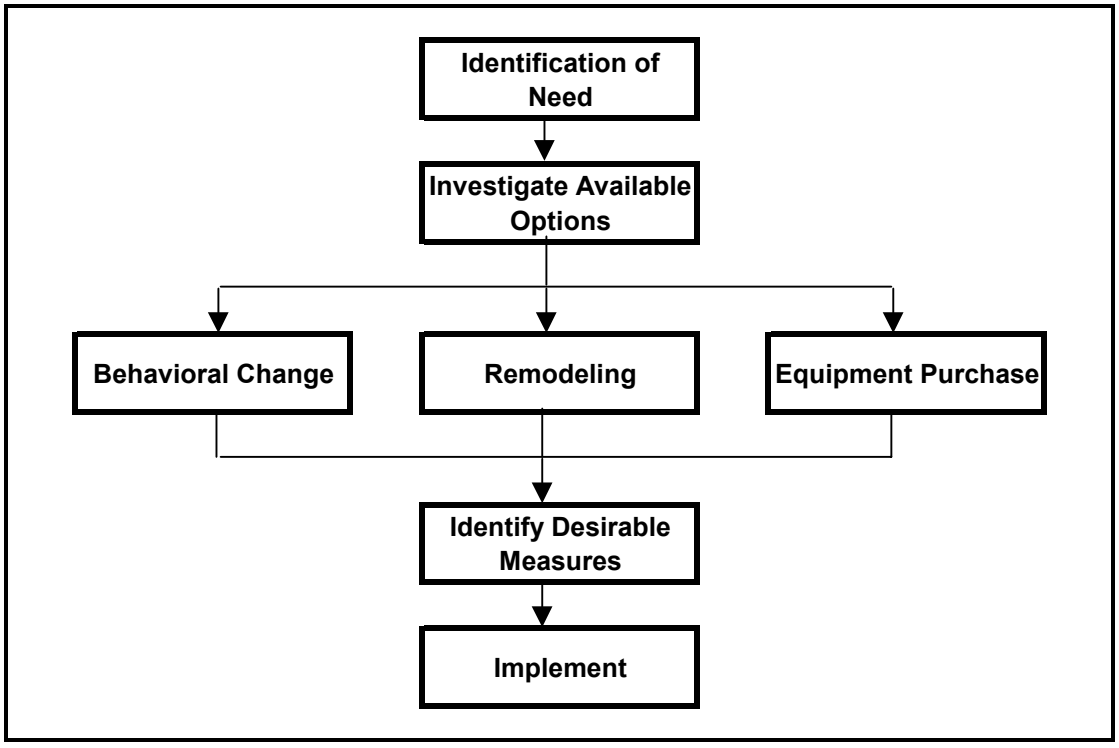

Figure 1. – Energy Reduction Adoption Model

A: Identification of Need

The circumstances that will create a need for the homeowner to enter the process of reducing energy usage are as follows:

1. Need to Replace Appliances
2. High Energy Bills
3. Remodeling a Home

The predominate situation homeowners encounter to create need is at the time of equipment repair or replacement. As existing equipment fails, the homeowner is forced to make a decision for investment. This includes equipment such as light bulbs, refrigerators, dishwashers, water heaters, air conditioners, etc. Typically, the more energy efficient versions of equipment have a higher first cost but a lower operating cost. For a homeowner to choose the more energy efficient option, he needs to take into account the longer-term cost of ownership for the various options.

With the high cost of electricity recently experienced in California, some homeowners have been motivated to take action to lower energy costs. The cost of energy has to be high enough to justify altering typical behaviors or investing money in products that may not typically be considered.

When a homeowner is engaged in a home remodeling project, there is an opportunity to investigate technologies that are more difficult (i.e. more expensive) to implement. During remodeling it may be more cost effective to upgrade wall insulation, install energy efficient windows and limit air infiltration.

The residential market is difficult in that the annual energy costs range from $350 to $3,600 per year for typical residences depending on type of home and climate. At these costs, homeowners are not likely to make significant investments in energy reduction measures for the sake of energy savings. If a set of energy reduction measures would result in an annual energy savings of 10% ($35 -$360 per year) and the acceptable payback for investment is 3 years, measures that have an installed cost of $105 to $1,080 are the only ones that will likely be implemented.

B: Investigate Available Actions

This is the stage of the process where the software tools can play an important role and motivate the homeowner to make informed decisions and take action to get to the implementation stage of the process. This stage is where the homeowner begins to become educated on the options available to reduce energy costs. If this process of investigation is too daunting for the homeowner and a clear road map for moving forward cannot be attained, the homeowner is likely to stop the process at this stage.

Measures categorized as a behavioral change can be implemented in a short time period at little or no cost to the homeowner. These types of measures would include altering

thermostat set points, turning off appliances and lights when not in use, eliminating the use of older secondary refrigerators and freezers, washing laundry at full loads and lower temperatures, and operating dishwashers using the energy savings modes.

Measures categorized as remodeling are those where the homeowner may be altering the structure. For this type of project, the homeowner may have an opportunity to make decisions on levels of insulation, types of windows, addition of skylights, etc.

Measures categorized as equipment purchase are a little more complex in that the homeowner needs to identify vendors, obtain quotes, purchase the equipment and install the equipment. Educating the homeowner on equipment procurement typically not addressed in the existing software tools.

C: Identify Desirable Measures

At this stage of the process, the homeowner has evaluated some options and must now decide which of the available options to pursue. One of the major objectives of the software tool should be to help the homeowner accomplish the task of identifying the desirable measures to implement. This should be presented in terms of recommendations that include a summary of the measure and how it affects the energy consumption and functionality of the home, an estimate of the cost to implement, an estimate of the annual savings, and the simple payback for the measure. Additional information could include a summary of non-energy benefits (i.e. increased comfort, reduced air emissions, etc.), case studies where the measure has successfully been implemented, and a reference to any applicable rebates from the State or utility that would help offset the cost of implementation.

D: Implementation

This stage of the process is when the homeowner takes action to alter behaviors, adjust controls, and replace or add equipment. The value of the software tool will be realized only if it functions to help the homeowner to implement energy reduction measures that create realizable savings. Additional software features that may help the homeowner implement specific measures most effectively are advice on equipment selection, tips of do's and don'ts, financing options, and operating the equipment most cost effectively.

III: Current Product Offerings

A review has been conducted on the software tools that are available in the market. Under the current project, eight software programs have been evaluated. The tools that were evaluated consisted of web-based tools provided by utility companies, web-based tools provided by federal agencies and stand-alone software tools. All of the tools evaluated are available at no cost.

PROGRAM	------ Availability ------- For Everyone on the Web	Utility's Customers	Available at a cost
1. Home Improvement Tool	X		
2. Home Energy Saver	X		
3. HomeEnergy Software (Home Owner)	X		
4. Home Energy Efficiency Design	X		
5. SMUD Home Energy Analysis		X	
6. SDG&E's On-Line Energy Profile		X	
7. SCE' On-Line Home Energy Survey		X	
8. PG&E's Home Energy Survey		X	

The common objective of these programs is to provide useful information to the homeowner that will allow him to determine the most cost-effective energy reduction measures and then to take action to implement these measures.

A: Types of Tools

Of the major utility companies stated above, all but LADWP have web-based residential analysis tools that allow customers to evaluate their energy usage. Access to these tools is typically restricted to customers of the utility. There are similar tools that are available on the web from the US DOE and US EPA that are available to everyone without a cost or usage restriction. The DOE and EPA tools focus mostly on encouraging the user to install Energy Star appliances. In addition there are a couple of non-web-based tools that are available at no cost.

Other energy suppliers offer recommendations to their customers in terms of static reports. Typical static reports provide a bulleted list of energy savings measures that the homeowner should consider. This approach may help educate the homeowner but is may not provide enough information to determine the most cost effective measures or take action for implementation. If a homeowner does identify an energy reduction measure and implement it but does not realize the level of incentive that is anticipated, the homeowner may not be likely to return to the tool to investigate addition energy savings measures.

In order to provide a software tool that is easy to use and provides useful information, a decision needs to be made on the approach for the software method of analysis. One end

of the spectrum are hourly building simulations and on the other end are general recommendations that may or may not be relevant to the user. The trade off between the two methods is the level of detail that is required and the accuracy of results. Although, the software tool review showed that the quality and usefulness of recommendations did not correlate to the accuracy of the model used.

Some programs allow the user to conduct an analysis based on varying levels of expertise ranging from only the zip code of the residence to requiring more than 150 detailed inputs to model a home.

PROGRAM	Skill or knowledge required to input data and run program		
	High	Med	Low
1. Home Improvement Tool			X
2. Home Energy Saver	X	X	X
3. HomeEnergy Software (Home Owner)		X	X
4. Home Energy Efficiency Design	X	X	
5. SMUD Home Energy Analysis		X	X
6. SDG&E's On-Line Energy Profile			X
7. SCE' On-Line Home Energy Survey			X
8. PG&E's Home Energy Survey			X

B: Methods of Analysis

Of the systems analyzed, three methodologies for estimating energy usage were observed in the programs: 1) General information that is typical for a home, 2) Percentage of total use per appliance and 3) Hourly simulation

4. General Information

This approach was incorporated into the SMUD home energy tool. In this approach, the user is provided with typical costs for the types of appliances that the user identified in the survey. The advantage of this approach is that the user only needs to indicate if various appliances are present or not. The level of knowledge required by the user is low and the time required to conduct the analysis is short (5 – 10 minutes). The disadvantage of this approach is that the accuracy of results may not be at a level that provides useful or relevant information to the user. In addition, recommendations may include measures that are already present in the home.

5. Usage Dissagregation

This approach has been incorporated into the PG&E, SCE and SDG&E home energy tools. This approach is an enhanced version of the method described above. It is appropriate when the user has access to historical energy usage which the three utilities provide through their tools. In this case, the sum of the annual costs for the appliances indicated by the user is equal the user's annual energy costs. Like the general information approach, this has the advantage of low level of knowledge by the user and the time required to conduct the analysis is short. The disadvantage is that the estimated cost associated with each end-use appliance is an estimate or average that may or may not reflect the user's application.

6. Simulation

This approach is incorporated into the Eley Home Energy, HEED, and Home Energy Software tools. This approach is based on actually modeling the home and conducting a detailed hourly analysis. In most cases, the developer has created a simplified simulation model that is run in conjunction with historical weather files to model building envelope heat transfer and appliances that vary with weather. In addition, models based on equipment capacity, efficiency, fuel type, and usage patterns are developed for other end-use appliances. While this approach can be a more accurate method of analysis than the previous methods, it requires the user to have a high level of knowledge of the building envelope characteristics, appliance nameplate data, and usage patterns. In an effort to create a tool that provides accurate results but does not require extensive detail, a software developer may incorporate a model where the user provides information on attributes that most significantly influence energy usage and combine it with assumptions on the secondary and tertiary input requirements. For instance when modeling the U-value of a wall, the characteristic with the highest impact on heat transfer is the R-value of the insulation (if present) with interior and exterior materials of construction affecting heat transfer rates but not significantly. Therefore, a software tool may only ask for the R-value of the insulation in the survey portion of the program and assume drywall interior construction and wood siding exterior construction. If the exterior construction of the home is stucco instead of wood, this will not materially alter the results in calculating annual heating and cooling loads (i.e. heating and cooling costs) for the analysis.

C: User Interface

All of the software tools evaluated had good user interfaces. An effective software tool needs to have an interface that allows the user to operate the software with little or no instructions. Furthermore, the input fields need to be designed such that they help facilitate a low level of knowledge requirement of the typical homeowner. This includes

the use of multiple choice answers, presentation of questions with pictures or other graphics, and easy navigation through the software. During the course of the software evaluation, several user attributes were observed that are desirable:

- Ability to save inputs and recall them for another session (HIT, HES, HS)
- Animated graphics (SMUD)
- Direct comparison between two modeled scenarios (HEED, HS, HES)
- Ability to evaluate individual measures (HIT)

Attributes that were observed to be undesirable features included the following:

- Lack of specific recommendations (HEED, HS)
- Requires user to step through entire survey to edit any input field (HS)
- Potential to bypass input fields (HEED, SMUD)
- Reports consisting of only an energy usage summary (HEED, HS)

D: Reports

Once the homeowner has completed the data input and been presented with the results, the user needs a printable report that can be used as a record to be referenced at a later time. At a minimum the report should include the following information:

- Summary of input data
- Summary of Modeled Energy Usage
- Comparison to similar homes in the area (benchmark)
- Recommendations
    - Description
    - Annual Savings
    - Installed Cost
    - Simple Payback
    - Overview of Technology
    - Advice on Implementation
    - Vendors
    - Contractors

The software program with most extensive and useful reports is the Home Energy Saver that has the following reports:

- Comparison of annual energy costs of modeled home to modeled home with upgrades
- Selected Recommended Upgrades
- Non-Energy Benefits
- Profitability
- Making It Happen
  - Remodeling
  - Tips
  - Purchasing
  - Installation
  - Financing
  - Examples (Case Studies)
  - Advice
- Complete Retrofit List

The software programs with least extensive and informative reports are the Home Energy Software (Homeowner version) and the Home Energy Efficiency Design which provide annual energy costs as the report. These software packages do not provide recommendations or economics of specific measures.

A summary of the types of reports provided by the various software programs is presented in the following table.

PROGRAM	Types of Reports				
	Comparisons	Recommend-ations	Product information	Measure economics	Non-Energy Benefits
1. Home Improvement Tool	X	X	X	X	X
2. Home Energy Saver	X	X	X	X	X
3. HomeEnergy Software (Home Owner	X	X			
4. Home Energy Efficiency Design	X		X		X
5. SMUD Home Energy Analysis	X	X		X	
6. SDG&E's On-Line Home Energy Profile		X		X	
7. SCE's On-Line Home Energy Survey		X		X	
8. PG&E's Home Energy Survey		X		X	

IV: Meeting the California Homeowners' Needs

Six needs have been identified that the software tools should provide the user to help homeowners manage and reduce energy usage in their homes. Presented along with the need is an identification of the evaluated software tools that provide the information to meet the need.

1. Presents a Summary of Historical Usage (PG&E, SCE and SDG&E)

Historical energy usage summary helps the homeowner see the fluctuation of monthly energy consumption. To provide the homeowner with this information, the software must have access to the user's historical energy consumption or the user must have historical bills and enter the data into the program. It is unlikely that the user will go to the effort to collect and enter twelve months of electric and gas usage. This is one advantage that the tools provided by PG&E, SCE and SDG&E have because they incorporate historical information. However, these utility tools do not take advantage of this information and provide the benchmark information (discussed below) to the homeowner.

2. Provides Information of Energy Costs by End-use Appliance - Bill Disaggregation (PG&E, SCE, SDG&E, SMUD)

Disaggregation of energy usage helps the homeowner identify the appliances in the residence that constitute the major portion of the energy costs. Typically, addressing control, loads and increased efficiency issues of the major use equipment have the highest impact on overall energy reduction. The PG&E, SCE, and SDG&E tools present the annual energy costs for the appliances such that the sum of the appliance costs is equal to the annual energy costs. The SMUD tool simply provides "typical costs".

3. Benchmarking (HIT, HES, SMUD, HEED, HS)

Benchmarking allows the homeowner to compare his energy use to other similar homes in the area. The benchmark gives the homeowner a starting point and a target goal for achieving reductions. One issue with the tools evaluated is that the definition of the comparison case is not always clear. SMUD indicates "Average Annual Energy Use of Similar Homes" and HES indicates "Average House in Your Area". It could be inferred that the similar homes are energy efficient but this may not be the case. The HEED tool provides a comparison of a home that meets the energy code, a more energy efficient home and the user modeled home.

The HIT and HS allow comparisons between two models, one base case and one improved case. This is not a benchmark but rather a starting point by which to compare various energy measures.

4. Makes Specific Recommendations (HIT, SMUD, PG&E, SCE, SDG&E)

a. Ranking of Measures (HIT)
b. Estimate of Savings (HIT, SMUD, PG&E, SCE, SDG&E)
c. Estimate of Cost ((HIT, SMUD)
d. Presentation of Payback or Return of Investment (HIT, SMUD)
e. Information on Applicable Incentive Programs (SCE)
f. Information on Equipment Manufacturers (HIT, HES)
g. Provides Measure Implementation Advice (HIT, HES, SMUD, SCE, PG&E)

5. Variable Level of Knowledge or Skill Required to Operate Software (HES, HS, HEED, SMUD)

V: Market Need

As discussed in the previous section, the reviewed software packages included desirable attributes of individual programs, but ***no program consisted of all the desirable software features and functionality***. Most of the programs are based on recommendations for the homeowner to purchase new technologies and new equipment.

The identified need in the market is a program that is more comprehensive than the evaluated tools and better educates the homeowner.

A: Homeowner Needs Not Being Met by Existing Tools

The software tools that come closest to meeting the needs of the homeowners is the Home Improvement Tool. The tool includes, ranked recommendations, references to manufacturer and vendor information, specific economics examples and the inclusion of non-energy benefits (i.e. higher level of comfort). The tools do not address skylights, pools, spas or plug loads. In addition the tool does not include benchmarking (only comparison between with and without upgrades), low cost/no cost measures, or references applicable rebate/incentive programs.

In reviewing the software tools that are currently on the market, is has been observed that the tools do not really educate the homeowner on methods for managing their energy consumption. The tools that provide recommendations provide the homeowner with lists of options and some information to support the recommendation. The typical recommendations are vague in terms of the level of savings, cost of implementation and equipment selection. For instance, the level of savings and cost of implementation are presented as a range without a discussion what the range means. Other recommendations may consist of purchasing new energy efficient versions of an appliance. While these may be appropriate recommendations, the information provided does not define the efficiency rating that the homeowner should purchase or provide

information on the level of savings for various efficiency levels. Information that summarizes the efficiencies and equipment costs would be helpful for the consumer.

As an example, it is anticipated that if a homeowner follows the recommendation of replacing the refrigerator and indicates to the salesman that he is interested in purchasing a high efficiency Energy Star refrigerator, the salesman will take the homeowner to the most expensive refrigerator on the showroom floor. At this point, the homeowner may not purchase the refrigerator because his perception might be that the savings of $35 - $50/year would not justify the higher cost of the appliance. On the other hand, if the homeowner were to be presented with more detailed information on refrigerators and their respective energy usage, the homeowner could make a more informed purchasing decision. For instance, if he is replacing a 12 year old refrigerator with a new standard refrigerator he will realize a level of savings due to the advancement in technology over the last 12 years. The homeowner should also be informed if there is a refrigerator that has an efficiency between the new standard and the Energy Star version. With this type of information, the homeowner understands that he has options that will result in energy savings for most of the refrigerators that he is considering and not just the Energy Star version.

Another example of a vague recommendation is for lighting. Most of the software tools make blanket statements that the homeowner should replace incandescent lamps with compact fluorescent lamps. One again a homeowner may look at replacing all lamps in the home. At the cost of $8 - $16 per CFL, a homeowner may be reluctant to purchase 10 to 20 lamps at once. The homeowner needs to be educated to identify the high usage fixtures and incorporate the efficient technology in the fixtures that are on the most hours per year. In addition, energy savings could be achieved if the homeowner reduced the wattage of incandescent lamps. For instance, the homeowner could replaced 100 watt bulbs with 65 or 75 watt bulbs in certain applications. This type of recommendation was never addressed in any of the software programs.

Programmable thermostats are also a typical recommendation provided in these tools but information on favorable settings is not included. The homeowner is not instructed on how to make the best use of the programmable thermostat or what features to look for when purchasing a new thermostat. The homeowner is not provided with information on the impact of each degree setting or identifying the appropriate time settings.

A topic that is not addressed is an explanation of the economics involved in the recommendations. There is also no information presented in the recommendations that provide a discussion of marginal costs as the basis for evaluating the economics of new equipment purchase versus the full replacement equipment cost for equipment that is operating adequately. While this may be a high level discussion, it can be presented in a simple and easy to understand manner. Also included in the recommendations should be information on the typical life expectancy of the equipment. This will allow the homeowner to start the process of evaluating options prior to a failure of the existing equipment. At time of equipment failure, the homeowner is not anticipated to take the

time to fully evaluate his options and take into account energy efficiency but will focus mostly on the first cost and functionality of the replacement equipment.

B: Software Pricing

Since most utilities provide their home energy software tools free of cost over the internet, it is anticipated that a software tool that has a cost and lead-time for delivery will not gain a significant market share. If the CEC is to develop and make available a home energy software tool that will have an impact on residential energy usage in the State, it should be provided as a free service.

C: Placement of Product

At a minimum, the software tool should be able to be accessed through the CEC web site. In addition, there should also be a version that can be loaded onto a computer from a CD or diskette for those homeowners who do not have access to the internet.

In addition, a program could be coordinated through retailers of appliances and building materials where computer terminals could be made available. This would provide homeowners access to the tool at the point of purchase. The program could also include downloadable rebate forms and incentive information that is applicable.

D: Promotion

Promotion of the software should be conducted through the existing CEC and State of California energy programs. Specifically, the Flex Your Power program as been promoted extensively throughout the state this summer on television, radio and newspapers. The software tool could leverage the effort of this program for access and promotion.

Another method of promotion is to coordinate the access of the tool from the web sites of the municipal utilities within the state that do not have a comparable tool available for their customers.

SUMMARY OF ENERGY SOFTWARE FOR HOMEOWNERS

	PROGRAM	Helps homeowner make decisions on which of the following?						Skill or knowledge required to input data and run program			Time Required to Input Data and Run Program			Availability			Accuracy and Completeness			Functionality		
		New House Design	Addition Design	Remodel	Component Replacement	Benchmarking	Conservation Advice	High	Med	Low	High (> 1 hour)	Med (15minutes – 1 hour)	Low (<15 minutes)	For Everyone on the Web	Utility's Customers	Available at a cost	High	Med	Low	High	Med	Low
1	Home Improvement Tool			X	X	X	X			X			X	X				X			X	
2	Home Energy Saver			X	X	X	X	X	X	X	X	X	X	X			X	X		X		
3	HomeEnergy Software (Home Owner)		X	X	X				X	X			X	X				X				X
4	Home Energy Efficiency Design	X	X	X				X	X			X		X				X			X	X
5	SMUD Home Energy Analysis				X	X	X		X	X		X	X		X			X			X	
6	SDG&E's On-Line Energy Profile				X		X			X			X		X			X			X	
7	SCE's On-Line Home Energy Survey				X					X			X		X			X			X	
8	PG&E's Home Energy Survey				X		X			X			X		X			X				X

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APPENDIX C.
LBNL AUDIT BENCHMARK STUDY

Review and Comparison of Web- and Disk-based Tools for Residential Energy Analysis*

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ABSTRACT

There exist hundreds of web- and disk-based building energy software tools. Exhibiting considerable range in approach and creativity, some are specialized while others consider the building as a whole. Users are faced with a dizzying array of choices and, often, conflicting results. We evaluated 50 web-based residential tools and 15 disk-based tools. Some require a relatively small number of well-considered inputs while others ask a myriad of questions and still miss key issues. Thus, more detail does not automatically translate into a “better” or “more accurate” tool. Efforts to quantify and compare the "accuracy" of these tools are difficult at best, and prior studies have not undertaken this in a meaningful way. Many factors conspire to confound performance comparisons among tools, and the sources or implications of observed differences in results are difficult to identify. Accuracy evaluations are inherently limited by the availability of measured end-use data. Furthermore, certain tool outputs can only be measured against values that are themselves calculated, while adequate measured data is rarely available. For the tools we tested, predicted energy bills for a single test building ranged widely (by nearly a factor of three), and far more so at the end-use level. Most tools over-predicted energy bills

and all over-predicted site energy consumption. The over-predictions ranged as high as $1400 per year (approximately 250% of the actual bills). Energy savings estimates automatically generated by the tools varied from $46/year (5% of predicted use) to $625/year (52% of predicted use). We also discovered a remarkable number of results that suggest errors in programming or algorithm inaccuracies. There are numerous potential avenues for improving residential energy tools. Synthesizing the information gathered, we developed best-practice guidelines that may be useful to developers of residential-energy tools. More coordinated funding and planning of tool development could help address the fragmentation of development and deployment efforts that has hampered tool quality and market penetration thus far.

* The research described in this article was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Building Technologies Program, U.S. Department of Energy, under Contract No. DE-AC03-76SF00098.

1 RESIDENTIAL ENERGY ANALYSIS SOFTWARE AND AUDITS

In their ideal form, building energy tools enable users to accurately and cost-effectively evaluate energy use and savings opportunities as well as non-energy issues such as those having to do with cost, environment, comfort, safety, and aesthetics. Generic building blocks include the core simulation engines, coupled with user interfaces, and supported with data on weather and component properties. The long-term vision held by many in the building science community is

one involving virtual (collaborative) "life-cycle" building tools that simulate actual buildings and their construction coupled with intelligent systems that monitor and archive building performance and feed the results back to the simulation tools that in turn grow more refined by operating on better empirical data (Bazjanac and Crawley 1999).

The origins of building energy software trace back to the 1970s, when development of the first simulation engines began. Prior to that time, energy audits had been conducted by hand and at significant cost. In the 1980s, the first-generation of simulation-based analysis and design tools came into use by researchers and consultants. The 1990s were marked by tool improvements and a rapid diversification of tools targeted at a broader spectrum of users, including commercial and residential consumers, and the advent of web-based tools. In parallel with these technical developments was a perhaps 500-fold reduction in the cost of delivering tool-based audits.[1]

Persistent barriers to the mainstream adoption of building energy tools include the time required to use them, process the often-extensive outputs, and evaluate strategies for reducing energy use below the performance level predicted for the existing or baseline building. This can require the use of multiple tools and multiple "runs" to evaluate alternate scenarios.

Compounding the problem are user-interface and performance irregularities stemming from the small market and correspondingly low level of investment in developing and maintaining these

[1] According to Michaels (2000) the evolution from the early computer-based residential audits to the emerging email-based audits has seen a cost reduction from approximately $250/home to $0.50/home. The cost reductions were due to a combination of lower computing costs, reduced human labor, and increased participation rates.

tools. Development teams typically number from one to five people, versus one to two hundred even for considerably simpler mainstream consumer software (e.g., checkbook-balancing tools). Numerous evident bugs and runtime instabilities evidence a lack of sufficient resources for quality assurance.

Despite steady improvements over time, residential energy tools (as well as non-residential ones) have attained very low market penetration. This has been partly ascribed to the extensive fragmentation of development and deployment efforts (as evidenced by the hundreds of tools in existence), resulting in a proliferation of tools each with a low user base. The argument has been made for unifying the currently disparate development efforts into a more coordinated and collaborative initiative (Papamichael and Pal 2002). This is particularly logical given the high historic level of public-sector funding for tool development.

2 PRIOR SOFTWARE REVIEWS

Mills and Ritschard (1987) previously evaluated disk-based tools applicable to multifamily buildings. Few if any of these tools still exist, or they have evolved considerably since the original review. *Home Energy* magazine has published various articles, each of which looks at a handful of tools (e.g., Hunter 1998). The Electric Power Research Institute commissioned a proprietary review of four web calculators in 1998 (EPRI 1998).

The most thorough prior study of this kind appears to be a review conducted for the California Energy Commission (Westerman 2001). Although only eight residential tools were evaluated (two disk-based and six web-based), the information collected was more detailed than prior studies. The study concluded that a tool should provide three kinds of recommendations (1) no-cost options such as behavioral changes, (2) envelope measures applicable during remodeling, and (3) equipment retrofits. The report lists non-energy benefits and case studies as additional information that tools should offer, as well as multiple user levels, recallable results, comparisons between multiple scenarios, and the ability to evaluate single measures (i.e., without having to do a whole-house survey). The authors emphasize the importance of tools that "educate" the user (i.e., not just generate numbers). The study concluded that no single tool "consisted of all the desirable features and functionality". Two additional related criticisms of all the tools were that the recommendations are often vague and don't specify the exact efficiency level that consumers should select, and that some give ranges (instead of point values) for results but do not assist the user in understanding the underlying uncertainties.

While not a critical review, The U.S. Department of Energy's Building Energy Software Tools Directory (Crawley 1998) is a rich compilation of tools and developer-provided information per a standard format. Lawrence Berkeley National Laboratory also maintains an on-line list of buildings energy software tools (LBNL 2002).

3 METHODOLOGY

To identify residential tools for evaluation, we conducted web- and literature searches, including review of the above-mentioned prior work. The disk-based tools were selected from the on-line version of DOE's directory (Crawley 1998). The selected tools were then cataloged and reviewed for useful features, methods of presentation, interface design concepts, etc. (Table 1). From this main set, the subset with a "whole-house" orientation were identified and evaluated in considerably more depth (Table 2).[2] To be included in the "whole-house" detailed review, a tool must consider the full range of residential energy end uses and fuels.

Most of the tools identified were developed in the U.S., and some in Canada. The few European tools identified were either not available in English or did not seem applicable to U.S. conditions.

Our methodology for comparing information tool characteristics expands significantly on that used by Mills and Ritschard (1987). A detailed matrix was constructed to capture, as comprehensively as possible, the house and household description, output, user-support features, and analytical methods used by each tool (Table 2). The range of user needs and the corresponding presence of these features in the tools informed decisions about which features to record in the matrix. No one tool possessed all possible features.

As a basis for top-level comparisons, we determined how many inputs were possible for each tool. There are various ways to define an "input". Some prior studies have used "number of questions" (e.g. Westerman 2001), but individual questions typically seek multiple pieces of information. We found it more consistent and meaningful to include the actual number of pieces of information that a user might have to enter. We observed that the numbers of inputs and input screens are systematically higher for the disk-based tools, due to their professional target audiences and correspondingly greater sophistication, especially concerning extensive materials and component libraries in which multiple characteristics of multiple items can be specified by the user.

We also separately tallied the numbers of technical (including house and household description) and decision-support (including calculation methodology, output, and user-support) features for each tool to glean overall ideas about comprehensiveness and ease of use.[3]

Toward the goal of understanding and comparing the tools' predictive power, we chose real homes for which we had actual consumption data and a detailed description of characteristics and occupant behavior. The web-based tools were evaluated against a test house in San Francisco, CA, and the disk-based tools were evaluated against a test house in Toledo, Ohio. We compared the tool results to the test houses and to each other. The choice of two test houses allowed us to explore different climates, and the California home had an extensive (8-year)

[2] Due to cost or other constraints, test or demonstration versions were used in some cases. Our data tables were provided to the developers for verification.

billing history while the Ohio home had detailed end-use energy estimates against which to compare the tools.

While this is not a comprehensive accuracy evaluation; the results are useful in demonstrating the variations among tool results and the need for more exhaustive validation efforts. Lacking was sub-metered end-use data to compare against the end-use predictions from the various tools.

It is important to keep in mind that the tools evaluated, especially those that are web-based, are under continuous development. Only those features available to users at the time of the evaluation (Spring 2002) were recorded. The review of web-based tools was exhaustive, whereas the web-based tools represent only a subset of those available.

4 FINDINGS

4.1 Existing Tools Exhibit Considerable Range & Creativity

Our review shows that there are many approaches to the design of residential energy tools and different levels of detail can be offered to users. More detail (questions asked) does not, however, automatically translate into a "better", more thorough, or more accurate tool. As

[3] Web-based evaluations of speed and performance were conducted on DSL or faster connections. The disk-based tools were evaluated using a PC equipped under Windows with an x86Family 6 Model 8 Stepping 10 Intel ~356 processor.

suggested by a comparison of Figures 1b and 1c (for web-based tools) and Figures 2b and 2c (for disk-based tools), some require a relatively small number of well-considered inputs while others ask a proliferation of questions and still miss key issues. For example, the Kansas City Power and Light's web-based tool asks 198 questions, but only encompasses 30 of the 124 potential features itemized in Table 2.[4]

The value of detail has a lot to do with the type of answers sought by the user (e.g., the availability of dozens of miscellaneous appliances is immaterial for a user attempting to evaluate their potential for space-heating savings by installing a new heating system).

The tools vary in their usability (e.g. approachability, navigability, wait time, etc.). Some have very elegant and easy-to-navigate interfaces while others were cumbersome (e.g., many screens, poor text legibility). Some are able to collect large amounts of information via a simple interface, while others had elaborate interfaces that did a poor job of collecting information. Several of the tools provide the user the opportunity to compare a base-case house with one outfitted with one or more energy efficiency measures.

Considerable creativity is demonstrated in the design of many existing tools. Even tools that are not particularly comprehensive (e.g. those providing load calculations only) have things to offer. While the diversity of specialized tools offer valuable features to users, it is

[4] The EPRI tool is another example that appears to be very extensive (9 input screens and 79 questions), yet is in fact very inflexible and full of embedded assumptions. For example, the efficiencies of heating systems and many other appliances are fixed, and by having the user enter "number of hours per year use of heating system" the building size, geometry, and envelope characteristics are entirely bypassed.

disadvantageous that they are not interoperable, e.g. similar information must be re-entered for each tool and the results are not coordinated or integrated.

4.2 Users Face Bewildering Choices and Often-Confusing Questions

There are today hundreds of web- and disk-based energy tools. Approximately 220 were listed in DOE's Building Energy Tools Directory as of Spring 2002. The first web-based energy calculator was the Home Energy Saver, developed in the mid-1990s. There ensued a rapid proliferation of web-based energy calculators. There has since been considerable consolidation; many web-based tools have vanished from the Internet. The (often unanticipated) cost of building and maintaining these sites is no doubt a factor in this trend (Primen 2002).

In the course of this study, we identified 50 web-based residential calculators, 21 of which can be considered "whole-house" tools. Of the whole-house tools, 13 provide open-ended energy calculations, 5 normalize the results to actual costs (a.k.a "bill disaggregation tools"), and 3 provide both options. Across the whole-house web tools, we found a range of 5 to 58 house-descriptive features (68 possible) and 2 to 41 analytical and decision-support features (55 possible.

We also evaluated 15 disk-based residential calculators. These tools offer ranges of 18 to 58 technical features (70 possible) and 10 to 40 user- and decision-support features (56 possible).

Of these tools, 11 provide open-ended energy calculations, 1 normalizes the results to actual costs (a.k.a "bill disaggregation tools"), and 3 provide both options.

The disk-based tools contain 21 to 364 input screens and 45 to 9,870 inputs, far more than the corresponding numbers for web-based tools. Despite the large numbers of potential inputs, limitations in the designs of some of the disk-based tools limit users' abilities to model their homes with the desired level of detail. The limiting of house geometries to a six-surface box shape is an example of this shortcoming.

Meta-evaluations of the disk- and web-based tools are presented in Tables 3 and 4, and the complete matrices of features appear in Mills (2002).

The tools exhibit a large range in analytical scope. It was surprising how few enable the evaluation of certain key energy issues and opportunities, e.g. ducts, advanced windows, cool roofs, programmable thermostats, or peak demand, and how few address indoor air quality considerations and other non-energy benefits of energy efficiency (Mills and Rosenfeld 1994). Most tools, however, give considerable (and appropriate) attention to miscellaneous energy end uses. Various important building science issues and energy efficiency features cannot be sufficiently well evaluated using any of the existing tools (e.g., peak power, IR reflective roofing, high-R perimeter attic insulation, thermal comfort, advanced crawlspace/foundations, advanced thermal distribution modeling, early appliance retirement). Few tools offer substantial decision-support content (either local or via links to useful web sites).

Many tools provide estimates of baseline energy bills but no recommendations or estimates of potential savings, and fewer still address cost-effectiveness or emissions analysis (even superficially). Where available, most savings recommendations are spotty, with a large focus on low/no cost measures (often focusing on appliance usage) and less on investments in better equipment or envelopes. Most recommendations are illustrative rather than comprehensive, e.g. for our test house SCE's On-Line Home Energy Survey only suggest caulking & weatherstripping, CFLs, and occupancy sensors for outdoor lighting.

Input questions are often formulated in a way that is likely to confuse lay users. In one of many examples, one tool asks for hours per day refrigerator usage (default is 24), while another asks the same question and defaults at 5 hours, and yet another asks for hours/month and the default value offered is 335 (24 x 30 = 720). In the EPRI tool, users are asked to enter the number of hours their heating system operates in each year. Even an energy expert would not likely be able to make an accurate guess at this value. In yet another example, one tool asks for total lighting hours aggregated by bulb type. This is an unreasonably challenging question for the typical consumer and invites poor estimates and thus poor results.

4.3 Web- and Disk-based Tools Differ Considerably

Only one web-based tool is suitable for professional audiences, as opposed to all of the disk-based tools. This is a somewhat subjective determination. We based our judgment on a tool's

technical depth and flexibility, e.g., in modeling specific equipment efficiencies, complex building geometries, a wide range of climates, and providing sufficiently detailed outputs for a professional user's needs. Several of the disk-based tools (and none of the web-based tools) are intended primarily for non-residential applications.

The level of detail varies accordingly, with up to 200 possible inputs among the web-based tools versus a maximum approaching 10,000 for the disk-based tools. The disk-based tools offer correspondingly greater choice and control over building characteristics, system sizing, weather location, outputs, etc. However, the disk-based tools generally offer a narrower end-use coverage and thus there are fewer (in comparison to the web-based tools) that qualified for the "whole-house" designation used in this study. None of the disk-based tools offer recommendations on no-cost energy-saving measures, while most of the web-based tools do so. Few of the disk-based tools offer a cost-effectiveness protocol for evaluating energy retrofit measures, whereas most of the web-based tools do.

Perhaps counter-intuitively, the web-based tools are more sophisticated in some areas. For example, they more frequently provide vintage-dependent defaults for appliance and equipment efficiencies.

The distribution of disk-based tools is naturally narrower than that of web-based tools. With one exception, the disk-based tools had between 50 and 2300 copies in circulation. (MECheck had 25,000 copies in circulation.) The web-based tools are more accessible to anyone using the

Internet, and, among those we evaluated, receive up to 350,000 visitors per year. None of the disk-based tools work on a Macintosh platform, while all of the web-based tools are (by definition) platform-independent.

The web-based tools are free to users, whereas, with a few exceptions, a fee is required to acquire the disk-based ones. In some cases, however, access to web-based tools is restricted to customers of specific utilities.

With one exception, all disk-based tools we examined provide documentation making their embedded assumptions and methods transparent, whereas only one web-based tool does so.

4.4 Evaluating Accuracy is an Elusive Goal

The question of tool "accuracy" is a complex and multi-faceted one. The ability to evaluate accuracy is inherently limited by the availability of measured end-use data, and manipulations of that data (e.g., weather normalization) to facilitate meaningful comparisons to tool outputs. Certain tool outputs can only be measured against "actual" values that are themselves calculated (e.g., HVAC sizing), while others are rarely if ever available (e.g., measured energy use or savings for specific measures). Similarly challenging is to understand the *sources* of inaccuracies. As described below, there are many ways in which quantitative errors can occur in tools, ranging from programming errors to problems inherent in a tool's design.

4.4.1 Types of Accuracy Problems

Conducting analytical inter-comparisons of residential energy tools raises a number of complicated issues, and the question of "accuracy" has multiple definitions. There are several potential sources of inaccuracy in the results produced by a given tool. The specific illustrations provided below are based on spot checks rather than exhaustive trials of each tool.

- **A given tool's underlying engineering calculations or simulation techniques may contain inaccuracies.** Pinpointing the source of such a problem can be virtually impossible for outside reviewers who do not have access to technical documentation and underlying source code and assumptions.

- **Even if baseline calculations are accurate, savings calculations may not be.** Finding measured data with which to validate savings calculations is far more problematic than finding measured data to validate baseline bills. Ideally, measured data are needed for savings estimates in each end use. Some of the savings estimates we encountered when running our test homes were implausible. One tool estimated the annual savings for a water heater blanket at questionably low values of $2/year, and at $4/year for reducing the water heater temperature. Another tool reported only $2/year annual savings for duct insulation. When testing another tool, going from zero ceiling insulation to "R20-30" resulted in $12/year HVAC savings, and going from "never" changing the air-conditioner filter to changing "every 3 months" resulted in no change in HVAC costs. When specifying a 10 to 15 year-old

standard non-ENERGY STAR model washer in one tool, it predicted only $2/year savings for upgrading (same answer for hot or cold wash temperature and independent of the number of loads washed). Another tool classified all clothes washers as "energy efficient", irrespective of the age (up to 27 years) input by the user.

- **Changes to inputs do not always result in expected changes in predicted energy use.** When examining one tool, we noted that energy bills *decreased* when the water-heater thermostat was *increased* from the 130 to 140 degree range to the 140 to 150 degree range, and were virtually the same from the "Low: below 120 degrees" setting to the "Very high: over 150 degrees" setting. Similarly, energy use increased with decreasing shower length. Computer energy use increased only $2/year when utilization inputs for use were changed from "a little" to "a lot".

We noticed several web-based tools in which the results did not always equal the sum of the individual end uses. In another example, the tool did not show any differences in energy bills as a function of house size (we tested a range of 1000 to 1500 square feet to 2000 to 2500 square feet). Another tool failed to capture the impact of roof insulation when both roof and attic insulation are specified for an unconditioned attic, and greenhouse-gas emissions calculated by that tool do not always increase when energy use increases.

Bill disaggregation tools provide special challenges. One tool reported increased heating use ($1119 versus $992) when a smaller home size (1000 to 1499 sq ft versus 2000-2499 sq. ft)

was specified. Also counterintuitive, lighting energy use was identical in the two homes. We observed the same problems in another tool, where in fact lighting energy use increased with decreasing house size. This particular bill-disaggregation tool also computed the same baseline air conditioning use for SEERs 6 to 16, perhaps an artifact of inflexible values for other end uses and an actual energy bill that must be matched.

- **User-specifiable options are often incomplete or not representative of the actual building.** Particular issues arise when users attempt to model non-typical homes or usage patterns. Cases involving particularly low- or high-energy-use homes are most likely to exhibit under/overestimation of results (except, of course, when using bill-disaggregation tools). For example, extreme high or low thermostat settings will lead to actual bills that differ from those predicted by tools that don't allow for explicit entry of thermostat settings. Problems can also arise, for example, in tools that specify ranges for inputs, such as a vintage range of "before or later than 1993" for appliance efficiency, implying only two possible "average" efficiency options based on the user answer, where in fact the user could have an ancient appliance or a brand-new premium-efficiency model.

  If a tool excludes miscellaneous uses, for example, results can easily be 20 to 30% lower than utility bills for this reason alone. Half of the tools we tested reported miscellaneous energy at less than 10% of total bills – a highly unlikely scenario – and in one case completely excluded it. Other examples include lack of provision for more than one refrigerator, values specified as a range (e.g., floor area), or that otherwise don't fit reality (e.g., different walls have different

R-values). One tool relies solely on defaulted building descriptions keyed to the user-entered zip code, and thus the resulting defaults will inevitably fail to fully represent the actual home in question (e.g., attribution of cooling energy use where none may exist in fact). Another tool does not allow fractional hours of use for many miscellaneous appliances (e.g., toasters, microwaves) – this can lead to over-prediction of energy costs. Another does not allow furnace efficiencies below 78%.

- **Interface design and questions formulated by some of the tools foster input errors or poor house descriptions that adversely affect the results.** These potential problems fall into two categories. "Hidden" options—those discretely placed in rather long pull-down menus or activated by the selection of related "lead-in" options—can easily go unnoticed. "Surrogate" inputs can also trigger unnoticed and undesired calculation paths. In one tool, a request for the number of bedrooms, rather than the number of occupants, in a house is an example of such a surrogate input.

  Wordings of input questions can confuse or mislead users, resulting in inappropriate building description information and thus inaccurate results. For example, many tools ask for "hours of operation" for various appliances and it is often unclear whether to provide annual or seasonal averages (in the case of space conditioning questions) or 24 hours/day in the case of refrigerators. Several tools ask for annual hours of for almost every end use including water heaters, furnace fans, and freezers. As another example, prediction of energy costs (bills)

requires that the user make an accurate estimate of the weighted-average energy prices where complex tariffs are in effect.

- **Not all tools can be run in all climates**. For example, in the case of the tools we examined, 10 of the 22 web-based tools and 5 of the 16 disk-based tools could not be run in the selected cities

- **The aforementioned factors conspire to confound comparisons *among* tools.** Differences in inputs can range from weather city, to types of HVAC systems, to appliance characteristics, to occupant-driven effects such as thermostat management. Differences in *results* would thus no doubt emerge from an extensive comparative exercise, but the *sources* or *implications* of these differences for the purposes of accuracy evaluation or tool development would remain largely unidentifiable (especially given the paucity of technical documentation available for most tools).

Another uncertainty associated with accuracy analysis is that different users would arrive at different results, given the many judgments entailed in describing a real home to a necessarily simplified tool.

Further complications apply in the case of bill-disaggregation tools. The question of whole-house "predictive" ability becomes moot, since such tools by definition agree with actual bills. In this case, the accuracy issue shifts to one of end-use predictive power, i.e., the correct

allocation of total bills to actual end uses. As noted above, some bill-disaggregation tools exhibited problems when submitted to spot tests. The scarcity of good end-use data makes it difficult to validate such tools.

4.4.2 Accuracy Evaluation Test Case: Web-Based Tools

We evaluated those web-based tools with which it was possible to analyze homes in the climate of our first benchmark home (San Francisco Bay Area). All in all, 12 tools were included in this part of the accuracy evaluation (Figure 3).

The results demonstrated considerable variability around the expected results

- Predicted energy bills varied from 25% below to 100% above the actual ($1179/year).

- All tools over-predicted energy use by a significant margin (by up to a factor of 2.4). The variability was higher when examined at the end-use level, e.g. a factor of 8 in water heating energy and a factor of 7 for space heating energy (Figure 4)

- Energy savings estimates automatically generated by the tools varied from $46/year (5% of predicted use) to $625/year (50% of predicted use) (Figure 5). Each tool has a different set of decision rules for including recommendations (often non-systematic and non-

comprehensive), and thus the issue here is not one of accuracy as much as conveying vastly different information to consumers.

4.4.3 Accuracy Evaluation Test Case: Disk-Based Tools

Because of the limitations of demonstration versions and available weather data, only six of the disk-based tools could be test run meaningfully with the second benchmark house, which was located in Ohio.

The results showed similar variability as was seen for the web-based tools:

- Predicted energy bills varied from 2.1 to 2.4-fold above the actual ($969/year) (Figure 6).

- All tools over-predicted energy use by a significant margin (by up to a factor of 2.8). The variability was higher when examined at the end-use level, e.g., a factor of 5.4 in air conditioning energy and a factor of 3.8 for water heating energy (Figure 7).

- Design load predictions varied by factors of 1.5 for both heating and cooling. (None of the web tools produce design load recommendations.)

- None of the disk-based tools generate automatic retrofit recommendations.

Although sub-metered heating and cooling energy use was not available for the Ohio test house, detailed estimates of end-use energy consumption can be compared to the disaggregated utility data, and the results are somewhat disturbing (Figure 7). In particular, the space-heating consumption is over-predicted by a factor of 4 or 5 across the board.

4.4.4 Limitations

Limitations of this exercise include the fact that only two buildings were studied, and without the full spectrum of potential end uses (one test house was located in a non-air-conditioning climate). Also, the analysis was performed by experienced modelers. Results for lay users are likely to exhibit even wider variability.

While Figures 3 and 6 suggest that some tools appear to be more "accurate" than others, the many above-mentioned caveats apply. A readily apparent question is that of fortuitous agreement with actual bills as opposed to genuine accuracy. For example, the "middle' version of the Home Energy Saver provides slightly "better" results than the "detailed" version. This is not because the former provides better modeling than the detailed tool, but rather that inaccuracies have fortuitously cancelled out. Similarly, the Home Energy Checkup provides results relatively close to actual, however, this is clearly fortuitous given that this tool is based on a very approximate "lookup" process using national survey data and highly aggregated

climate zones. The test house, for example, has electricity prices a full 50% higher than the Home Energy Checkup's (invariable) energy prices.

Note also that most results are above those of the actual test house bills. One would expect a more random distribution of over- and under-prediction.

Some web-based tools were not very stable, i.e., they delivered different results when the homes were rerun without changing the building description or when saved runs were recalled subsequent to the initial session.

More comprehensive accuracy evaluations would require a statistically representative sampling of homes and climates, detailed measured end-use data (baseline and savings for a range of measures), highly flexible inputs (house size, window types, utilization patterns, etc.), relevant outputs. Very large numbers of runs would need to be conducted to examine all of the combinations. Furthermore, complete fulfillment of the preceding list would make most of the existing tools ineligible for evaluation. Conversely, conducting such an analysis limited to the least common denominator required for all tools to qualify would result in such a highly "denatured" analysis.

5 DEFINING BEST PRACTICE

Specifying the desired characteristics of residential energy tools should be grounded in social science as well as engineering. None of the tools we evaluated offer all desirable features. There are many potential avenues for improvement in the existing web-based tools. For example (and surprisingly), many provide only estimates of existing energy bills and no recommendations or estimates of potential savings, and fewer still address cost-effectiveness or emissions analysis (even superficially). Few tools offer substantial decision-support content. Based on our review, we offer the following topics for consideration by tool developers.

- Targeting & Usability – we suggest carefully identifying and serving diverse audiences and their equally diverse needs, providing qualitative decision-support information (in addition to calculations), keeping information and data current, fostering linkages among an every-growing proliferation of tools, and focusing on user convenience. Analytical results (e.g., benchmarking) and "what-if" capabilities are more helpful for users than raw data outputs.

- Technical Features & Rigor – we suggest maximizing the applicable geographic range of tools (weather conditions), ensuring technical rigor (e.g., modeling of interactions) while providing for the modeling of occupant effects, open-ended energy calculations as well as results normalized actual billing history, incorporating means for users to appreciate the uncertainties embodied in the results, and ensuring quality control to remove errors from the design and

programming of tools. A comprehensive validation protocol would be of value. The BestTest method, for example, focuses largely on building envelope modeling (USDOE 2002).

• Platform – web-based tools offer considerable advantages over disk-based tools. Among these, are platform independence, lower cost of distribution, ease of updates, and the ability to implement links to a growing array of related resources elsewhere on the internet.

• Strategic Considerations – future efforts could encourage heightened objectivity, technical inclusiveness, and accuracy, and improved transparency and documentation of assumptions. There exists tremendous fragmentation and redundancy (as well as disparate results) among tools currently in use. Efforts should be made to unify existing disparate public and private development initiatives in order to focus scarce development resources into higher-quality and more well-validated tools.

6 REFERENCES

Bazjanac, V. and D.B. Crawley. 1999. "Industry Foundation Classes and Interoperable Commercial Software in Support of Design of Energy-Efficient Buildings," *Proceedings of Building Simulation '99*, Volume 2:661-667.

Crawley, D.B. 1998. *Building Energy Software Tools Directory*, World Wide Web site: http://www.eren.doe.gov/buildings/tools_directory/. Washington, DC: U.S. Department of Energy. (The on-line version has been updated extensively since first published in 1998.)

EPRI. 1998. "An Evaluation of Web-Based Residential Energy Bill Disaggregation Software." Report TR-111192, 90 pages.

Hunter, H. 1998. "Residential Energy Audits: Only A Website Away." Home Energy Magazine http://www.homeenergy.org/webaudit.intro.html

LBNL. 2002. Energy Crossroads Website, Energy Software Category. http://eetd.lbl.gov/cbs/eXroads/soft.html

Michaels, H. 2002. "Comparing Approaches to Reducing Efficiency Market Barriers through Interactive Energy Audit Software," *Proceedings of the 2002 ACEEE Summer Study on Energy Efficiency in Buildings*," p. 7.159. Washington: American Council for an Energy-Efficient Economy.

Mills, E. 2002. "Review and Comparison of Web- and Disk-based Tools for Residential Energy Analysis." Lawrence Berkeley National Laboratory Report No. 50950.

Mills, E. and R. Ritschard. 1987. "DOE-Sponsored Microcomputer Tools for Buildings Energy Analysis: Applications to Multifamily Retrofit Evaluation," Lawrence Berkeley Laboratory Report No. 24307.

Mills, E. and A. Rosenfeld. 1994. "Consumer Non-Energy Benefits as a Motivation for Making Energy-Efficiency Improvements," *Proceedings of the 1994 ACEEE Summer Study on Energy Efficiency in Buildings*, pp. 4.201-4.213. (Also in *Energy—The International Journal*, 21 (7/8):707-720.)

Papamichael, K. and V. Pal 2002. "Barriers in Developing and Using Simulation-Based Decision-Support Software," *Proceedings of the 2002 ACEEE Summer Study on Energy*

Efficiency in Buildings," p. 7.179. Washington: American Council for an Energy-Efficient Economy.

Primen. 2002. "Utilities Hard-Pressed to Justify Investment sin Residential-Customer Websites," http://www.primen.com/about/pr_utilities.asp

U.S. Department of Energy. 2002. BESTEST Software. http://www.eren.doe.gov/buildings/tools_directory/software/bestest.htm

Westerman, J. 2001. "Home Energy Analysis Software Study: Final Report," SAIC, San Diego, CA. 95 pp.

***Table 1**. List of tools examined*

Tool Name (web-based)	Developer
Appliance Calculator	San Diego Gas & Electric Co
Appliance Energy Estimator	Southern California Edison
ATCO Energy Sense House	Atco Gas (Canada)
BEACON	Oarsman
Chicopee Electric Light Department	Chicopee Electric Light Department
City of Oxford Electric Energy Calculator	City of Oxford
Comfort Check	Enercom & Nicor
Ecalc	Pacific Gas & Electric Company
ELPC Pollution Calculator	ELPC
Energy Calculator	Niagra Mowhawk
Energy Calculator	Electric Power Research Institute
EnergyCheckup.com	Geopraxis
EnergyCheckup.com HERS version	Geopraxis
EnergyGuide	Nexus
Environment - Energy Calculator	BC Hydro
EREN Energy Conversions Calculator	US Department of Energy
Find Out About Your Electricity	Environmental Defense
Home Energy Advisor (EPA/LBNL)	USEPA/Lawrence Berkeley National Lab
Home Energy Analysis (SMUD)	Sacramento Municipal Utility District
Home Energy Audit	Texas-New Mexico Power Company
Home Energy Calculator	Central Main Power Company
Home Energy Checkup	Alliance to Save Energy
Home Energy Saver	USDOE/Lawrence Berkeley National Lab
Home Energy Survey	Electrotek Concepts
Home Energy Survey	Pacific Gas & Electric Company
Home View	Volt VIEWtech
Watts On Schools	American Electric Power
KCPL Electricity Calculator	Kansas City Power & Light
KUA Electricity Calculator	Kissimmee Utility
My Home	Green Mountain Power
On-Line Energy Profile	San Diego Gas & Electric
On-Line Home Energy Audit	International Council for Local Environmental Initiatives
On-line Home Energy Survey	Southern California Edison
ORNL Calculators	Oak Ridge National Laboratory
Personal Energy Profiler	United Illuminating
PowerSmart Home; PowerSmart Business	BC Hydro
PSNH Electricity Calculator	Public Service of New Hampshire
PVWatts	National Renewable Energy Laboratory
Radon Project	Columbia University & Lawrence Berkeley National Lab
Residential Calculator	Utilities
Residential Energy Bill Analyzer	Florida Power Corporation
Residential Energy Bill Analyzer	Electrotek Concepts
Residential On-Line Energy Audit	Enercom
Residential Ventilation Calculator	Lawrence Berkeley National Laboratory
RP&L Energy Calculator	Richmond Power & Light
Solar Energy Calculator	Iowa Energy Center
Torchiere energy cost and payback	Lawrence Berkeley National Laboratory
Twenty Percent Solution	Lawrence Berkeley National Laboratory
Western Massachusetts Online Energy Calculator	Western Massachusetts Electric Co.
Your California Home	Geopraxis

Tool Name (disk-based)	Developer
AkWarm (v1.03d)	Alaska Housing Finance Corporation
BTU Analysis REG (v6.1.0)	Enchanted Tree Software
Energy-10 (v1.4.035)	NREL, LBNL
ENERPASS (v4)	Enermodal Engineering
EZDOE (v2.1)*	Elite Software
E-Z Heatloss (v6)*	Thomas & Associates
HOT2000 (v8.606)	Natural Resources Canada
J-Works (v4.809)	MicroWorks, Inc.
MECcheck (v3.3)	U.S. Department of Energy
Micropas (v6.01)*	Enercomp, Inc.
NEAT (v7.1.3)	Oak Ridge National Laboratory
REM/Rate (v10.3)	Architectural Energy Corporation
ResRatePro (v1.26)	Florida Solar Energy Center
TREAT (v0.8.985)**	Taitem Engineering
VisualDOE (v3.0.111)*	Eley Associates

* Demonstration version
** Beta version

***Table 2**. Information tabulated for each tool.*

General Information
- Developer
- Program version
- Release date
- Cost
- Computer requirement
- Operating system requirement
- Hard drive requirement
- RAM requirement
- Commercial/e-commerce content
- Privacy statement
- Non-proprietary
- User base
- Audience(s)
- Consumer
- Professional
- Type of tool
- Open-ended calculation
- Bill disaggregation
- User level(s)
- Input screens
- Inputs

Technical Features--General Building
- Age of house
- Building type(s)
- Single-family detached
- Townhouse
- Apartment building
- Mobile home
- Room additions
- House geometry
- House orientation
- Number of stories
- Floor area
- Ceiling height
- Exterior shading

Technical Features--Building Envelope
- Foundation type
- Wall exterior/construction type
- Doors
- Insulation levels
- Foundation
- Floors
- Walls
- Ceiling
- Roof
- Attic radiant barrier
- Roof color, reflectance, or absorptance
- Window area
- Glazing/frame types
- Skylights
- Leakage (airtightness)
- Leakage (blower door data)
- Caulking and weatherstripping

Technical Features--HVAC Systems
- Heating system type(s)
- Cooling system type(s)
- Secondary heating
- HVAC system efficiency
- Duct location/insulation/sealing
- Ceiling fans
- Whole-house fans

Technical Features--Major Appliances
- Water heating
- Types
- Fuels
- Solar water heating
- Variables (e.g., setpoint, recovery factor)
- Water conservation options
- Refrigerator
- Freezer
- Refrigerator and freezer sizes
- Multiple refrigerators and/or freezers
- Stove
- Oven
- Dishwasher
- Clothes washer
- Clothes dryer
- Hot tub or spa

Technical Features--Miscellaneous End Uses
- Miscellaneous end uses (gas and electric)
- Usage-driven end uses
- Miscellaneous gas end uses
- Module to describe generic appliances

Technical Features--Occupant Effects
- Number of occupants
- Ages of occupants
- Occupants home during day
- Movable window insulation
- Movable window shades
- Thermostat type(s)
- Standard
- Setback option
- Programmable
- Zone heating/cooling
- Water heater setting
- Tap water consumption
- Use of cooking appliances
- Use of dish- and clothes-washing appliances
- Use of clothes line
- Use of miscellaneous appliances
- Use of lights

Technical Features--IAQ
- Calculations
- Content

Technical Features--Economic Analysis
- Variable energy prices
- Variable energy tariffs (e.g., block rates, TOU rates)
- Cost-effectiveness indicator(s)
- LCC

#NAME?
- PBT
- Other
- Rebates, tax incentives, etc.
- Early appliance retirement

Energy Analysis Methods and Details
- Type of calculation(s)
- Simulation
- Engineering estimates
- Watts X hours
- Survey data/lookups
- Weather locations
- Solar gains
- Internal gains
- Occupants
- Appliances
- Lighting
- Aggregate analysis
- Room-by-room or fixture-by-fixture
- Retrofit/savings calculations include interactions
- Calculation time-step
- Transparency of assumptions and methods

Defaults
- Location-dependent defaults
- Pre-defined prototype library
- HVAC-vintage-driven defaults
- Appliance-vintage-dependent defaults

Outputs
- Energy consumption
- Peak electricity demand
- Energy savings
- Energy cost/savings
- Consumption by fuel type
- Cost by fuel type
- End-use breakdowns
- Retrofit recommendations
- No-cost measures
- Cost-associated measures
- Ranking of measures
- Flexibility of retrofit cost assumptions
- Benchmarking
- Run comparisons
- HVAC system sizing
- Water consumption
- Emissions
- Output time-step
- Graphical outputs
- Stored/retrievable runs

User and Decision-Support Services
- Internal text-based content
- FAQs
- Glossary
- General program help
- Context-sensitive help
- Help search
- Example input and output sets
- Case studies
- Non-energy benefits
- Links to external energy-related Web sites
- E-mail support

Table 3. *Meta-evaluation: Web-based tools*

	ATCO Energy Sense House	BEACON (Oarsman)	Ecalc (PG&E)	Energy Calculator (Niagara Mohawk)	Energy Calculator (EPRI)	Energy Checkup.com (Geopraxis)	Energy Checkup "HERS Server" (Geopraxis)	EnergyGuide [Fast Track] (Nexus)	EnergyGuide [Detailed] (Nexus)	EnergyGuide [Full] (Nexus)	Home Energy Advisor (EPA/LBNL)	Home Energy Checkup (ASE)
• Ease of use/speed of calculations	Somewhat Difficult/Very Fast	Reasonable/Very Slow	Efficient/Very Fast	Efficient/Very Fast	Cumbersome/ Very Fast	Not functioning at time of evaluation	Not made available for evaluation	Reasonable/Slow	Somewhat Difficult/Slow	Cumbersome/Very Slow	Efficient/Fast	Efficient/Very Fast
• Overall suitability for building envelope/HVAC analysis	Very Low	Low	Very Low	Very Low	Very Low	Not functioning at time of evaluation	Not made available for evaluation	Very Low	Very Low	Low	Moderate	Low
• Overall suitability for appliance analysis	Moderate	High	High	Low	Moderate	Not functioning at time of evaluation	Not made available for evaluation	Very Low	Moderate	High	Moderate	Low
• Overall suitability for occupant effect analysis	Moderate	Low	Low	Very low	Moderate	Not functioning at time of evaluation	Not made available for evaluation	Very low	Very low	Good	Moderate	None
• Overall helpfulness of outputs and other information in supporting decisions	Low	None	Low	Very Low	None	Not functioning at time of evaluation	Not made available for evaluation	Moderate	Moderate	Moderate	Moderate	Moderate

	Home Energy Saver [Simple] - (LBNL/DOE)	Home Energy Saver [Middle] - (LBNL/DOE)	Home Energy Saver-[Full] (LBNL/DOE)	Home Energy Survey (PG&E)	HomeVIEW (VoltVIEW)	KCPL Electricity Calculator (KCPL)	My Home (GMP/Red-Wire)	On-Line Home Energy Audit (ICLEI)	On-Line Home Energy Survey (SCE)	Residential Calculator (Buckeye)	Residential Energy Bill Analyzer (Electrotek)	Residential On Line Energy Audit (Enercom)	Your California Home [Quick Survey] (Geopraxis)	Your California Home [Expert] (Geopraxis)
• Ease of use/speed of calculations	Efficient/Very Fast	Efficient/Fast	Reasonable/Fast	Cumbersome/ Fast	Efficient/Slow	Somewhat Difficult/Very Fast	Cumbersome/ Very Fast	Efficient/Very Fast	Reasonable/ Very Slow	Efficient/Fast	Reasonable/Fast	Reasonable/ Acceptable	Somewhat Difficult/Slow	Reasonable/ Very Slow
• Overall suitability for building envelope/HVAC analysis	Very Low	Moderate	High	Low	High	Very Low	Very Low	Moderate	Low	Very Low	Low	High	Very Low	Moderate
• Overall suitability for appliance analysis	Low	Low	High	High	High	Moderate	Moderate	Very Low	High	Low	High	High	None	Moderate
• Overall suitability for occupant effect analysis	Low	Low	High	Moderate	Moderate	Moderate	Moderate	Low	High	Low	High	Moderate	None	High
• Overall helpfulness of outputs and other information in supporting decisions	Moderate	Moderate	Moderate	Moderate	Low	Low	None	Low	Low	Low	Low	Moderate	Low	Low

Table 4. *Meta-evaluation: Disk-based tools*

	AkWarm	BTU Analysis REG	Energy-10	ENERPASS	EZDOE	E-Z Heatloss	HOT2000	J-Works
• Ease of use/speed of calculations	Reasonable/ Very Fast	Reasonable/ Very Fast	Reasonable/ Acceptable	Cumbersome/Very Slow	Cumbersome/?	Reasonable/Very Fast	Cumbersome/ Fast	Somewhat Difficult/Very Fast
• Overall suitability for building envelope/HVAC analysis	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
• Overall suitability for appliance analysis	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Moderate	None
• Overall suitability for occupant effect analysis	Very Low	Very Low	Moderate	High	Moderate	Low	Moderate	Very Low
• Overall helpfulness of outputs and other information in supporting decisions	Moderate	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Moderate

	MECcheck	Micropas	NEAT	REM/Rate (Simplified)	REM/Rate (Detailed)	ResRatePro	TREAT	VisualDOE
• Ease of use/speed of calculations	Reasonable/ Very Fast	Reasonable/ Acceptable	Somewhat Difficult/Fast	Reasonable/Fast	Reasonable/Fast	Reasonable/Slow	Cumbersome/ Very Slow	Cumbersome/ Slow
• Overall suitability for building envelope/HVAC analysis	Moderate	Moderate	Moderate	Moderate	High	High	High	Moderate
• Overall suitability for appliance analysis	None	None	Moderate	Very Low	High	Moderate	High	Low
• Overall suitability for occupant effect analysis	None	Very Low	Moderate	Low	Moderate	Moderate	High	Moderate
• Overall helpfulness of outputs and other information in supporting decisions	Moderate	Low	Moderate	Moderate	Moderate	High	Low	Moderate

Figure 1a-c. *Features, input screens, and inputs vary widely: Disk-based tools*

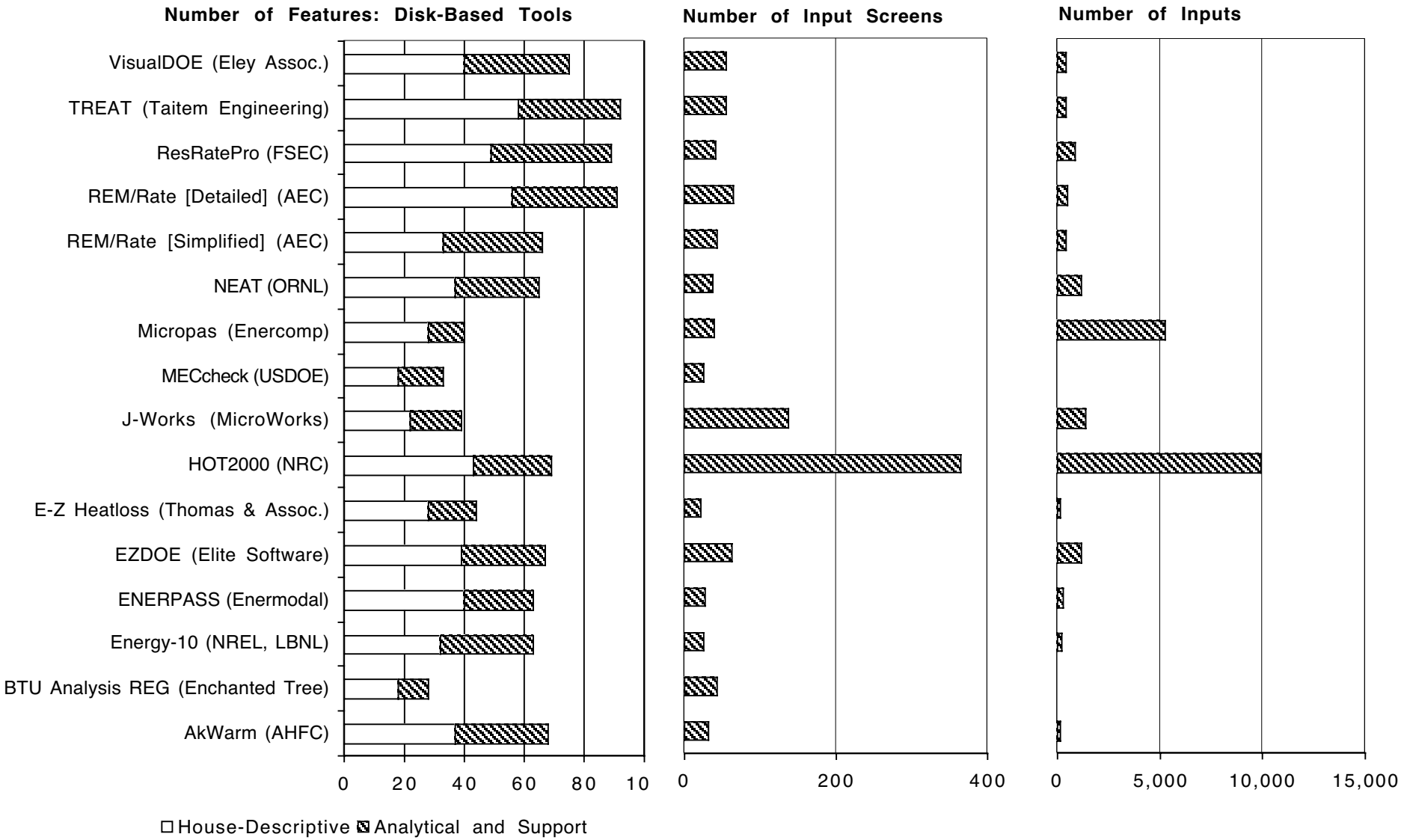


Figure 2a-c. *Features, input screens, and inputs vary widely: Web-based tools.*

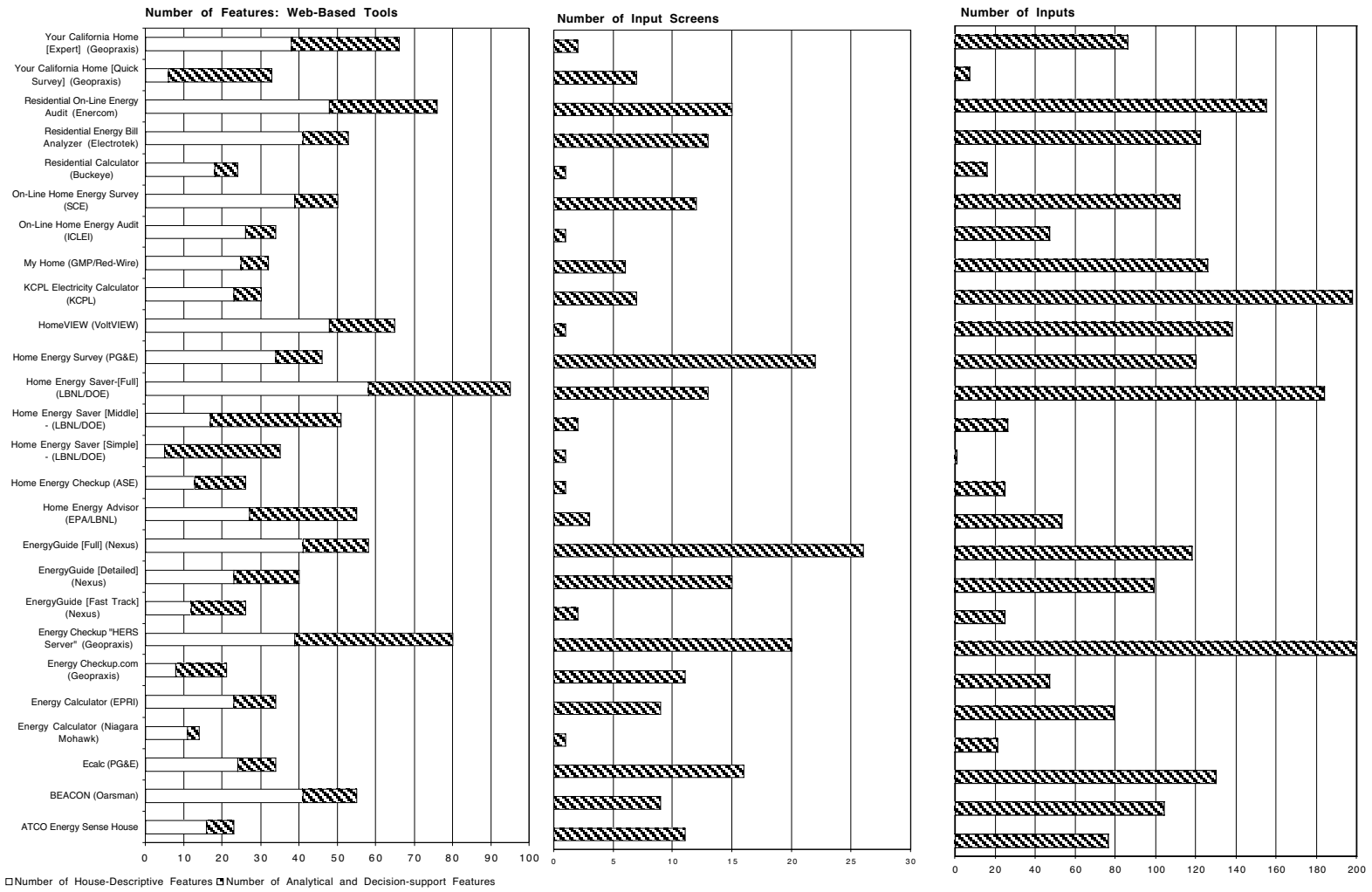
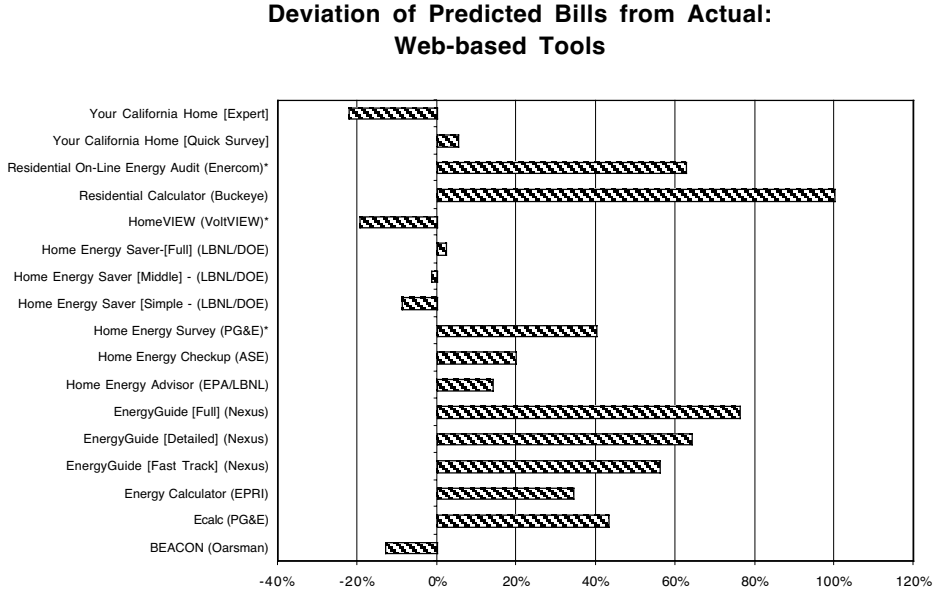


Figure 3. *Predicted versus actual annual energy bills vary widely: Web-based tools*



Notes:
- Actual: $1179/year (8-year weather average)
- Energy prices specified in the models identical to those in test home.
- Where applicable, bill disaggregation modules supplied only with August data.
- EnergyGuide: Initial estimates were $2566 (Fastrack) and $3283 (Detailed). Subsequent visit yielded lower outputs (shown here) for same inputs.
- PG&E: Subtotals disagree with grand total by 30%.
- Residential Calculator (Buckeye): Results adjusted to reflect actual energy prices.

Figure 4. Predicted energy use and end-use breakdowns vary widely: Web-based tools

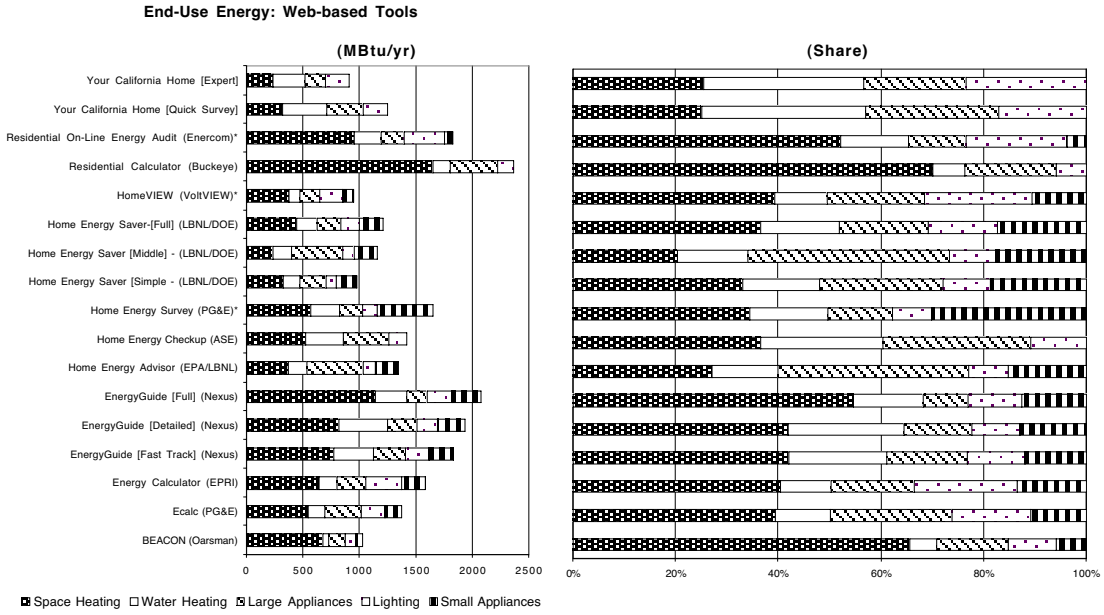


Figure 5. *Predicted annual energy savings defaults vary widely among the web-based tools.*

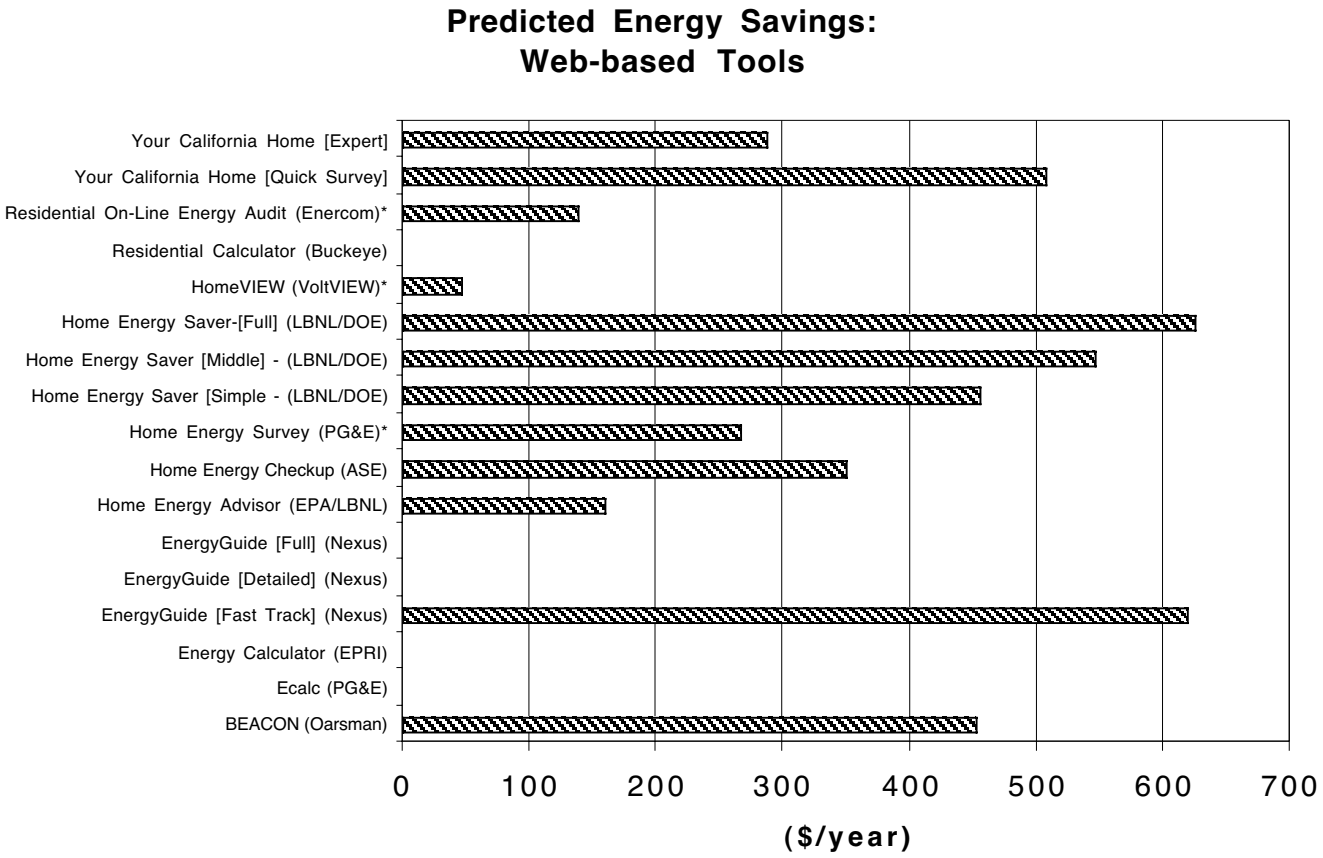
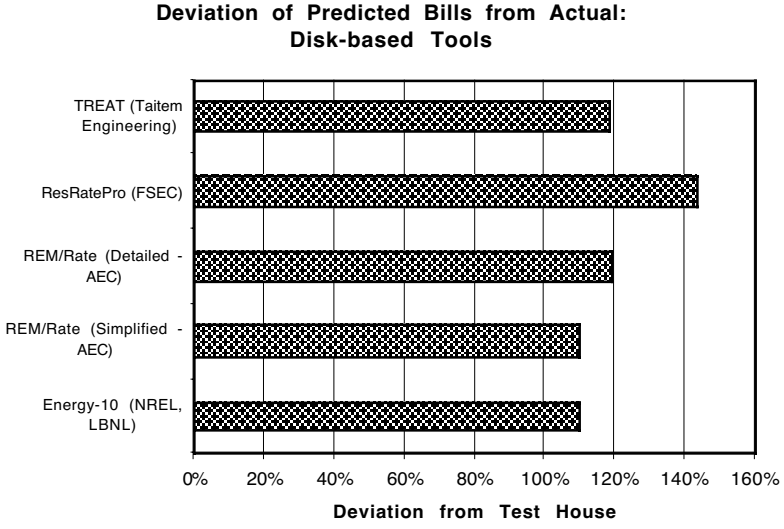
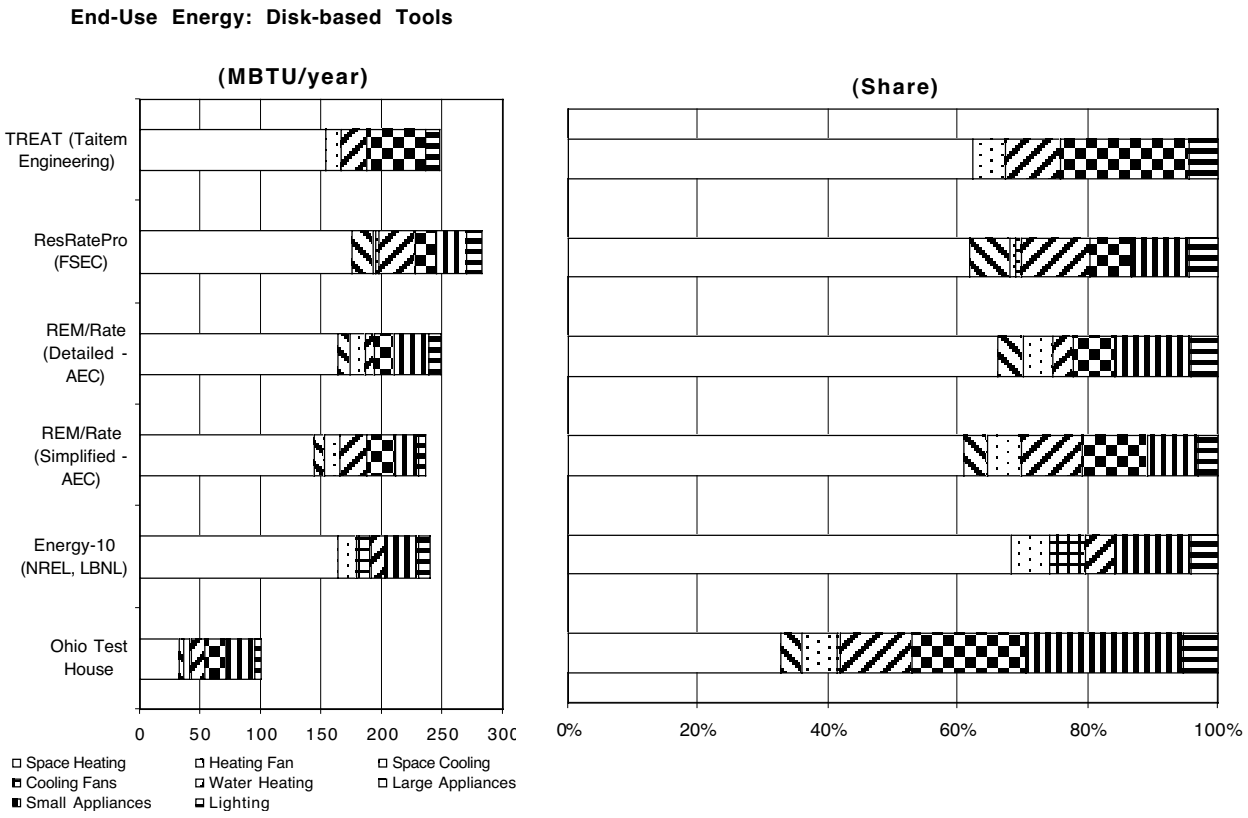


Figure 6. *Predicted versus actual annual energy bills vary widely: Disk-based tools.*



Note: Actual = $969/year Agreement = 0% deviation

Figure 7. Predicted energy use and end-use breakdowns vary widely: Disk-based tools



APPENDIX D.
YEAR-OVER-YEAR COMPARISON OF USER EXPERIENCE

APPENDIX D
YEAR-OVER-YEAR COMPARISON OF USER EXPERIENCE

This appendix presents longitudinal data tables comparing user opinions of the California Energy Connection Web site usage in Year 1 and Year 2. User ratings are based on a 5 point scale, where 5 means extremely positive. Discussion of these results can be found in Chapter 4.

Exhibit D-1
Overall Impression of California Energy Connection
Year 1 versus Year 2

	Year 1		Year 2	
	Residential (N=70)	Bus (N=6)	Res (N=150)	Bus (N=27)
Overall impression of Web site				
Very Favorable	23%	33%	19%	19%
Somewhat Favorable	63%	50%	49%	52%
Neither	10%	17%	29>%	26%
Somewhat Unfavorable	3%	3%	3%	4%
Very Unfavorable	1%	1%	0%	0%

Exhibit D-2
User Opinions about California Energy Connection
Year 1 versus Year 2

	Year 1		Year 2	
	Res (N=70)	Bus (N=6)	Res (N=150)	Bus (N=27)
Opinions about the Web site*				
This Web site is interesting	3.86	3.50	3.73	3.74
This Web site is easy to navigate	3.71	3.33	3.67	3.70
This Web site is hard to understand	2.24	3.00		
This Web site looks appealing	3.83	3.33	3.79	3.85
This Web site is useful to me	4.04	3.83	3.70	3.63
This Web site loads quickly and easily	3.84	4.00	3.75	3.85
I would recommend this site to others	3.94	3.83	3.65	3.52
I would bookmark this site	3.57	3.50	3.48	3.67
It was hard to get the info. I was looking for	2.37	2.67	2.57	2.59
The Web site is laid out well	3.76	3.00	3.75	3.74>
The energy-saving tips and recommendations are credible information	3.90	3.33	3.80	3.70
Overall, the Web site was helpful in getting me to manage my energy use	3.50	3.50	3.35	3.41
This Web site was helpful in getting me to make decisions regarding purchasing energy-efficiency equipment	3.46	3.17	3.26	3.04

Exhibit D-3
Usability of California Energy Connection
Year 1 versus Year 2

	Year 1		Year 2	
	Res (N=70)	Bus (N=6)	Res (N=150)	Bus (N=27)
Ease of use/usability*				
Look at energy usage history	3.84 (n=55)	4.40 (n=5)	3.70 (n=71)	4.00 (n=13)
Get an energy analysis	3.75 (n=56)	4.50 (n=2)	3.75 (n=59)	3.58 (n=12)
Use energy calculators to see the costs of various appliances	3.78 (n=60)	4.67 (n=3)	3.83 (n=66)	3.91 (n=11)
Get tips on energy savings	3.92 (n=66)	4.00 (n=5)	3.99 (n=112)	4.00 (n=15)
Look for rebate opportunities	3.91 (n=53)	4.00 (n=6)	3.85 (n=93)	4.00 (n=15)
Find out about renewable energy sources	3.63 (n=52)	4.33 (n=3)	3.67 (n=67)	4.14 (n=7)
Learn about energy-saving products	3.93 (n=61)	3.83 (n=6)	3.88 (n=101)	3.89 (n=18)
Get information about the CA energy market	3.60 (n=45)	3.50 (n=4)	3.73 (n=52)	3.69 (n=13)
See current news about energy	3.62 (n=47)	3.33 (n=3)	3.76 (n=70)	4.19 (n=16)
Use “My Home Page” to customize my Web Site Account	NA	NA	3.43 (n=14)	3.80 (n=15)
Use the Bill Analyzer to find out about why my energy bill may have changed	NA	NA	3.38 (n=40)	3.22 (n=9)

Exhibit D-4
Intentions to Return and Future Visits
Year 1 versus Year 2

	Year 1		Year 2	
	Res (N=70)	Bus (N=6)	Res (N=150)	Bus (N=27)
Intention to return				
Yes	86%	83%	90%	96%
No	14%	17%	10%	4%
Areas intended for future visits				
Look at my energy usage history	66%	67%	70%	62%
Look for rebate opportunities	66%	83%	81%	73%<
Get tips on energy savings	54%	67%	68%	73%
Get an energy analysis	53%	50%	56%	54%
Learn about energy-saving products	51%	17%	64%	73%>
Use energy calculators	47%	50%	62%	38%
Find out about renewable energy sources	31%	17%	31%	35%
Get information about the California energy market	21%	0%	25%	23%
See current news about energy	20%	17%	31%	35%

Exhibit D-5
Most Visited Areas of California Energy Connection
Year 1 versus Year 2

	Year 1		Year 2	
Most visited areas	**One-Time Visitors**	**Return Visitors**	**One-Time Visitors**	**Return Visitors**
Look at my energy usage history	**35%**	**61%**	**23%**	**48%**
Get an energy analysis and custom savings recommendations	**45%**	**48%**	**15%**	**33%**
Use energy calculators to see the costs of various appliances	**20%**	**46%**	**20%**	**28%**
Get tips on energy savings	**40%**	**63%**	**48%**	**55%**
Look for rebate opportunities	**40%**	**54%**	**42%**	**54%**
Find out about renewable energy sources	**20%**	**11%**	**12%**	**21%**
Learn about energy-saving products	**35%**	**48%**	**32%**	**46%**
Get information about the California energy market	**10%**	**11%**	**0%**	**0%**
See current news about energy	**0%**	**16%**	**8%**	**21%**
Receive a free gift from Amazon	**45%**	**48%**	**63%**	**57%**

Exhibit D-6
Frequency of Visits
Year 1 versus Year 2

	Year 1		Year 2	
	Residential (N=70)	**Bus (N=6)**	**Res**	**Bus**
Frequency of visits				
1 time	**27%**	**17%**	**33%**	**41%**
2-3 times	**61%**	**67%**	**60%**	**48%**
4-5 times	**9%**	**17%**	**7%**	**11%**
6-9 times	**3%**	**0%**	**0%**	**5%**

Exhibit D-7
Reason for Visit
Year 1 versus Year 2

	Year 1		Year 2	
	Res (N=70)	Bus (N=6)	Res	Bus
Reason for visit				
Get tips on energy saving	57%	50%	49%	70%
Look at my energy usage history	51%	83%	28%	48%
Look for rebate opportunities	49%	67%	52%	37%
Get an energy analysis	47%	50%	27%	30%
Receive a free gift from (XXX)	46%	67%	57%	74%
Learn about energy-saving products	44%	50%	28%	11%
Use energy calculators	41%	17%	19%	11%
Find out about renewable energy sources	14%	0%	19	11%
See current news about energy	13%	0%	19%	7%
Get information about the California energy market	11%	0%	9%	11%

Exhibit D-8
Sponsorship Awareness
Year 1 versus Year 2

	Year 1		Year 2	
	Res (N=70)	Bus (N=6)	Res	Bus
Sponsorship awareness				
PG&E	41%	50%	67%>	44%
California Public Utilities Commission	31%	17%	22%	37%
The State of California	20%	33%	5%	11%
Manufacturers of Appliances or industrial equipment	3%	0%	0%	0%
Consumer watchdog group	1%	0%	3%	0%
For-profit energy services company	1%	0%	1%	4%
Southern California Edison	0%	0%	1%	4%
San Diego Electric Company	0%	0%	%	%

Exhibit D-9
Sources of Web site Awareness
Year 1 versus Year 2

	Year 1		Year 2	
	Res (N=70)	Bus (N=6)	Res	Bus
Sources of Web site awareness				
Received Notice in the mail	33%	50%	33%	59%
Printed on Utility Bill	16%	0%	17%	4%
PGE.com	17%	17%	12%	7%
Internet Search Engine	7%	0%	2%	0%
Print advertisement	3%	33%	7%	7%
Link or banner ad on another Site	3%	0%	1%	0%
Friend or colleague	1%	0%	2%	0%

*** Rating based on a 5 point meaning scale where 5 means positive**

APPENDIX E.
PG&E MAILERS TO RESIDENTIAL AND BUSINESS PILOT CUSTOMERS

California Energy Connection

Mail Code B29R
77 Beale Street
San Francisco, CA 94105-1814

Presorted
First-Class Mail
U.S. Postage
PAID
Sacramento, CA
Permit No. 690

www.californiaenergyconnection.com/buspilot

Register with the California Energy Connection Web site now and receive a $20 Gift Certificate from Amazon.com.

Details inside ▶▶▶

You've been selected as a pilot customer on a new Web site developed by Pacific Gas and Electric Company! This site was created to provide customers with the tools and information needed to help **manage energy use and save money**.

If you're

one of the first 2,500 customers to register

with the California Energy Connection Web site, we'll send you

a $20 Amazon.com gift certificate.

To take advantage of this offer, just follow these quick and easy steps:

1. Visit the California Energy Connection Web site: **www.californiaenergyconnection.com/buspilot**

2. Enter your PG&E account number and electric meter number. We've provided your PG&E information here for your convenience:

   Account Number:

   Electric Meter Number:

3. Once you have registered you'll receive an email with your $20 Amazon.com gift code.

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www.californiaenergyconnection.com/respilot

Register with the California Energy Connection Web site now and receive a $20 Gift Certificate from Amazon.com.

Details inside ▶▶▶

You've been selected as a pilot customer on a new Web site developed by Pacific Gas and Electric Company! This site was created to provide customers with the tools and information needed to help **manage energy use and save money**.

If you're

one of the first 2,500 customers to register

with the California Energy Connection Web site, we'll send you

a $20 Amazon.com gift certificate.

To take advantage of this offer, just follow these quick and easy steps:

1. Visit the California Energy Connection Web site: **www.californiaenergyconnection.com/respilot**

2. Enter your PG&E account number and electric meter number. We've provided your PG&E information here for your convenience:

   Account Number:

   Electric Meter Number:

3. Once you have registered you'll receive an email with your $20 Amazon.com gift code.