Evaluation of the 2002 Home Energy Efficiency Survey Program

MAESTRO Workshop March 31, 2004

Rick Ridge, Ridge & Associates
Katherine Randazzo, KVD Research Consulting
Angela Jones, MA&E Liaison, Vanward Consulting for SCE

Agenda

- Program Description
- Program Goals
- Methods
- Preliminary Results

Mail Audit

- Outreach:
  - Targeted mailings, handouts, public events, and requests.
  - Available in English and Spanish for all four IOUs, in Chinese for PG&E, SoCalGas, and SCE, and in Vietnamese for SDG&E.
  - At least 50 percent of the mailed surveys must be sent to the hard-to-reach customers
- Once completed, the survey is returned and processed.
- A report describing household energy use along with recommended measures & practices is sent to customer.

Hard-To-Reach Customers

- Language: Primary language spoken is other than English
- Income: Those customers who fall into the moderate income level
- Housing Type: Multifamily and mobile home tenants
- Geographic: Residents of areas other than San Francisco Bay area, San Diego area, Los Angeles Basin, or Sacramento
- Homeownerships: Renters

On-Line Audit

- Outreach:
  - Websites, e-mail blasts, on-line advertising
  - Available in English and Spanish for all four IOUs, in Chinese for PG&E, SoCalGas, and SCE, and in Vietnamese for SDG&E.
- Once completed, customer receives immediate results through an on-line report that contains an energy use report and recommended measures & practices.

Evaluation Objectives

- Process
  - Verify the number of residential energy audits.
  - Provide ongoing feedback and corrective guidance regarding program design and implementation.
- Impact
  - Estimate adoption rates and kWh, kW, and therm savings.
  - Assess the impact of the HEES Program on customer awareness and knowledge.

Assess Impact of HEES on Awareness & Knowledge

- Awareness of EE measures and practices prior to receiving an audit.
- Knowledge about EE measures and practices as a result of the audit.

Verify the Number of Residential Energy Audits

- Review HEES Program database to determine the number of residential energy audits, by utility, weather zone, and by Mail versus On-Line.
- Describe the characteristics of participating customers, by utility, weather zone, and by Mail versus On-Line.

Estimate Energy and Demand Impacts

- While estimating savings is not required for information-only programs, it was done to show the complete impacts of the program.
- Gross kWh, kW, and therm savings were calculated by the RECAP software for each recommended measure and practice.
- Customers were asked to self-report any of the recommended measures and practices that they have adopted.
- A ratio of adopted to recommended was used to adjust gross savings.

Review of Engineering Algorithms

- Engineering-based approaches to estimating savings were reviewed for:
  - RECAP
  - Enercom
  - Nexus
- Review attempted to address:
  - The algorithms
  - The default input assumptions
  - Reasonableness of savings

Data Collection

- 303 telephone interviews with Mail Audit participants
- 197 telephone interviews with On-Line Audit participants

Quarterly Survey Provided On-Going Feedback

- Customer characteristics
- Customer satisfaction
- Adoption rates
- Implementation problems
- Program design problems

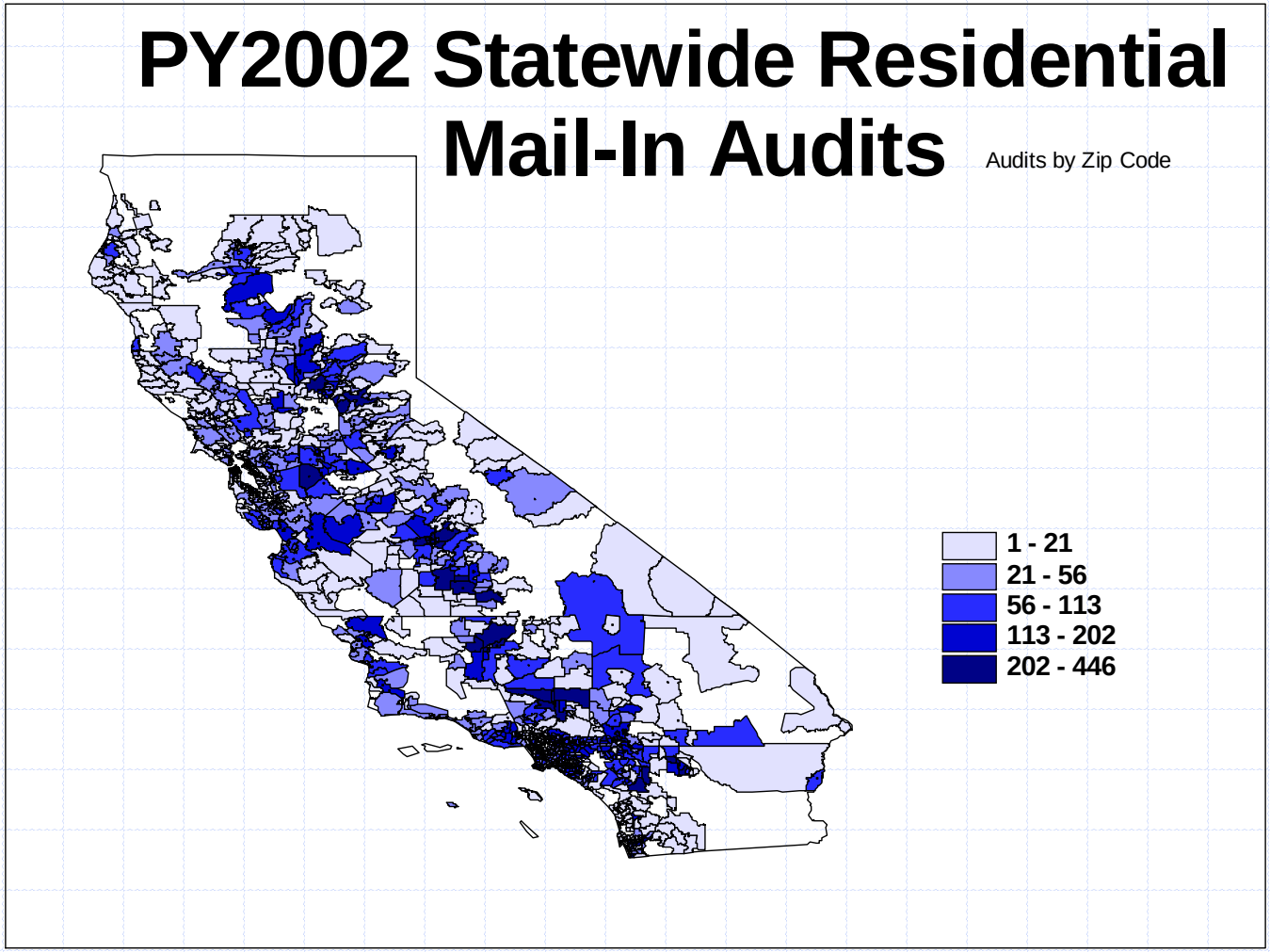
PY 2002 Mail Survey Targets & Achievements

Utility	Target	4th Quarter Report
PG&E	18,000	20,872
SCE	18,000	20,100
SoCal Gas	3,000	3,590
SDG&E	4,000	4,028
Total	43,000	48,590

PY 2002 On-Line Survey Targets & Achievements

Utility	Target	4th Quarter Report
PG&E	12,000	9,146
SCE	12,000	10,057
SoCal Gas	2,000	1,507
SDG&E	2,667	1,721
Total	28,667	22,431

Geographic Coverage



Demographic Characteristics Mail Audit Participants

- Apartment dwellers are underrepresented.
- Nearly 87 percent of the participants live in single-family detached dwellings.
- Those making less than $50,000/year are underrepresented.
- More than 22 percent make more than $100,000/year.

Demographic Characteristics Mail Audit Participants

- Hispanics and Asian-Americans are underrepresented.
- Those with a college or graduate degree are overrepresented.
- Participants have slightly larger households
- Age of home is consistent with general population.

Program Satisfaction

Satisfaction Question	RECAP Mail-in	RECAP Online (SCE)	SDG&E Online
How would you rate your overall impression of the site?	NA	3.31	4.27
The form/web site was easy to use	3.26	3.31	4.15
The amount of time to complete the energy survey was about right	3.20	3.23	3.95
The energy survey report was delivered to me in a timely manner	3.22	3.41	3.98
The energy survey report was easy to understand	3.29	3.45	4.01
The recommendations in the energy survey report were relevant to my house	3.16	3.22	3.86
The information contained in the energy survey report was informative	3.29	3.25	4.00
In general, the energy savings associated with the recommendations were believable	3.22	3.26	3.92

*Ratings were from 1 to 5, with 5 being most favorable

Awareness and Adoption Rates

- 86 percent were of the benefits prior to receiving the recommendations.
- 47 percent of the recommended measures and practices were adopted.

2002 Statewide Residential Single-Family Rebate Program Evaluation

Summary of Final Evaluation Report

Prepared by:

Kenneth James, PG&E

John Cavalli & Marissa Myers, Quantum Consulting

Kathleen Gaffney & Tami Rasmussen, KEMA-XENERGY

QUANTUM CONSULTING

PG&E Pacific Gas and Electric Company™

Evaluation Goal & Research Objectives

The overarching goal is to assess the program's effectiveness in moving the market toward more energy efficient measures.

Program Accomplishments and Verification

- What measures drew the most customers, rebate dollars and energy savings?
- Are the accomplishments reported by the IOUs accurate?
- Were the measures actually installed and program-qualifying?

Market Assessment and Process Evaluation

- Which program delivery mechanisms reached customers?
- Were customers satisfied with the program?
- How can the program be refined to work better?

Program Effects Assessment

- What evidence do we have for market effects occurring from this program?
- Has the program influenced customers' energy efficiency behaviors?

Research Activities

Program Verification

- 1,087 Verification surveys and 127 Onsites conducted to verify that rebated equipment was installed and program-qualifying.

Market Actor and Process Assessment

- 50 market actors (program staff, contractors, retailers, manufacturers and others) interviewed about their program experience.

Customer Market Assessment and Program Effects

- 1,001 General Population customers interviewed about their energy efficiency awareness, knowledge and attitudes, equipment purchases, experience with retailers, and energy efficient product usage.
- 613 Participants interviewed about their program experience as well as their energy efficiency behavior.

Program Targets and Accomplishments

- Overall, energy savings accomplishments fell short of targets.

Utility	CPUC Target	Result	% Target Reached
PG&E			
Energy Savings, kWh	16,767,505	12,490,176	74%
Demand Reduction, kW	18,910	18,074	96%
Therms Reduction	1,426,372	2,283,900	160%
SCE			
Energy Savings, kWh	19,483,521	16,335,879	84%
Demand Reduction, kW	8,606	10,691	124%
Therms Reduction	-	-	-
SDG&E			
Energy Savings, kWh	8,466,000	4,316,080	51%
Demand Reduction, kW	6,460	3,274	51%
Therms Reduction	336,893	424,453	126%
SCG			
Energy Savings, kWh	2,586,000	2,886,049	112%
Demand Reduction, kW	1,380	-170	-12%
Therms Reduction	925,000	1,056,111	114%
Statewide			
Energy Savings, kWh	47,303,026	36,028,184	76%
Demand Reduction, kW	35,356	31,869	90%
Therms Reduction	2,688,265	3,764,464	140%

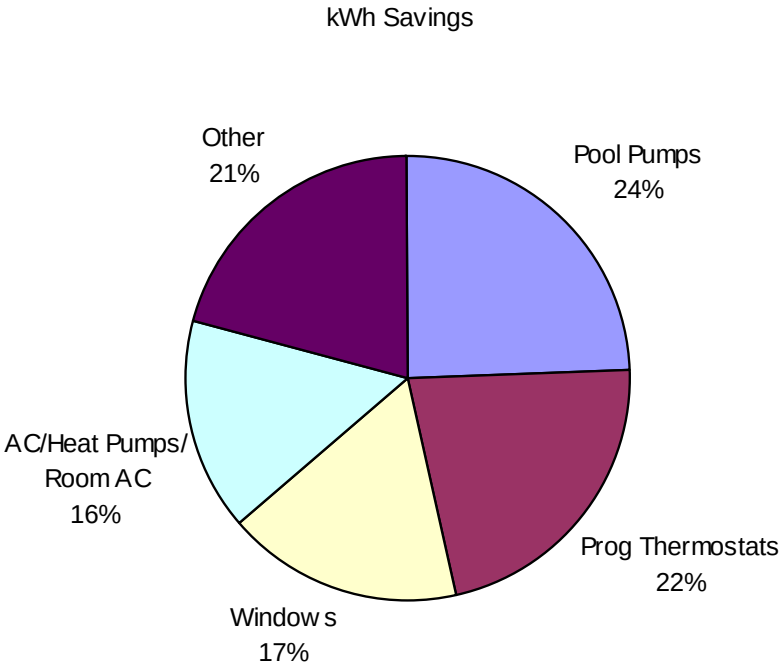
HTR Targets and Accomplishments

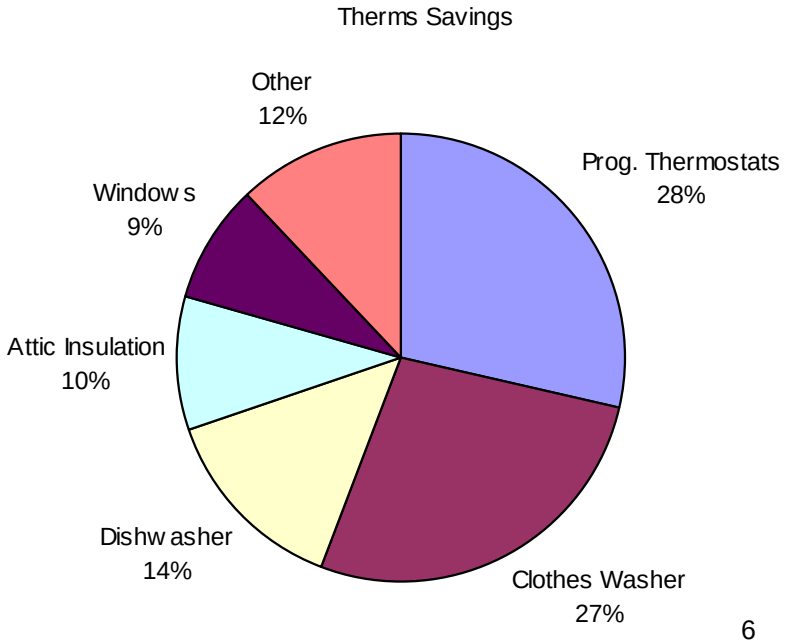
- Overall, Hard-to-Reach targets were met.

Utility	HTR Target	Result
PG&E	32%	37%
SCE	34%	37%
SDG&E	66%	59%
SCG	11%	24%

Program Accomplishments: Key Measures

- Programmable Thermostats contributed to nearly a quarter of the program's kWh and Therms accomplishments.
- Pool Pumps and Clothes Washers contributed a quarter of the program's kWh and Therms accomplishments, respectively.





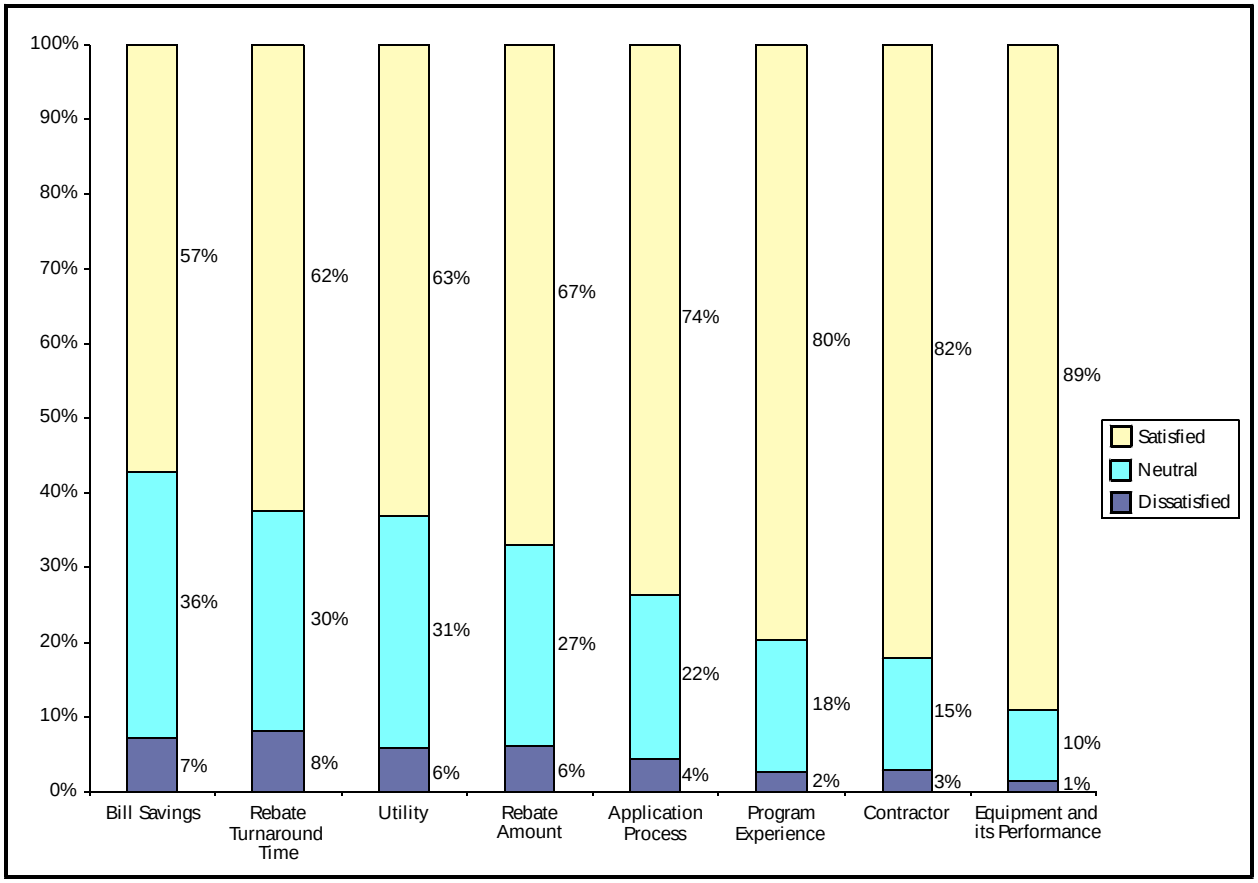
Verification Results

Overall the accomplishments reported to the CPUC were accurately reported and installed.

- Applications– were entered correctly and invoices verified program qualifying equipment.
- Measure Accomplishments and Ex Ante Values – were verified comparing tracking data, CPUC Final workbooks and PIPs.
- HTR Accomplishments – were verified comparing tracking data and CPUC Final workbooks.
- Measure Installations – were verified through 1,087 telephone surveys, and were determined to be program qualifying through 127 on-sites.

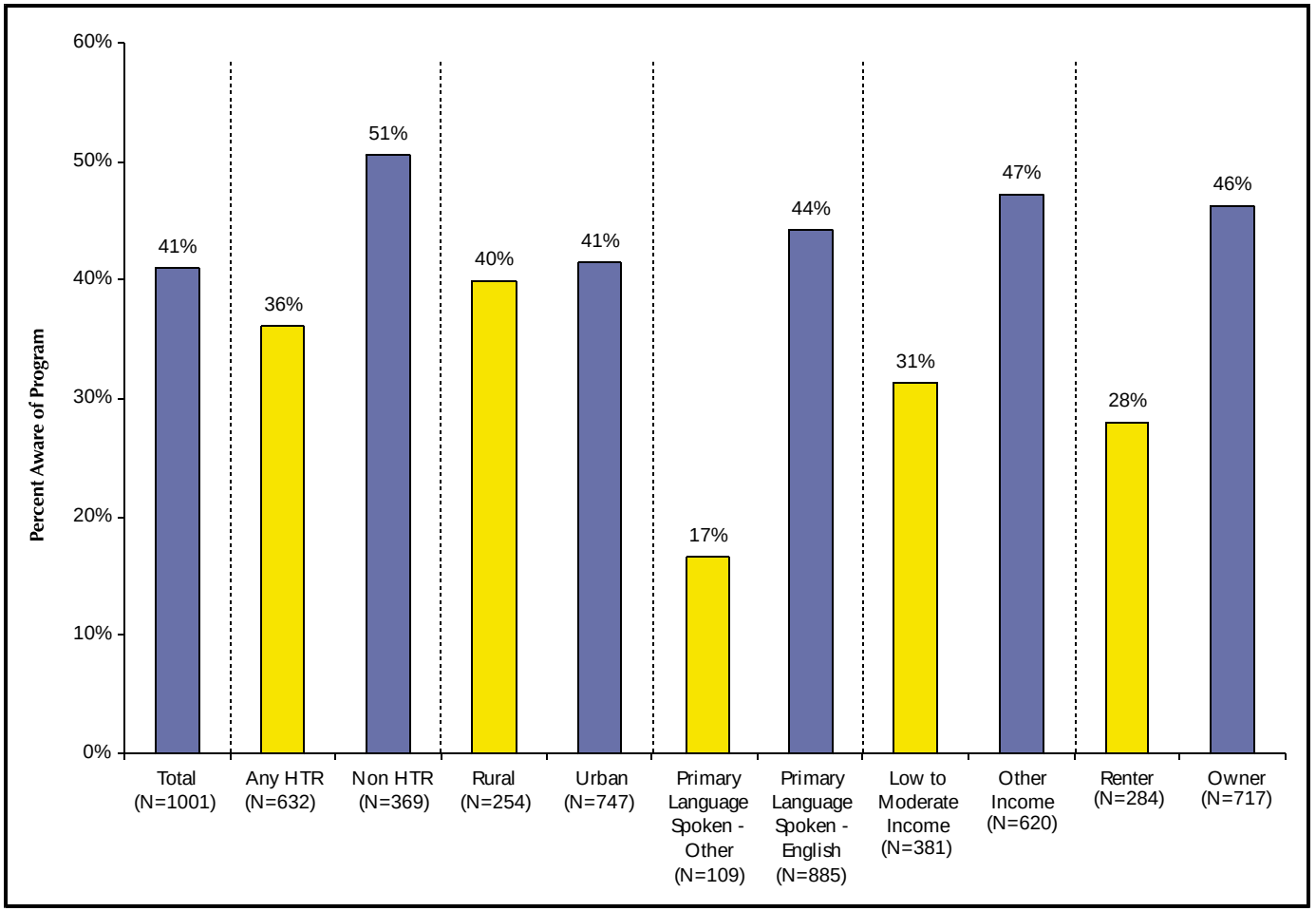
Program Satisfaction

- Participants are Satisfied with all aspects of the Program.



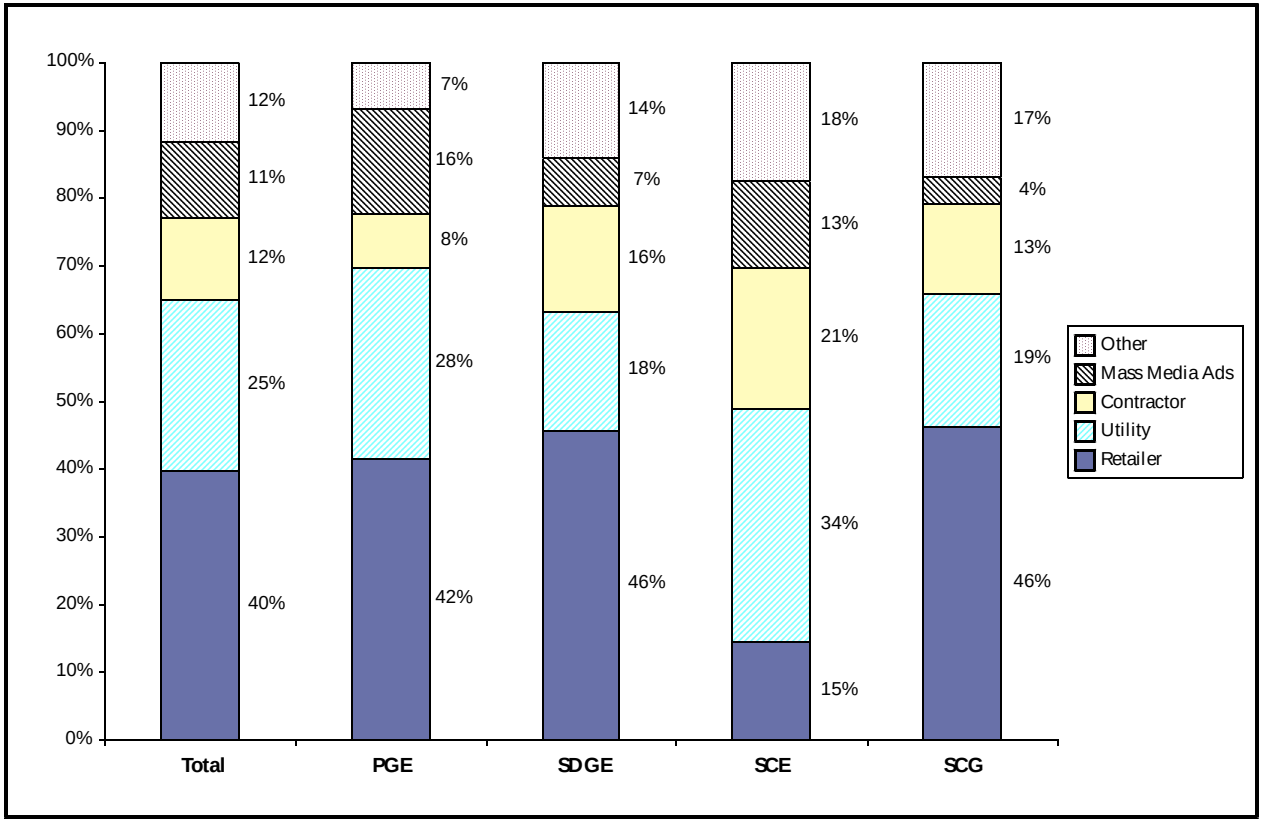
Program Awareness for General Population and HTR Segments

- Program awareness among HTR segments lags the population



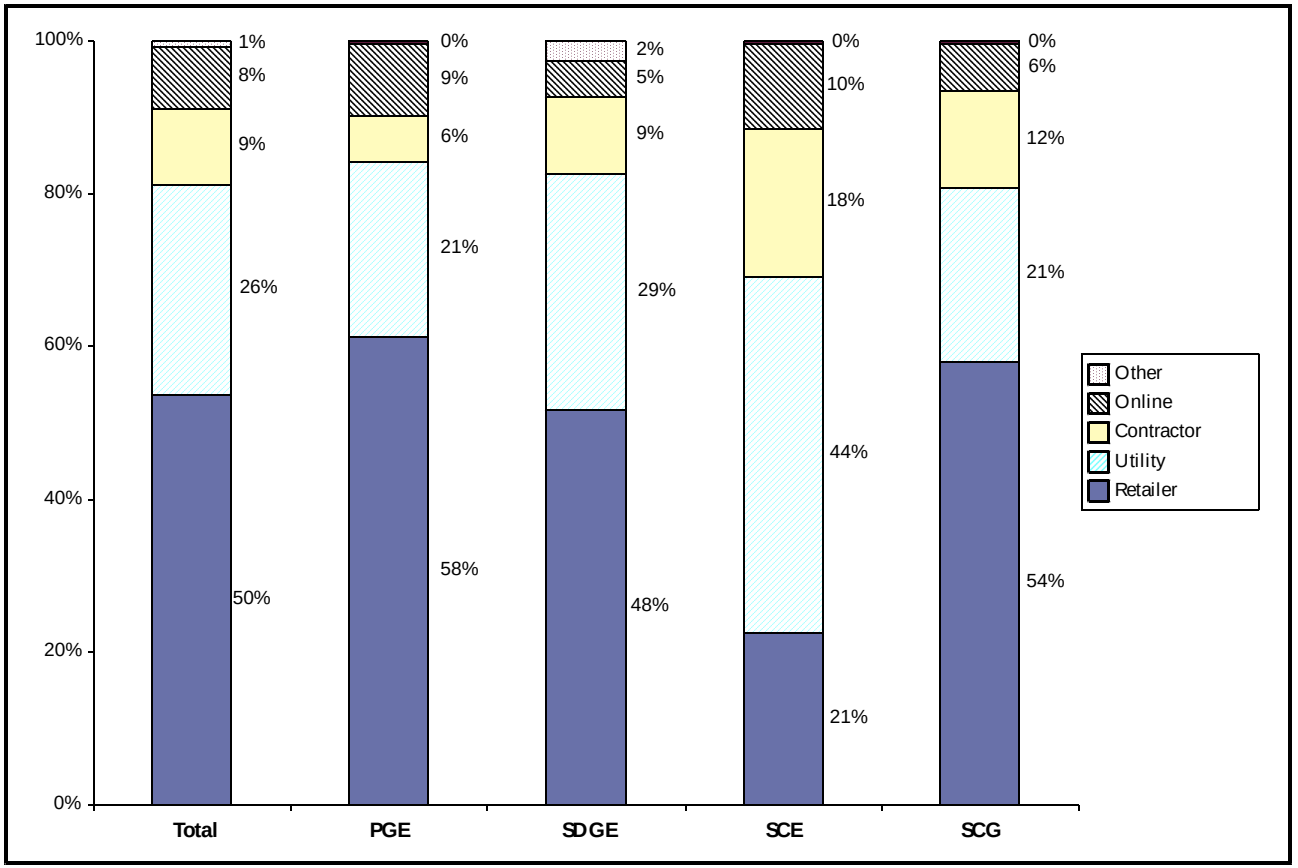
Major Sources of Participant Awareness

- Retailers are a significant source of program awareness.



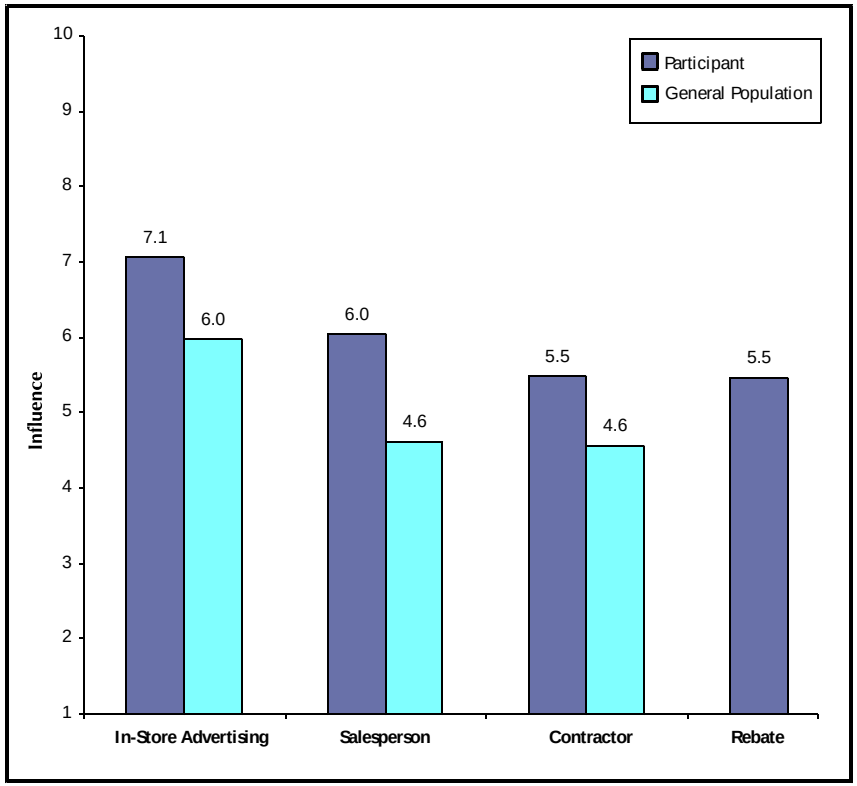
Sources For Obtaining Program Applications

- Most customers obtain their applications from a retailer



Influences on Purchase Decision for Participants and the General Population

- Retailer channels - in-store advertising and sales staff - are more influential than contractors or rebates on energy-efficient purchases



Program Delivery - Process Findings and Recommendations

- Strengthen Marketing Partnerships with Retailers
  - One in two participants received a rebate application from a retail store in 2002
  - Most participants recalled promotional material at retailers
  - Participants said in-store advertising influenced their purchases
- Consider offering more point of sale discounts
  - Retailers responded positively to the fall 2002 pilot POS rebate

Program Delivery - Process Findings and Recommendations

- Contractors Took a Backseat to Retailers
  - Contractors were not very influential on purchases, even heating and cooling measures
  - Only 1 in 10 participants learned of rebates or obtained an application from a contractor
  - Majority of participants not interested in utility referrals to contractors

- Online Applications Are Increasingly Popular
  - Over half of participants with Internet access were aware that rebate applications were available online
  - 20% of participants said they downloaded an application

Pool Pump Recommendations

- Accounted for more kWh energy savings than any other measure
- Continue to educate contractors
  - Resistant to changes in operating hours, off-peak usage and two-speed pumps
- Educate pool owners about off-peak or greatly reduced pump operation, since they seem more responsive to these messages than contractors
- Continue current statewide guidelines on reduced usage and off-peak pumping
- Offer contractor incentives at the beginning of the pool season

Programmable Thermostat Recommendations

- Accounted for more combined gas and electric savings than any other measure
- Point of sale rebates are an effective way to move the thermostat market
  - Retailers responded positively to the POS pilot
  - Energy Star staff interviewed said programmable thermostat sales levels were drastically higher in 2002
- Consider phasing out rebates for contractor-installed programmable thermostats
  - Many contractors install programmable thermostats when installing a new AC or furnace
  - Impact of rebate is minor compared to the total cost of thermostat relative to AC changeout

High Performance Dual Pane Windows Recommendations

- Third most popular measure in the program
  - Account for 17% of program kWh savings
- Free ridership rate for window rebates should be examined
  - Most replacement windows are high efficiency
  - Energy Star window market share is rising
  - Contractors estimate that over 90% of customers would have installed rebate-qualifying windows without a rebate
  - *NOTE: These findings based on a small non-random sample of participating vendors.*

Air Conditioner Recommendations

- AC, Heat Pumps, & Room AC account for 16% of kWh savings
- Application rejection rates are high for both customers & contractors
- Need to simplify:
  - Program requirements
  - Qualifying-measures
  - Paperwork
- Investigate baseline SEER installations
  - The lower end of the CAC market is at or moving toward 12 SEER packaged and 13 SEER split systems
  - Energy Star CAC market share in California is rising
- Consider distributor incentives
- Consider working more closely with distributors on program requirements and administrative procedures

Whole House Evaporative Cooler Recommendations

- Not a high-volume measure through the program in 2002
  - Accounted for less than 1% of customers
  - Less than 5% of kWh
- Education may be more important than rebates in moving the market
  - Manufacturers believe that evaporative coolers “sell themselves” through word of mouth
- Consider offering a distributor incentive to improve product availability
  - Few contractors stock and install them

Whole House Fan Recommendations

- Rebate was cut in half to to $75 in 2002
- Whole house fans accounted for few participants, rebate dollars or energy savings
- Energy Star staff reported sales of whole house fans were flat in 2002
- Customers were satisfied with their fans and bill savings, but participation was low
- Reconsider rebate levels

Key Recommendations

- Partner with big box retailers
  - Greatest source of awareness, applications and influence
- Consider point of sale rebates for more measures
  - Lighting and Thermostat pilot have been successful
  - Retailers are receptive
- Continue to educate the pool pump industry
  - Mobile training exhibit has been successful in the past
- Lower HVAC application rejection rates
  - 2003 Program process has been more successful
- Reconsider window rebates
  - Conduct a free ridership analysis with a larger random sample
- Stimulate whole house evaporative cooler market by partnering with distributors
  - Consider offering distributor incentives to increase availability and educate contractors

2002 Evaluation of the California Statewide Multi Family Rebate Programs

Presented by

Robert Wirtshafter, Wirtshafter Associates, Inc.

MAESTRO Workshops

San Francisco, March 31, 2004

Overview of MFRP Program

- New program focus on multi-family and mobile home parks.
- Rebates for both common and tenant area measures.
- Targeted to property managers and owners.
- Large contractors (ESCOs) dominate the electric side—Funds quickly reserved
- Gas side because of lower incentives needs marketing push.

Overall Assessment

- MFRP was a new program
- Program rolled out successfully
- MFRP was successful in reaching tenant spaces
- MFRP has extremely large market potential—2.8 million units, most not previously treated.

Major Issues

- Lighting Quality Issues
- Marketing to Gas Users
- Hard to Reach Policies

Surprising Light Quality Issue Found

- On site inspections and property manager/owner (PMO) survey uncovered major quality control issue.
- On-site--Large number of lamps and fixtures not found.
  - Up to 25% of 16W CFLs missing.
  - Up to 30% CFL fixtures missing.
- Only 62% of landlords surveyed were completely satisfied with program
- Lighting issue only--Other measures were generally still in place, without PMO complaints.

Overall Participant Property Manager Satisfaction by Measure Type

▪	Not Completely Satisfied*	Completely Satisfied	Percent Satisfied
Lighting Only	47	58	55%
No Lighting Measures	7	28	80%
Lighting and Other Measures	3	7	70%
Total	57	93	62%

* Represents at least one of the five satisfaction/recommend program questions received less than a satisfied response.

Possible Reasons Why Lamps Are Not Found

- Some never installed
- Some taken with relocation
- Some burned out
- Some removed for aesthetic, light quality, or remodeling

- Evaluation design was not created to quantify distribution

Lamp Quality Is the Big Issue

- Not all CFLs are created equal.
- Contractors note that some lamps have been of lower reliability.
- EnergyStar label only measure lamp efficiency, not reliability or quality.
- Program for the Evaluation and Analysis of Residential Lighting (PEARL) measuring retail lamp reliability-but contractors buy direct
- Fixture quality and lighting level also serious quality issues not covered by above.

Hurrah for Evaluation

- **Program had little feedback as PMOs just pulled plug.**
- **On-sites/PMO survey first indicator of trouble.**
- **Contractors reacted positively**
  - **Several contractors immediately contacted all of the properties.**
  - **Many started leaving extra lamps.**
  - **Pressure put on manufacturers**

Recommendations to Improve Lamp Retention

- Subsidy undermines market link between contractor and landlord.
- Utility has a role to strengthen weak relationship.
  - Stick approach—add specification standards, enforce warranties
  - Carrot approach—empower landlords to make better decisions and look to contractors for remedy

Hard-to-Read (HTR) Process

- CPUC determines which customer groups are hard to reach.
  - **Language**. Primary language spoken is other than English, and/or
  - **Income**. Customers who fall into the moderate income level (income levels less than 400% but greater than 150% of federal poverty guidelines), and/or
  - **Housing Type**. Multifamily and mobile home tenants, and/or
  - **Geographic**. Residents of areas other than San Francisco Bay, San Diego, Los Angeles Basin, or Sacramento, and/or
  - **Homeownership** Renters
- Utilities set goals, by program, to reach HTR customers
- Each evaluation assesses HTR achievement for program.

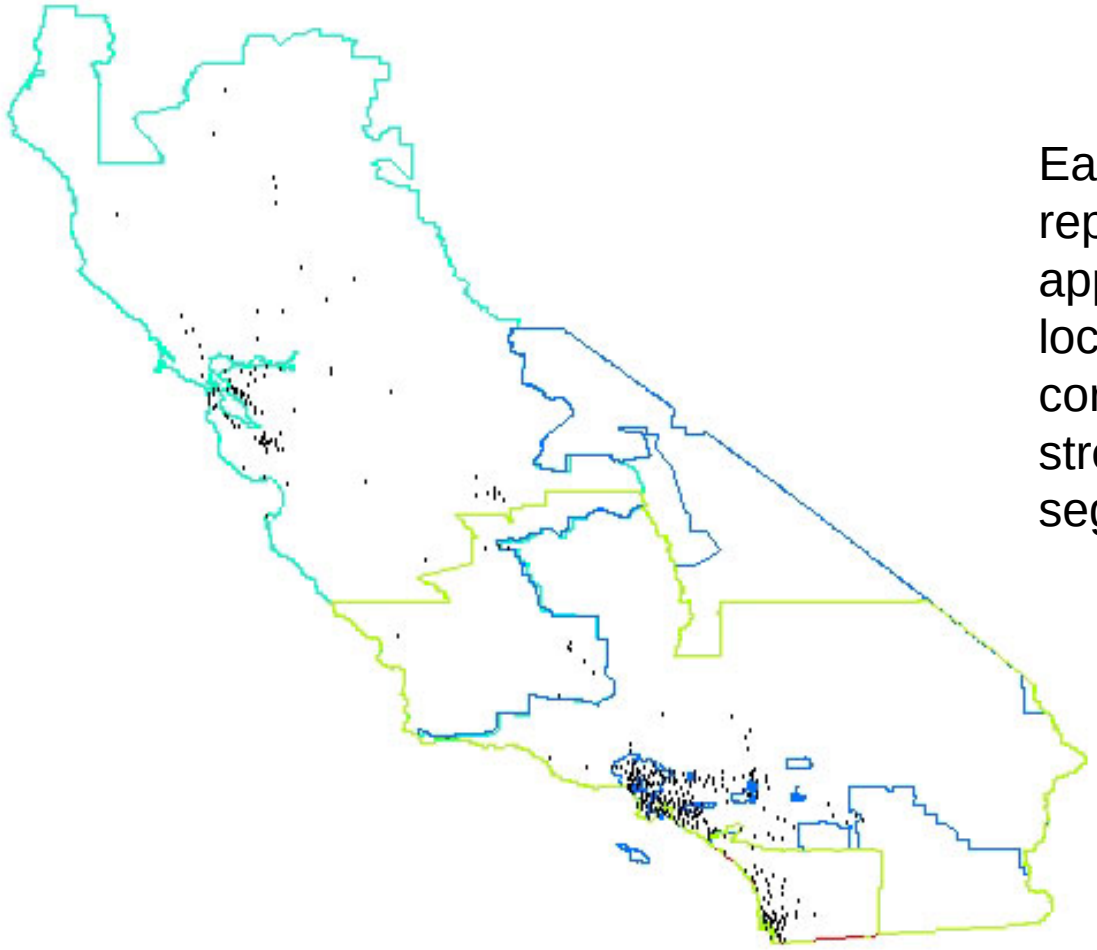
MFRP Hard-to-Reach Definitions and 2002 Goals

	2002 HTR Performance Goals	2002 HTR Performance Result	Criteria Used to Determine Which Zip codes Are HTR
PG&E	30%	31%	Zip codes outside Bay area nine counties and Sacramento
SCE	36%	58.5%	Rural and those zip codes with 43% or more of households with household incomes between 150% and 400% of poverty level.
SCG	10%	34%	Rural and those zip codes with 43% or more of households with household incomes between 150% and 400% of poverty level
SDG&E	93%	94%	All renters in multifamily units and mobile homes.

Issues with this HTR Approach

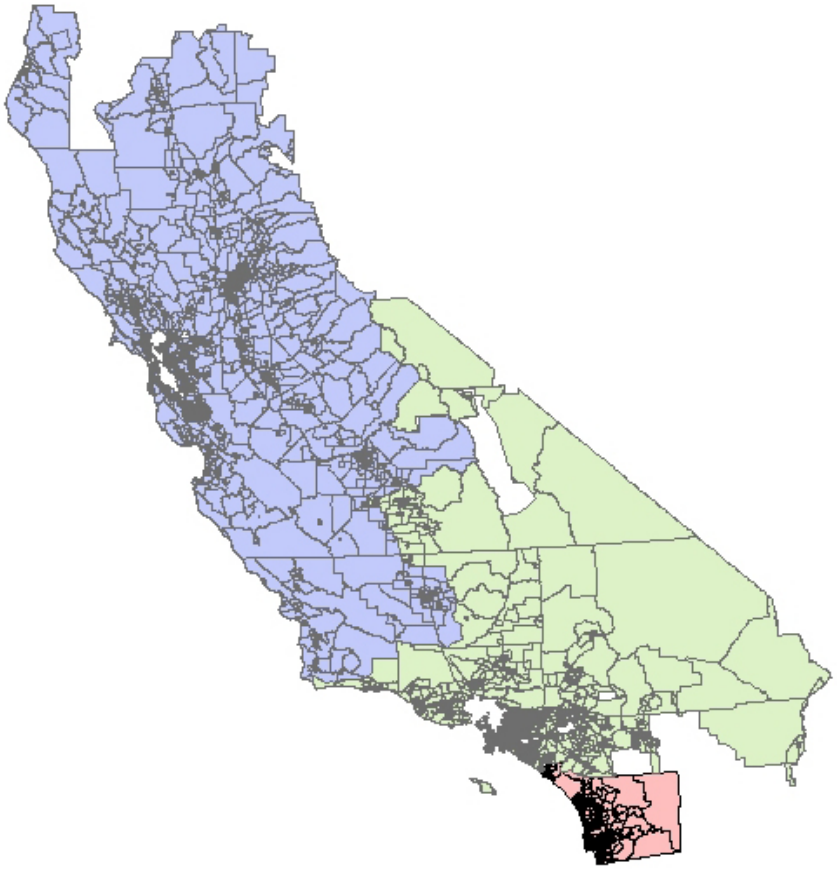
- Each utility has its own basis for setting HTR goals. – Is 10% better than 93%
- The goal of promoting emphasis in rural areas is counterproductive.
- The emphasis on secondary goals such as rural or moderate-income targets detracts from the all-important goal of reaching multifamily units.
- Actual data shows reasonable distribution across race, language, and income, but not spatially.

Use Geographic Information to Locate Each Participant



Each dot represents application located to the correct side of street segment.

Overlay US Census Tracts

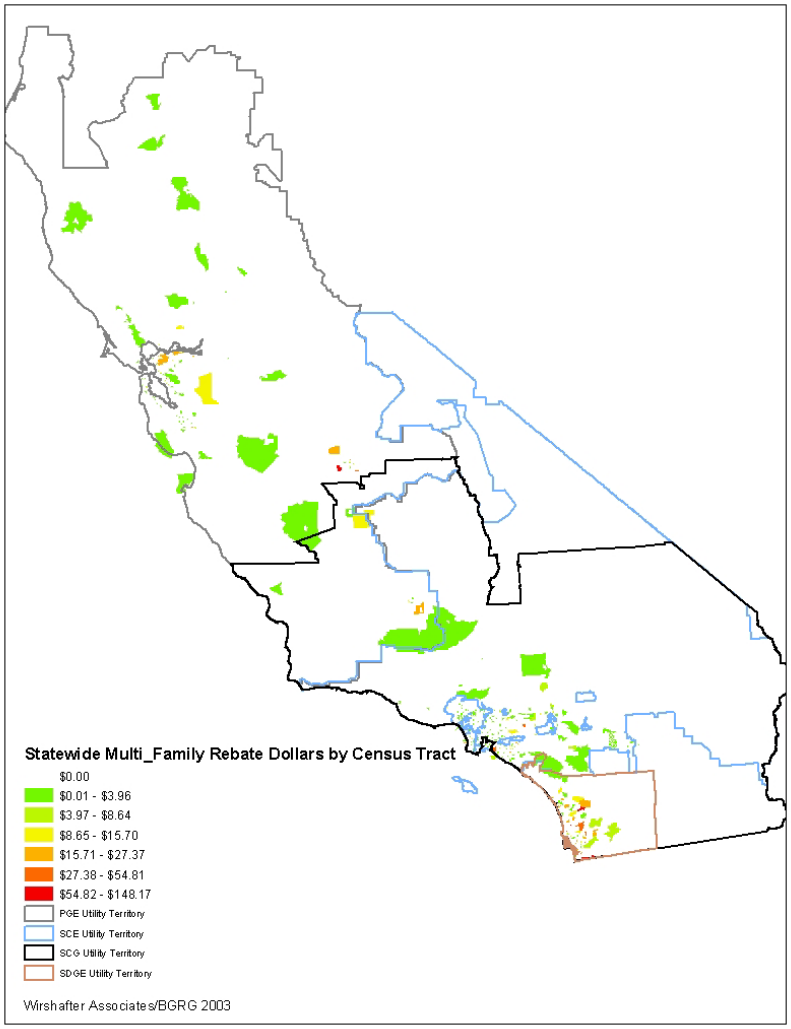


And Assign Average Demographic Values to Each Point

Distribution of MFRP Activity

Rebate $ per Household

5.4 % of tracts have MFRP activity.



Average Characteristics of Active Tracts Similar to Non-Active Tracts

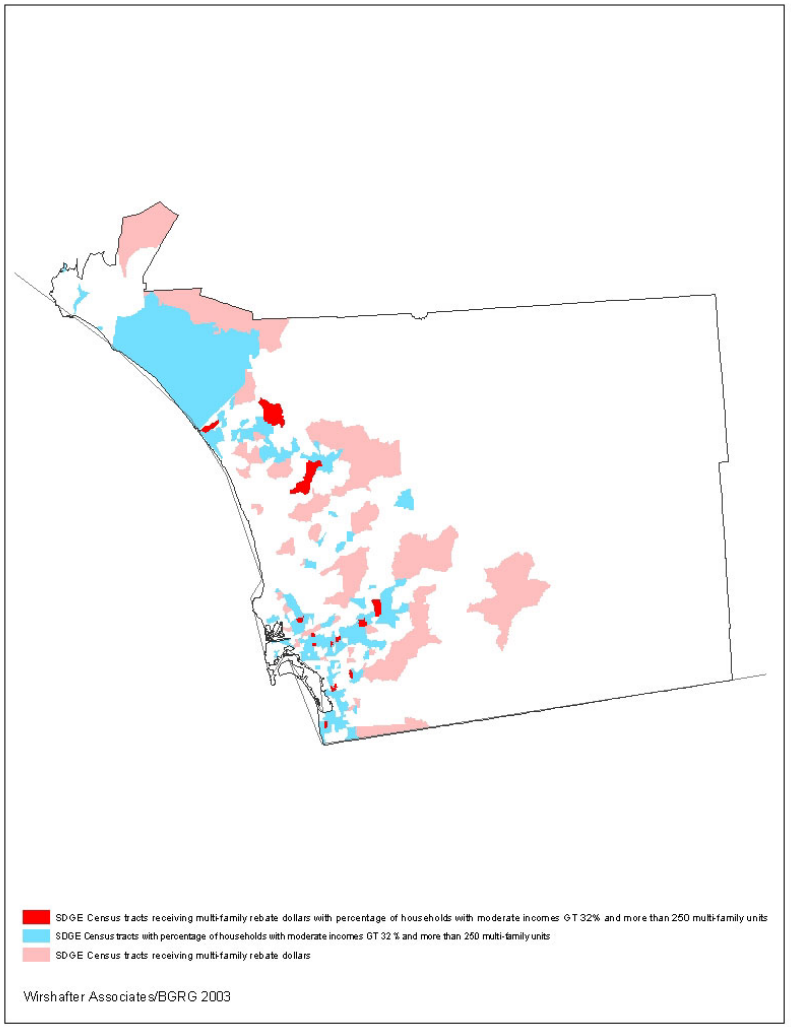
	MFRP Active Tracts	Tracts with No MFRP Activity
Average Percent Rural Households	8.33%	6.63%
Average Percent Non-White/Latino	42.09%	45.55%
Average Percent in Moderate Income Range	31.81%	33.92%

Areas of MFRP Activity (pink) versus Areas with Large Market Potential (blue)

SDG&E

227 tracts meet prime marketing criteria of more than 250 MF units and > than average number of moderate income households.

13 of those had activity in 2002.



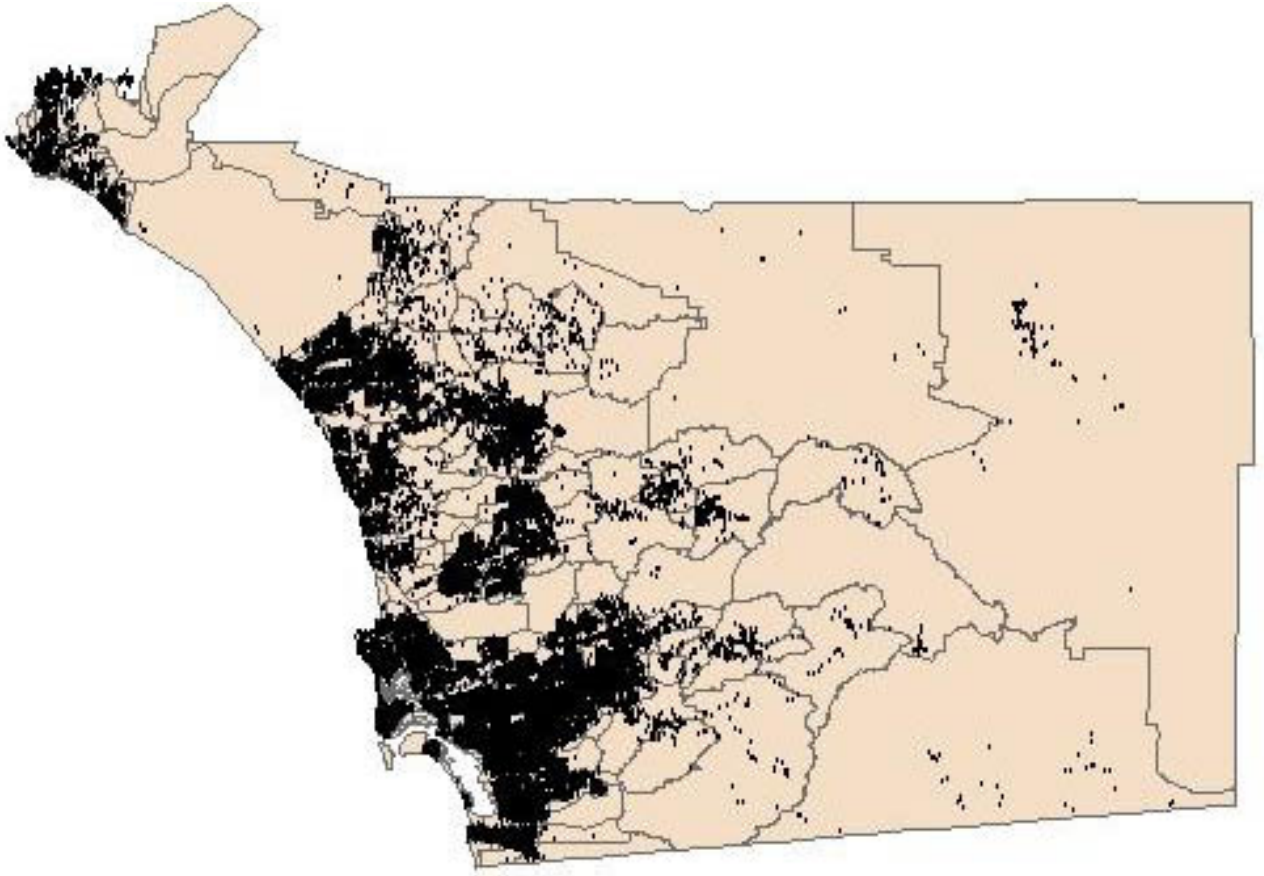
Better HTR Strategy

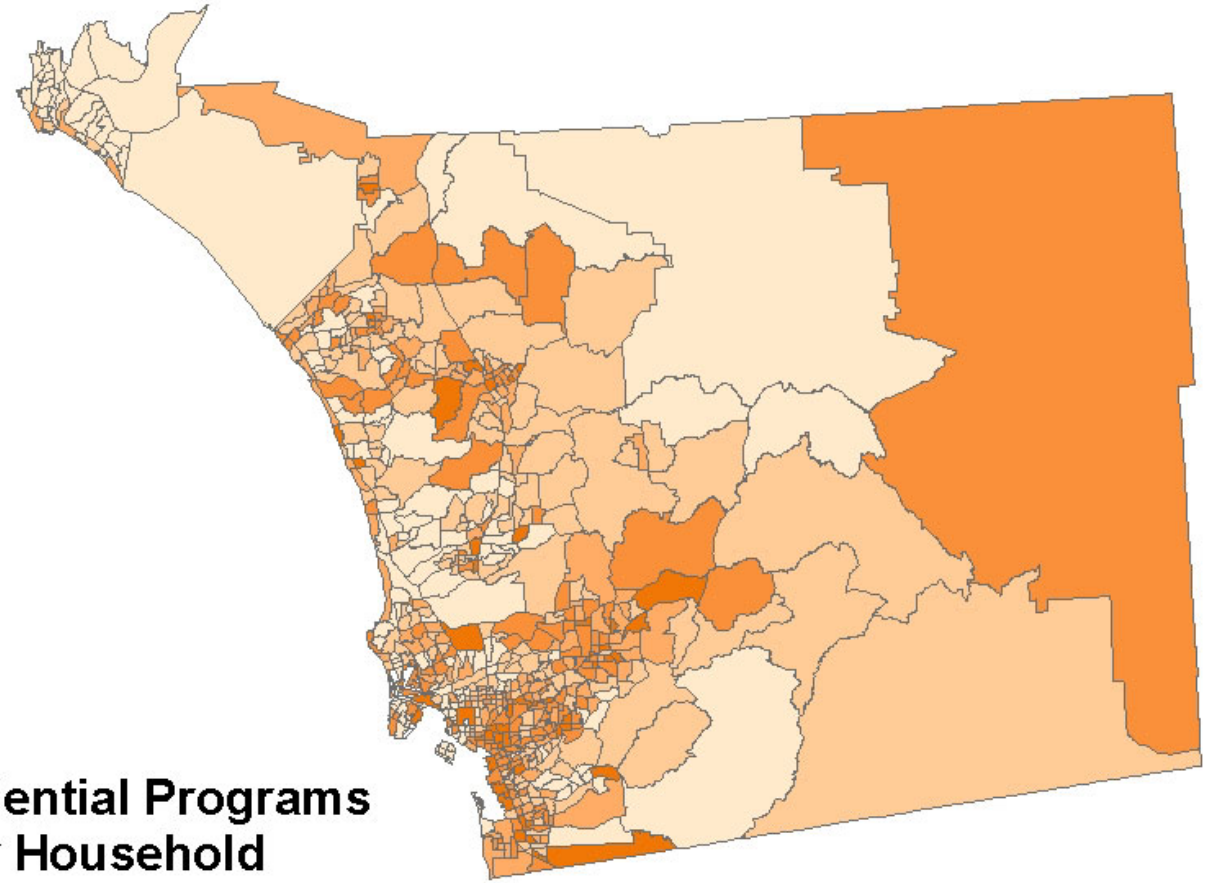
- Use GIS to identify who has been participating in programs, and groups underserved.
- Determine HTR on portfolio basis, not individual programs
- Structure new programs or targeted marketing of strategic programs to attract HTR groups
- Continually repeat process further refining definition of HTR and programs that target them.

Location of SDG&E Res. Activity

Includes:

- Res MF Rebate
- Res Single Family
- Low Income
- Upstream Lighting
- Res Downstream Lighting





SDGE 2002 Residential Programs
Dollars Spent per Household

- $0.06 - $4.49
- $4.50 - $9.34
- $9.35 - $15.20
- $15.21 - $39.44
- $39.45 - $367.33

Rebates per Household by Tract Income Percentiles

Percentiles by Average Income of Households (range of values)	Average Funds Received per Household
Average all Tracts	$14.59
10% of Tracts with Least Average Income. (<$35,930)	$23.77
Group of Tracts that are 10 to 25% least Average Income (>$35,931 to $47,737)	$20.85
25 to 50% of Tracts ($47,738 to $62,934)	$17.20
50 to 75% of Tracts| ($62,935 to $83,635)	$11.62
75 to 90% ($83,636 to $111,904)	$8.30
10% of Tracts with Highest Average Income (>$111,904)	$5.28

SDG&E 2002 Rebates per Household by Tract Racial Composition

Percentiles by Percent of Households that Are Either Non-White or Latino *(range of values*)	**Average Funds Received per Household**
Average all Tracts	$14.59
10% of Tracts with Least Percentage of Non-White or Latino. *(<10% non-white)*	$9.00
Group of Tracts that are 10 to 25% least Non-White *(10 to 14% non-white)*	$11.53
25 to 50% of Tracts *(14 to 27% non-white)*	$10.56
50 to 75% of Tracts| *(27 to 50% non-white)*	$13.99
75 to 90% *(50 to 78% non-white)*	$21.87
10% of Tracts with Highest Percentage of Non-White or Latino *(>78% non-white)*	$23.76

Updating the Database for Energy Efficient Resources (DEER)

Project Overview
Gary Cullen, Itron
March 31st, 2004

Itron
Knowledge to Shape Your Future

Project Purpose

- **Update the Energy Impact Estimates Within DEER**
  - Weather sensitive utilizing the DOE-2 building simulation model
  - Non-weather sensitive measures
- **Create a Web Interface to the Database**

DEER Background

- Originally conceived by the California Conservation Inventory Group (CCIG) in early 1990's
- Initial data collected from utility program filings
- Separate contracts let to identify costs, energy impacts, and database structure

DEER Background (cont.)

- **Costs**
  - Xenergy performed initial measure cost study in early/mid 1990's.
  - This effort has been updated twice since then, both by Xenergy.
  - Latest update in 2001
- **Energy Impacts**
  - Initial effort completed in 1994 by NEOS Corporation
  - Initial effort covered both the residential and non-residential sectors.
  - DOE-2 the primary analysis tool for weather sensitive measures.
  - Residential portion updated in 2001 by Xenergy
- **Database Development**
  - Developed by a local Sacramento contractor in mid-1990's in Fox Pro.
  - No linkage between measure cost and measure impact data

Current DEER Project Elements

- Update and expand the information for non-weather sensitive measures (residential and non-residential)
- Update and expand the information for weather sensitive measures (residential and non-residential) using the DOE-2 building simulation model.
- Create a web interface for the database to allow for on-line access.

DEER Project Team

- **Itron – Overall project management and responsibility for developing the non-weather sensitive data. The Itron project team has extensive evaluation experience and familiarity with DEER.**
- **JJ Hirsch & Associates – Responsible for developing the software to create the weather sensitive impact estimates. JJH has been the leading developer of DOE-2 applications over the past decade. Team members have been part of both the initial NEOS and the Xenergy update teams.**
- **Synergy – Responsible for developing the web interface to DEER. Synergy created a similar web interface for the Pacific Northwest's Regional Technical Forum.**

Original DEER Project Elements

- Update and expand the information for non-weather sensitive measures (residential and non-residential)
- Update and expand the information for weather sensitive measures (residential and non-residential) using the DOE-2 building simulation model.
- Create a web interface for the database to allow for on-line access.

Project Elements Have Changed

- **Linkage between the measure impact estimates and measure cost and lifetime estimates not originally included. Now included but research is limited to reviewing existing sources.**
- **The number of building types expanded and reference to both the T24 and forecasting climate zones included.**
- **Originally, the update was to consider 2001 Codes and Standards as the most current. Now, the 2005 T24 standards will be addressed.**

Effects of These Changes

- Continue to update and expand the information for non-weather sensitive measures (residential and non-residential)
- Continue to create a web interface for the database to allow for on-line access. However, for this phase of the project, this will only include the non-weather sensitive measures
- The 2005 T24 standards and their effects on building and measure characterizations need to be established among the utilities, regulatory agencies, and other parties.
- The result of now considering 2005 T24 standards is to delay development of the weather sensitive measure impacts until the next phase of the DEER update.
- The JJH team will work on these characterizations and finalize development of the DOE-2 based Measure Analysis Software for use in the next phase.

Current Project Status

- Both the residential and non-residential non-weather sensitive databases have been completed and forwarded to Synergy.
- Synergy has uploaded the residential dataset and it is currently in beta testing. The non-residential dataset should be available soon, if not already. Web address is www.rtf.nwppc.org/deer2003/. The CPUC will host the web site after beta testing.
- The JJH team is working with other parties to begin the process of characterizing the measures and prototypes to handle the 2005 T24 standards. Because of the uncertainty of the issues and the need to work with many parties, the timeline for completing the software is delayed until the fall of 2004.

California Energy-Efficiency Potential

Recently Completed Studies

MAESTRO Workshop

March 31, 2004

Pacific Gas and Electric Company

SDGE

A Sempra Energy utility

Southern California EDISON

An EDISON INTERNATIONAL Company

Southern California Gas Company

A Sempra Energy utility

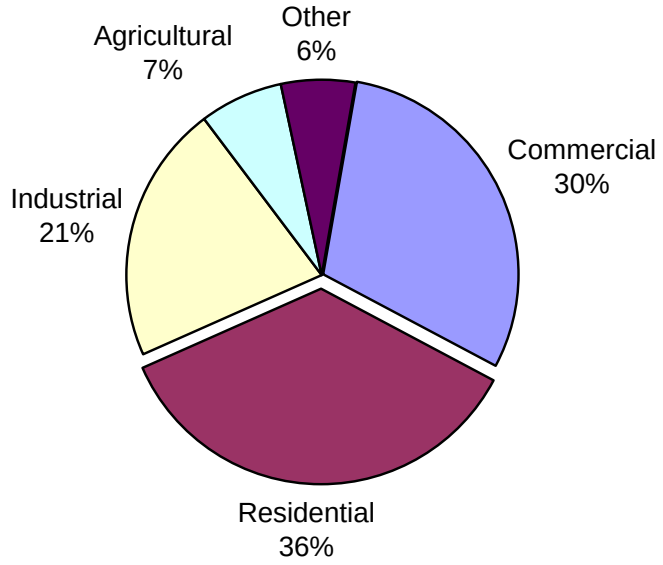
KEMA

Studies Completed to Date

- Commercial Electric — July 2002
- Residential Supply Curves (CEC) — Summer 2002
- "Secret Surplus" — September 2002
  - Res, Com, Ind, NC, Electric Only
- Residential — April 2003
  - Electric and Natural Gas
- Commercial Gas — May 2003

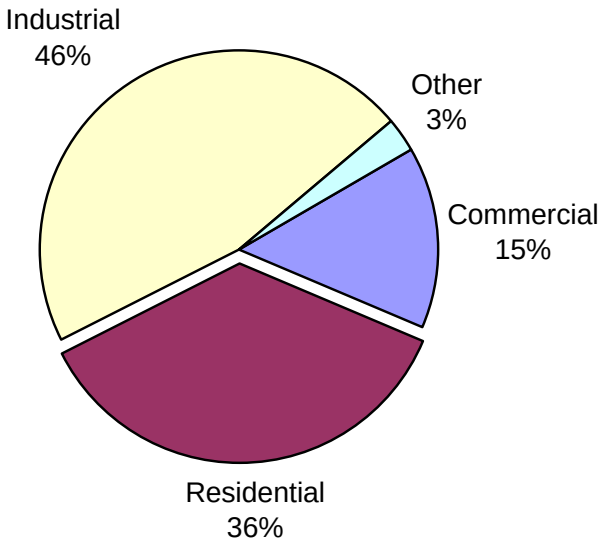
California Energy Use

Electricity



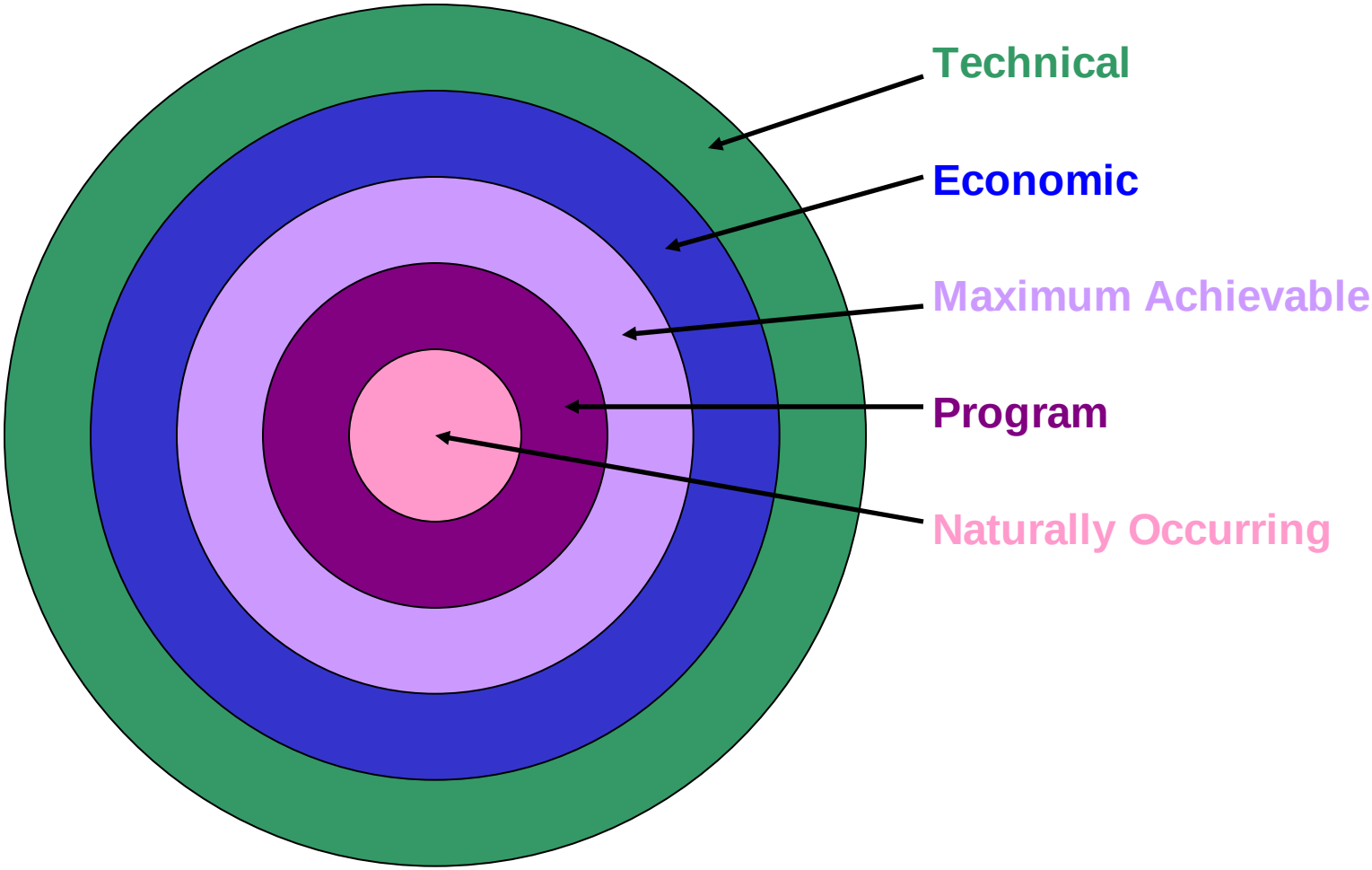
Total Use: ~ 280,000 GWh

Natural Gas

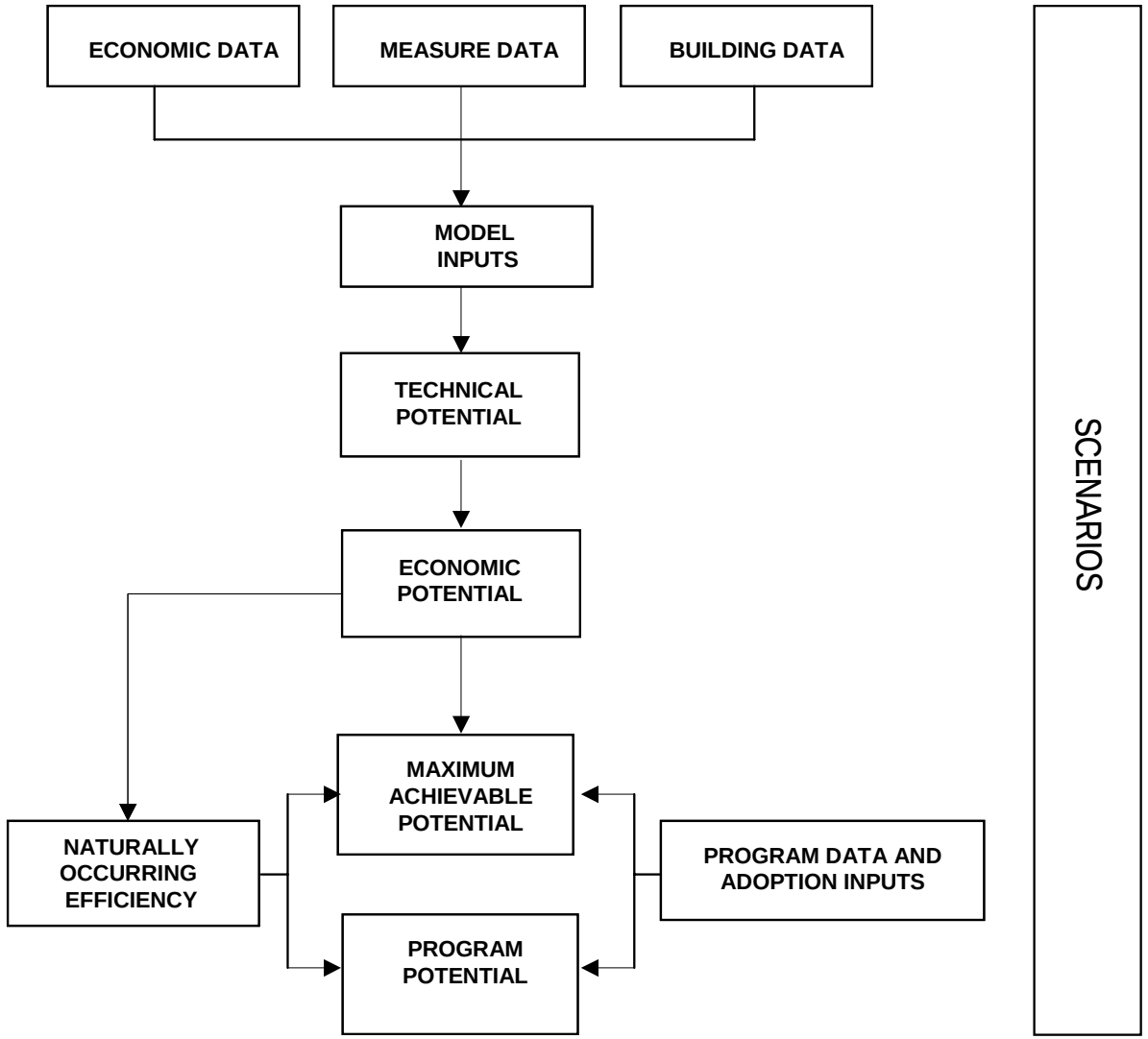


Total Use: ~ 14,000 Mth

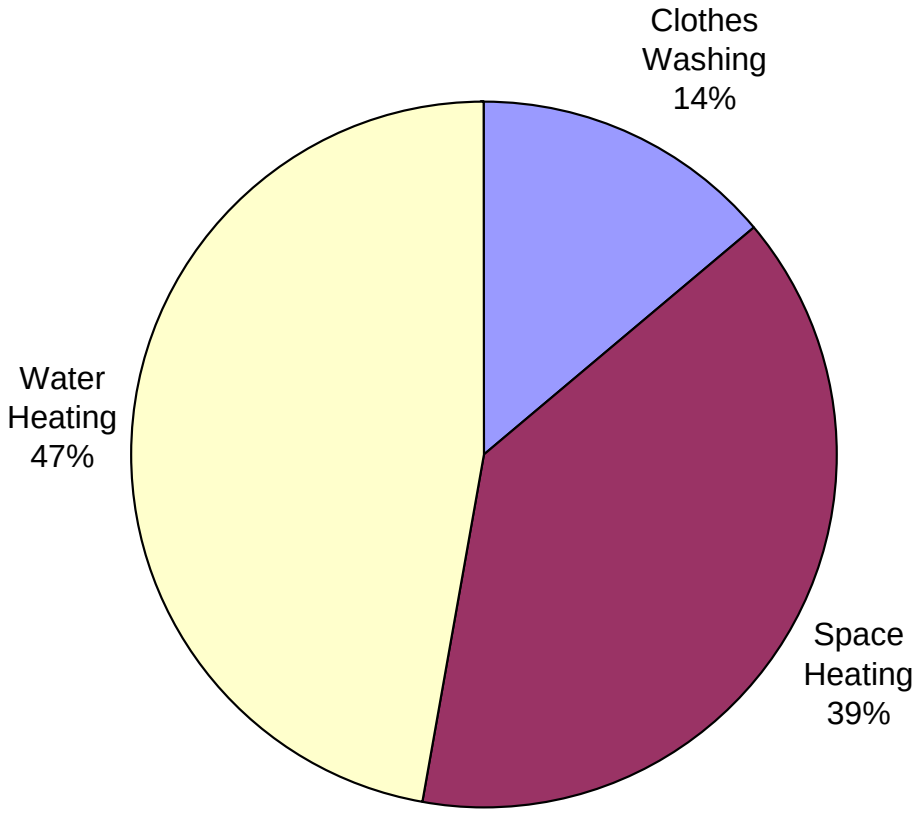
Types of Potential



Study Process



Achievable Residential Gas Potential by End Use



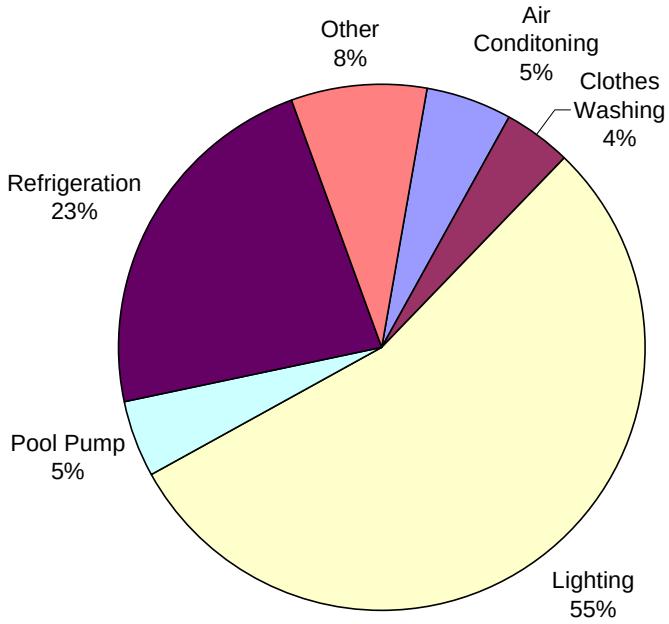
Business as Usual
Program Funding Scenario

Residential Gas Measures

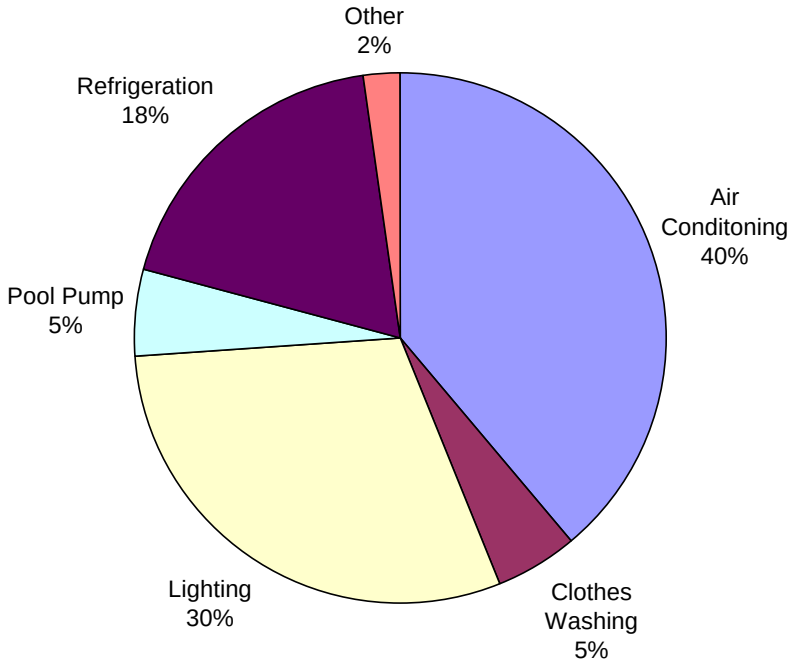
Measures	Mth Savings	Cumulative Mth Savings	Levelized Energy Cost $/Therm	Cumulative Percent Savings
Water Heater Blanket	105	105	$0.08	2%
Pipe Wrap	20	125	$0.17	2%
Low-Flow Showerhead	39	164	$0.29	3%
Faucet Aerators	24	188	$0.34	4%
Boiler Controls	8	196	$0.40	4%
Duct Insulation	12	208	$0.59	4%
Programmable Thermostat	15	223	$0.69	4%
HVAC Testing And Repair	60	284	$0.78	6%
HE Boiler	6	290	$0.82	6%
HE Water Heater	76	366	$0.93	7%
Horiz Access Clothes Washer	322	688	$0.93	14%
Wall Insulation	152	839	$0.98	17%
Ceiling Insulation	84	923	$1.07	18%
Duct Repair	40	963	$1.70	19%
ENERGY STAR Dishwasher	79	1,042	$1.99	21%
Condensing Furnace	193	1,235	$2.82	25%
Floor Insulation	71	1,306	$3.11	26%
Solar Water Heat	831	2,137	$3.52	42%
Infiltration Reduction	6	2,143	$5.06	43%
HE Clothes Dryer	5	2,148	$6.43	43%

Achievable Residential Electric Potential by End Use

GWh



MW



Business as Usual
Program Funding Scenario

Residential Electric Measures

Measures	GWH Savings	Cum. GWH Savings	Levelized Energy Cost $/kWH	Cum. Percent Savings
Water Heater Blanket	126	126	$0.008	0%
Pipe Wrap	24	150	$0.016	0%
HE Tube Fluorescent	324	475	$0.017	1%
Dbl Pane Wndw, Low-E	976	1,450	$0.023	2%
Low Flow Showerhead	45	1,495	$0.026	2%
HE Pool Pump and Motor	1,152	2,648	$0.029	4%
Faucet Aerators	28	2,676	$0.031	4%
CFLs	6,523	9,199	$0.036	13%
HE Clothes Washer	654	9,852	$0.043	14%
HE Water Heater	97	9,949	$0.057	14%
HE Freezer	181	10,131	$0.064	14%
Refrigerator-Early Replace	4,313	14,444	$0.065	20%
Heat Pump Space Heater	419	14,864	$0.085	21%
Energy Star Dishwasher	199	15,063	$0.086	21%
Duct Insulation	28	15,091	$0.109	21%
HE Refrigerator	1,077	16,169	$0.120	23%
Thermal Expansion Valve	127	16,295	$0.124	23%
Heat Pump Water Heater	622	16,917	$0.143	24%
HE Clothes Dryer	173	17,090	$0.178	24%
Wall Insulation	214	17,305	$0.205	25%
Ceiling Insulation	276	17,580	$0.214	25%
Prog. Thermostat	50	17,630	$0.240	25%
Basic HVAC Testing/Repair	175	17,806	$0.241	25%
Duct Repair	87	17,892	$0.263	25%
Floor Insulation	23	17,915	$0.477	25%
HE Room Air Conditioner	36	17,951	$0.529	25%
Default Window w/ Snscrn	420	18,370	$0.600	26%
Solar Water Heat	261	18,631	$0.647	26%
Direct Evaporative Cooler	197	18,829	$0.652	27%
Whole House Fans	206	19,034	$0.679	27%
Attic Venting	67	19,101	$0.789	27%
Central Air Conditioner	468	19,569	$1.095	28%
Infiltration Reduction	16	19,585	$2.049	28%
Ceiling Fans	18	19,603	$2.454	28%
Cool Roofs	107	19,710	$16.810	28%

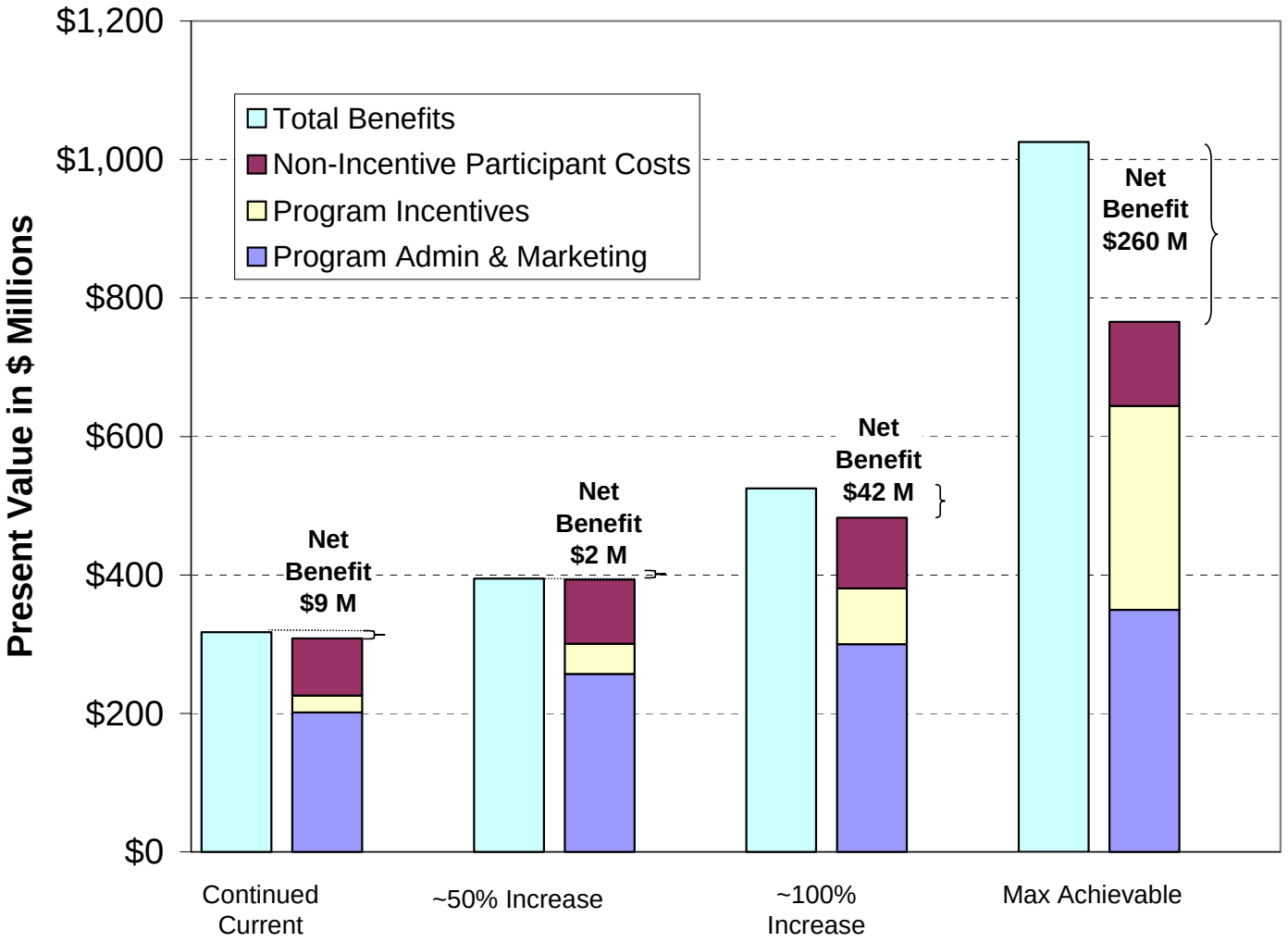
Measures	MW Savings	Cum. MW Savings	Levelized Capacity Cost $/kW	Cum. Percent Savings
Dbl Pane Wndw, Low-E	1,295	1,295	$17	8%
Duct Insulation	37	1,332	$83	8%
Water Heater Blanket	12	1,344	$87	9%
Thermal Expansion Valve	162	1,506	$97	10%
Prog.Thermostat	47	1,553	$149	10%
Pipe Wrap	2	1,555	$164	10%
HE Pool Pump and Motor	205	1,760	$165	11%
Basic HVAC Testing/Repair	223	1,983	$189	13%
HE Tube Fluorescent	28	2,012	$192	13%
Duct Repair	104	2,116	$219	13%
HE Clothes Washer	120	2,235	$233	14%
Low Flow Showerhead	4	2,240	$272	14%
Wall Insulation	51	2,290	$308	15%
Faucet Aerators	3	2,293	$321	15%
Ceiling Insulation	99	2,392	$341	15%
HE Room Air Conditioner	55	2,448	$342	16%
CFLs	570	3,018	$415	19%
Default Window w/ Snscrn	555	3,572	$454	23%
Direct Evaporative Cooler	281	3,854	$457	25%
HE Freezer	25	3,878	$469	25%
Refrigerator - Early Replace	560	4,438	$502	28%
HE Water Heater	9	4,448	$594	28%
Attic Venting	68	4,516	$768	29%
Central Air Conditioner	571	5,088	$897	32%
Whole House Fans	155	5,243	$899	33%
HE Refrigerator	140	5,383	$926	34%
Energy Star Dishwasher	17	5,400	$991	34%
HE Clothes Dryer	25	5,425	$1,238	35%
Heat Pump Water Heater	60	5,485	$1,496	35%
Infiltration Reduction	10	5,495	$1,966	35%
Ceiling Fans	12	5,507	$3,649	35%
Solar Water Heat	25	5,532	$6,748	35%
Cool Roofs	111	5,643	$16,125	36%
Floor Insulation	0	5,643	N/A	36%
Heat Pump Space Heater	0	5,643	N/A	36%

Achievable Savings Estimates – 10 Years

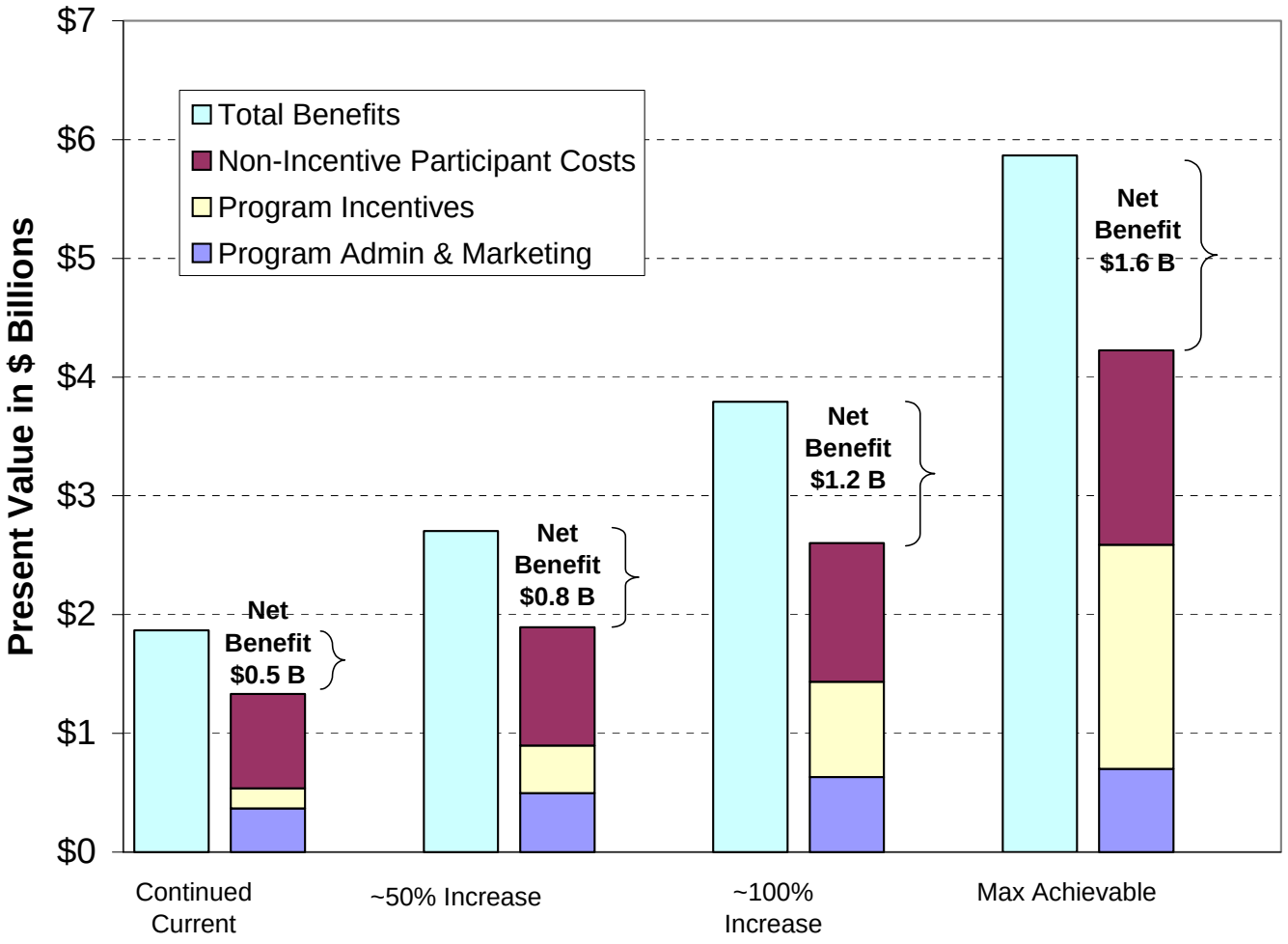
Program Funding Scenario	Electricity			Natural Gas	
	GWh	MW	TRC	Mth	TRC
Continued Current	2,413	385	1.40	51	1.03
~ 50% Increase	4,149	611	1.43	73	1.00
~ 100% Increase	6,327	907	1.46	109	1.09
Maximum Achievable	9,826	1,773	1.39	238	1.34

TRC: Total Resource Cost Ratio = $\frac{\sum \textit{Avoided Cost Benefits}}{\sum \textit{Program and Participant Costs}}$

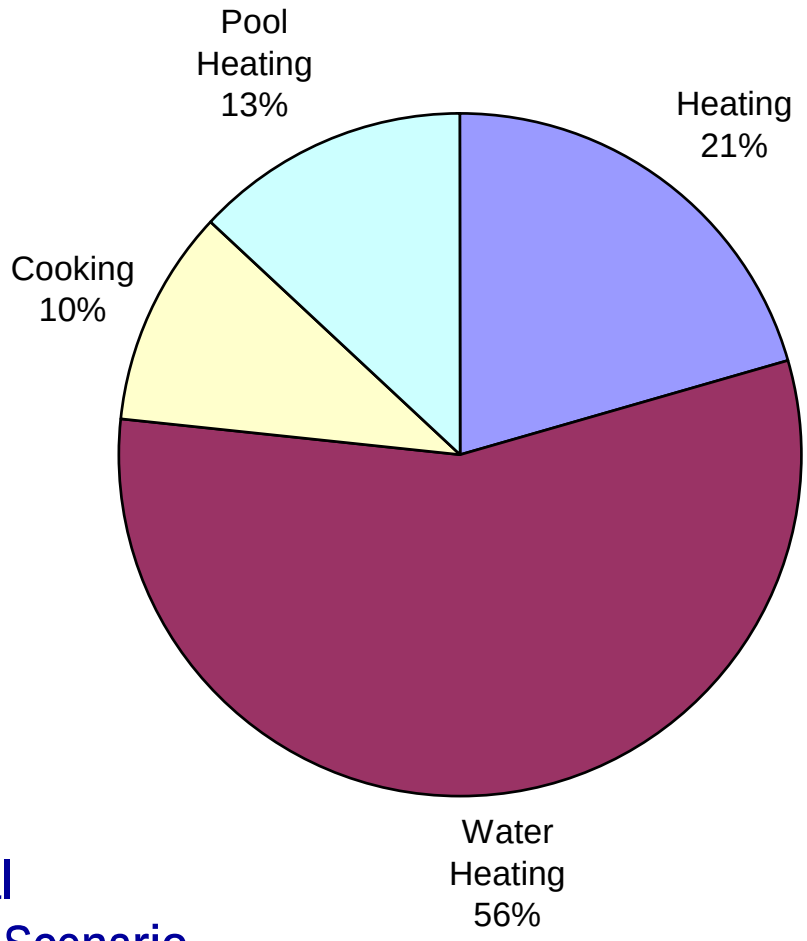
Residential Gas: Costs and Benefits – 10 Years



Residential Electric: Costs and Benefits – 10 Years



Achievable Commercial Gas Potential by End Use



Business as Usual
Program Funding Scenario

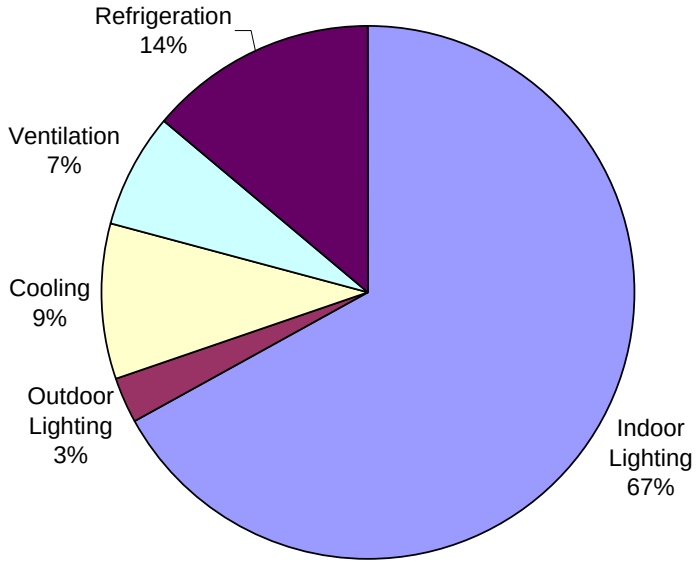
Commercial Gas Measures

Measures	Mth Savings	Cumulative Mth Savings	Levelized Energy Cost $/Therm	Cumulative Percent Savings
Pool Cover	7	7	$ 0.03	0%
Double Pane Low-E	50	57	$ 0.09	3%
Tank Insulation	30	88	$ 0.12	4%
Faucet Aerator	5	93	$ 0.14	4%
Circulation Pump Time Clocks	4	97	$ 0.16	5%
Low Flow Showerheads	1	98	$ 0.17	5%
Instant Water Heater	5	103	$ 0.32	5%
Infrared Fryer	61	164	$ 0.35	8%
Duct Insulation Installed	2	165	$ 0.36	8%
Pipe Insulation	4	170	$ 0.36	8%
HE Gas Water Heater	97	267	$ 0.38	13%
HE Furnace/Boiler	103	370	$ 0.43	17%
HE Pool Heater	4	374	$ 0.48	18%
Boiler Tune-Up	1	375	$ 0.60	18%
Efficient Infrared Griddle	23	398	$ 0.60	19%
Solar DHW System	184	582	$ 0.77	28%
Infrared Conveyer Oven	45	627	$ 1.29	30%
Solar Pool Heater	5	632	$ 1.50	30%
Power Burner Fryer	13	645	$ 1.75	31%
EMS Installed	31	676	$ 1.85	32%
Convection Oven	18	694	$ 2.32	33%
Ceiling Insulation	6	700	$ 2.87	33%
Boiler- Heating Pipe Insulation	0	701	$ 3.97	33%
EMS Optimization	4	704	$ 3.97	33%
Power Burner Oven	12	716	$ 4.79	34%
Heat Recovery: Air to Air	34	751	$ 9.80	35%

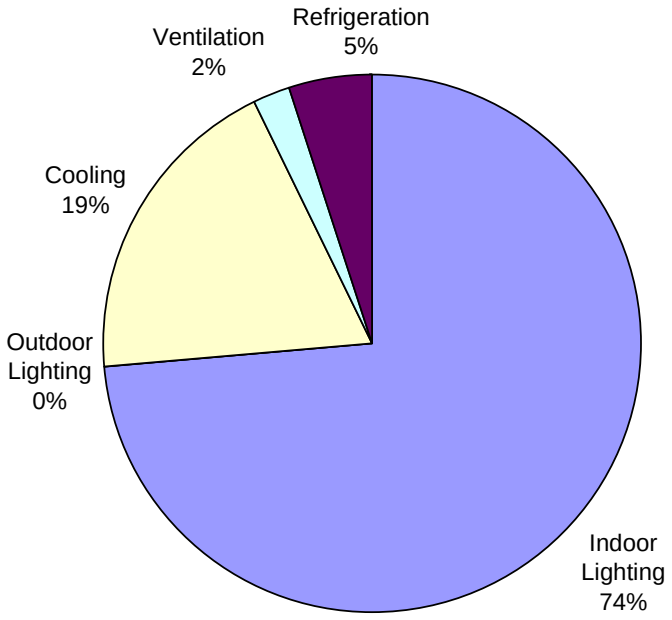
Equipment measures analyzed as replace on burnout – savings are achievable over a ~15-year period.

Achievable Commercial Electric Potential by End Use

GWh



MW



Business as Usual
Program Funding Scenario

Commercial Electric Measures

Measures	GWH Savings	Cumulative GWH Savings	Levelized Energy Cost $/KWH	Cumulative Percent Savings
T8/EB, Refl.	1,010	1,010	$0.007	1%
Refrig. Misc.	45	1,054	$0.007	1%
Refrig. Controls	458	1,512	$0.017	2%
HE Chiller	478	1,990	$0.017	2%
Refrig. Covers	350	2,340	$0.021	3%
Prog. T-Stat	277	2,616	$0.022	3%
CFL	724	3,340	$0.025	4%
Ext. Lite Cont.	236	3,576	$0.026	4%
Refrig. Comp./Motors	1,222	4,798	$0.032	6%
Vent. VSD	453	5,251	$0.034	7%
Occ. Sensor	1,104	6,355	$0.048	8%
Ext. HPS	319	6,674	$0.052	8%
T8/EB	2,539	9,213	$0.059	11%
HE DX	445	9,658	$0.066	12%
HE Vent. Motor	156	9,814	$0.071	12%
Refrig. Commis.	112	9,927	$0.071	12%
Off Eq. Power Mgmt.	1,019	10,945	$0.090	14%
EMS	227	11,173	$0.097	14%
Wind. Film	224	11,397	$0.110	14%
Halogen	295	11,692	$0.136	15%
Chiller Pumps	110	11,802	$0.148	15%
Cool Tuneups	308	12,110	$0.225	15%
Cool Roof	193	12,304	$0.238	15%
Per. Dimming	1,696	14,000	$0.250	17%
Met. Halide	273	14,273	$0.265	18%
Pre-Cooler	170	14,444	$0.326	18%
Off. Eq. Nite Shutdown	113	14,556	$2.031	18%
LCD Monitor	165	14,721	$5.976	18%

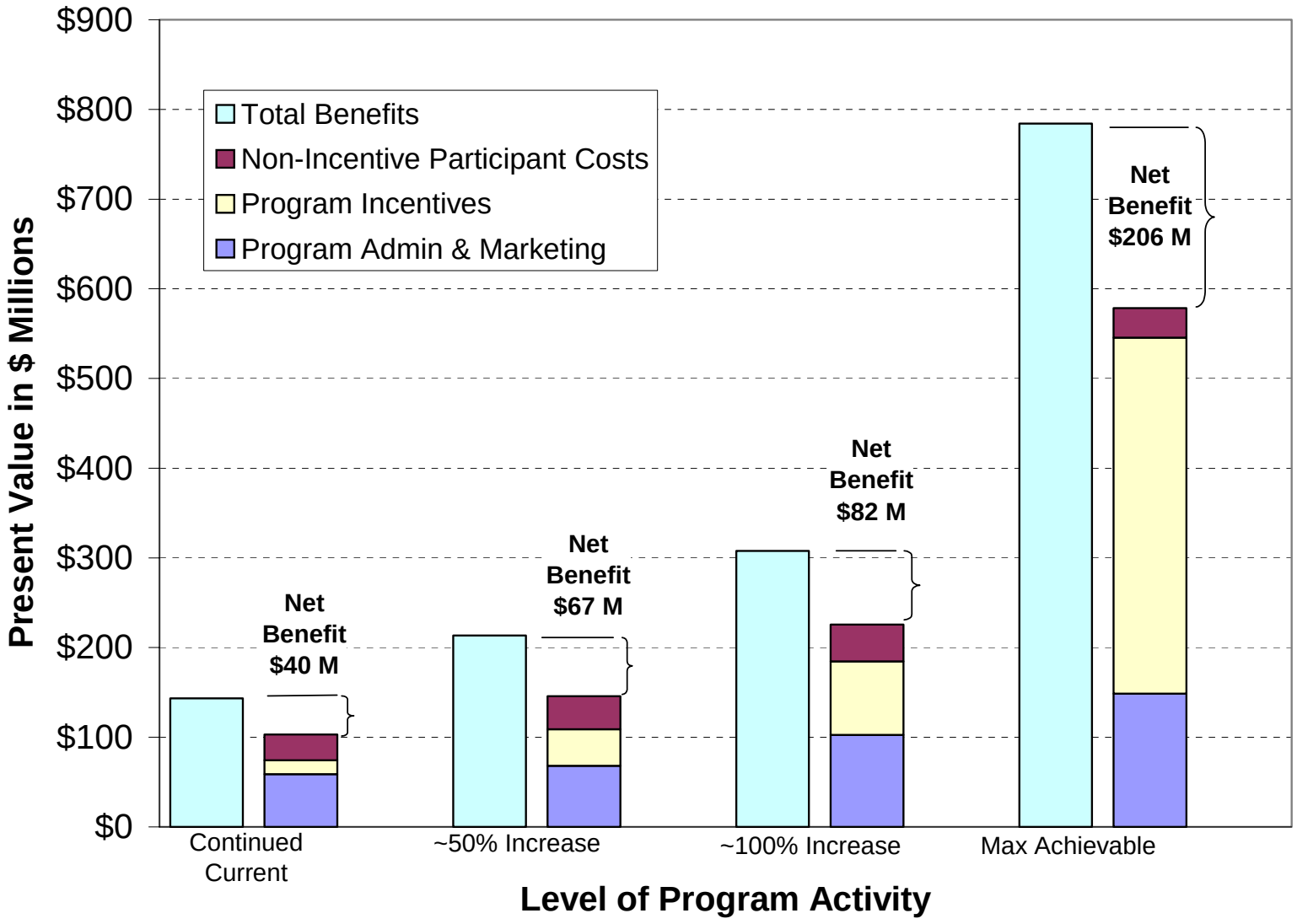
Measures	MW Savings	Cumulative MW Savings	Levelized Energy Cost $/MW	Cumulative Percent Savings
HE Chiller	315	315	$26	2%
T8/EB, Refl.	202	517	$33	3%
Refrig. Misc.	6	523	$49	3%
HE DX	246	769	$120	5%
Prog. T-Stat	46	815	$135	5%
CFL	124	939	$144	6%
EMS	147	1,086	$150	7%
Occ. Sensor	290	1,376	$184	8%
Wind. Film	124	1,500	$199	9%
Chiller Pumps	73	1,572	$224	10%
Refrig. Comp./Motors	151	1,723	$259	10%
T8/EB	485	2,208	$312	13%
Cool Tuneups	186	2,394	$372	14%
HE Vent. Motor	28	2,422	$397	15%
Cool Roof	95	2,517	$483	15%
Refrig. Commis.	15	2,533	$520	15%
Per. Dimming	769	3,301	$553	20%
Pre-Cooler	95	3,396	$587	21%
Vent. VSD	26	3,422	$596	21%
Halogen	55	3,476	$732	21%
Met. Halide	51	3,527	$1,427	21%
Ext. HPS	3	3,530	$6,151	21%
LCD Monitor	29	3,558	$34,229	22%
Refrig. Covers	10	3,569	N/A	22%
Refrig. Controls	18	3,587	N/A	22%
Off Eq. Power Mgmt.	86	3,673	N/A	22%
Off. Eq. Nite Shutdown	0	3,673	N/A	22%
Ext. Lite Cont.	0	3,673	N/A	22%

Achievable Savings Estimates - 10 Years

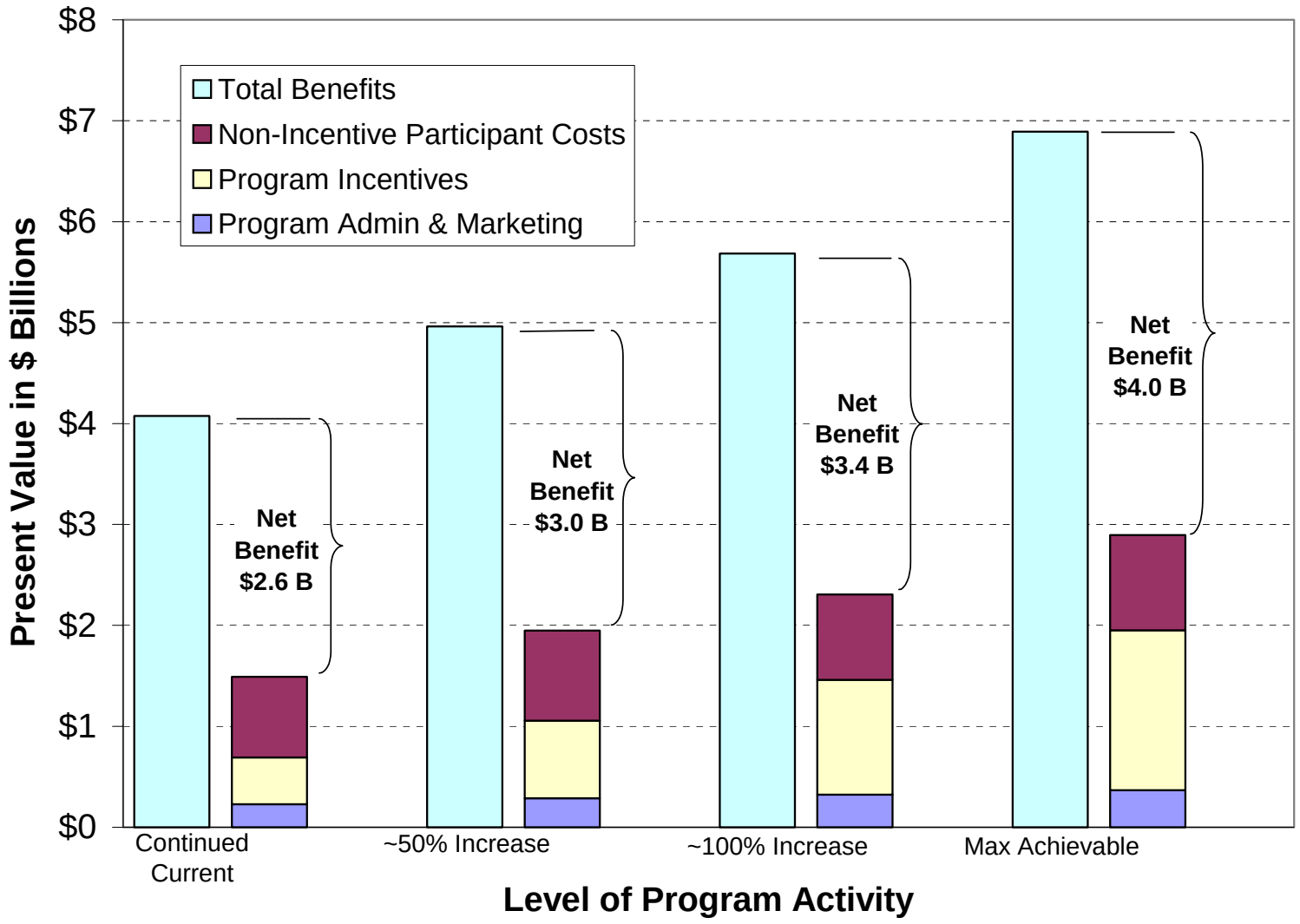
Program Funding Scenario	Electricity			Natural Gas	
	GWh	MW	TRC	Mth	TRC
Continued Current	4,042	785	2.73	30	1.39
~ 50% Increase	5,256	1,090	2.55	49	1.46
~ 100% Increase	6,112	1,294	2.47	75	1.36
Maximum Achievable	7,758	1,650	2.38	193	1.36

TRC: Total Resource Cost Ratio = $\frac{\sum \textit{Avoided Cost Benefits}}{\sum \textit{Program and Participant Costs}}$

Commercial Gas: Costs and Benefits – 10 Years



Commercial Electric: Costs and Benefits – 10 Years



CALMAC.org and How It Can Help You

A Review of CALMAC, its Website, and the use of the Searchable Database

What is CALMAC

CALMAC provides a forum for:

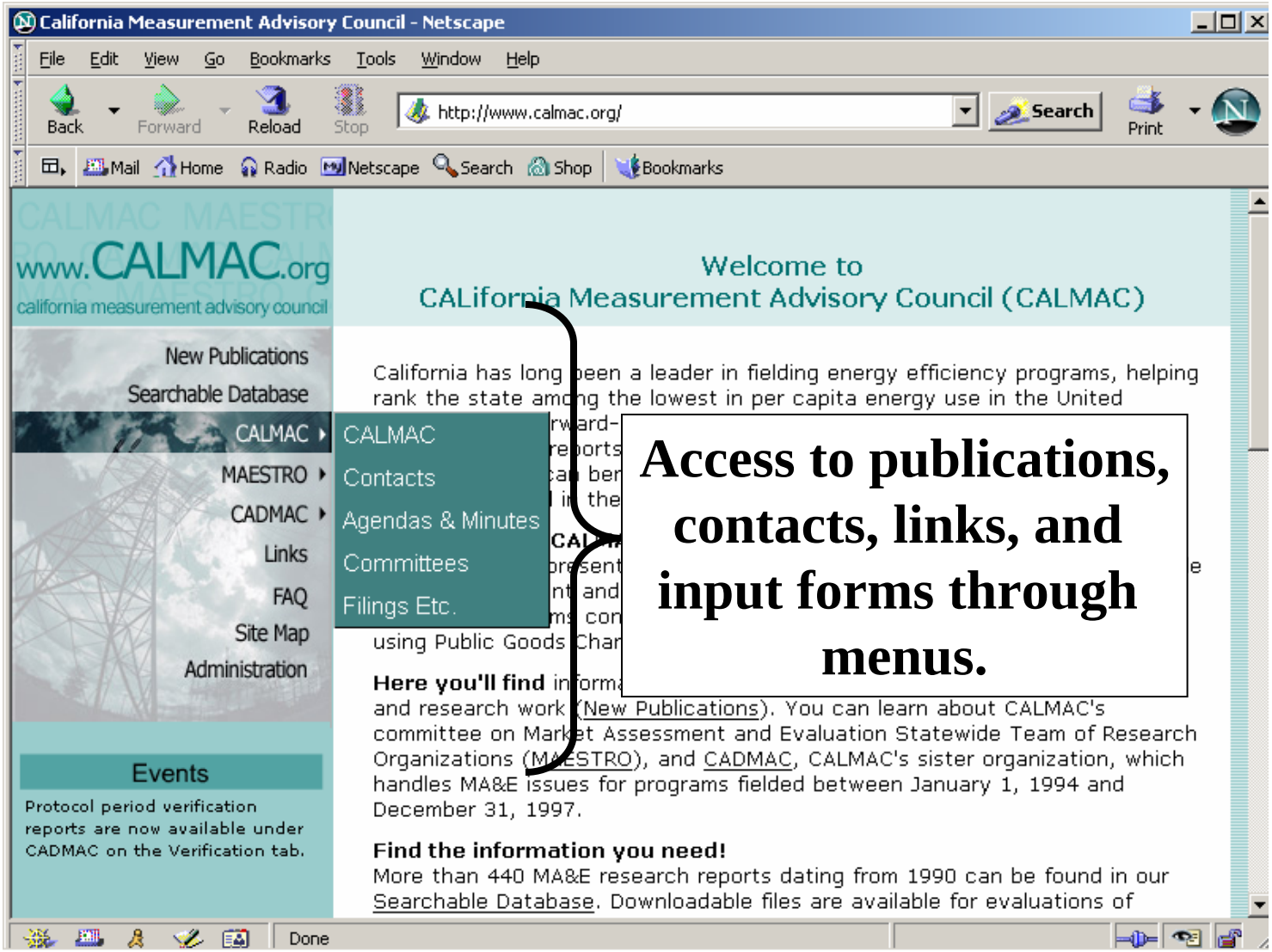
- development, implementation, presentation, discussion, and review of
- regional and statewide
- market assessment and evaluation (MA&E) studies

for California energy efficiency programs conducted by member organizations using Public Goods Charge funds.

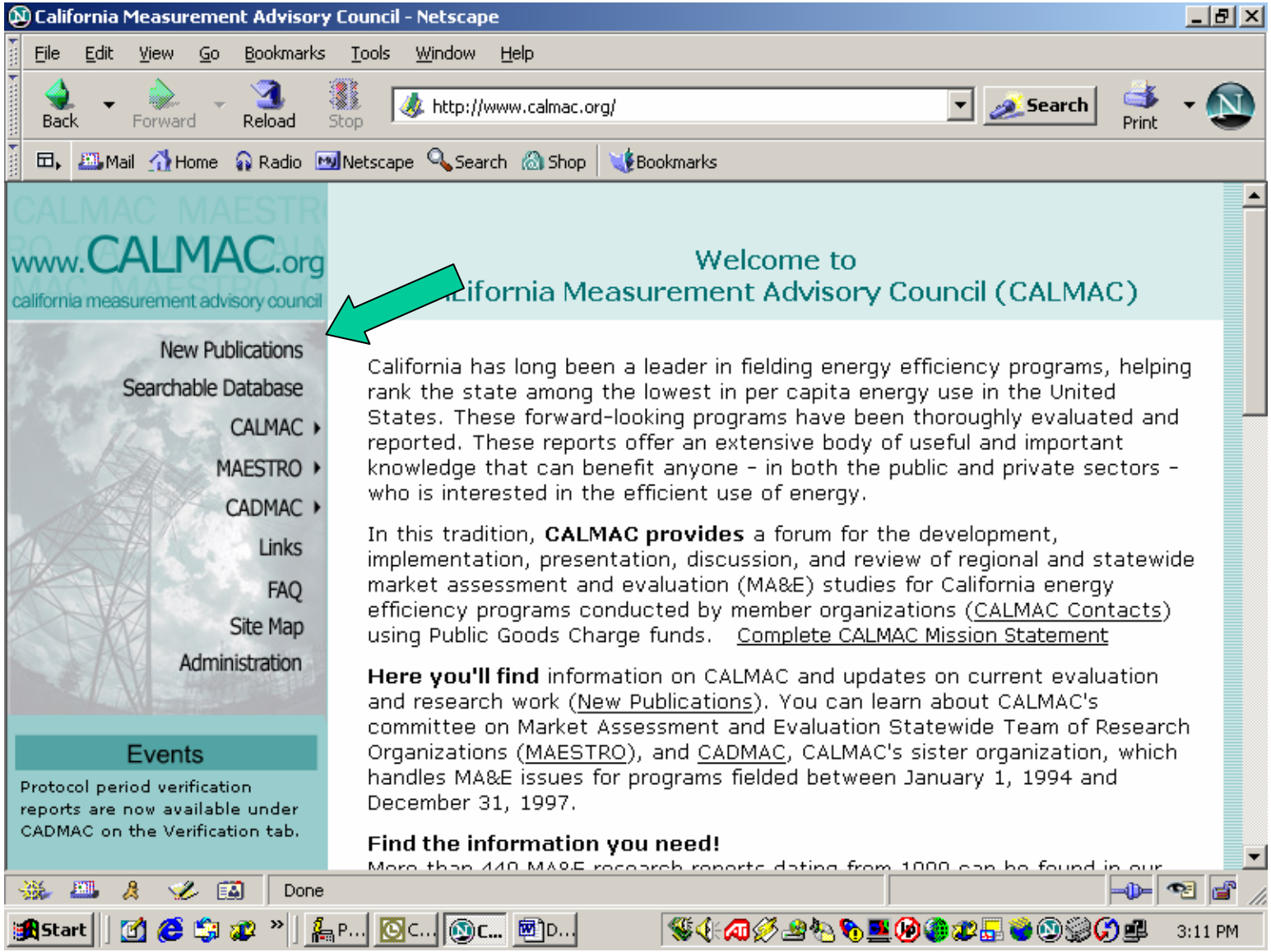
Who Is CALMAC

- California Energy Commission
- California Public Utilities Commission
  - Energy Division
  - Office of Ratepayer Advocates
- Natural Resources Defense Council
- Pacific Gas & Electric Company
- Southern California Edison Company
- Southern California Gas Company
- San Diego Gas & Electric Company

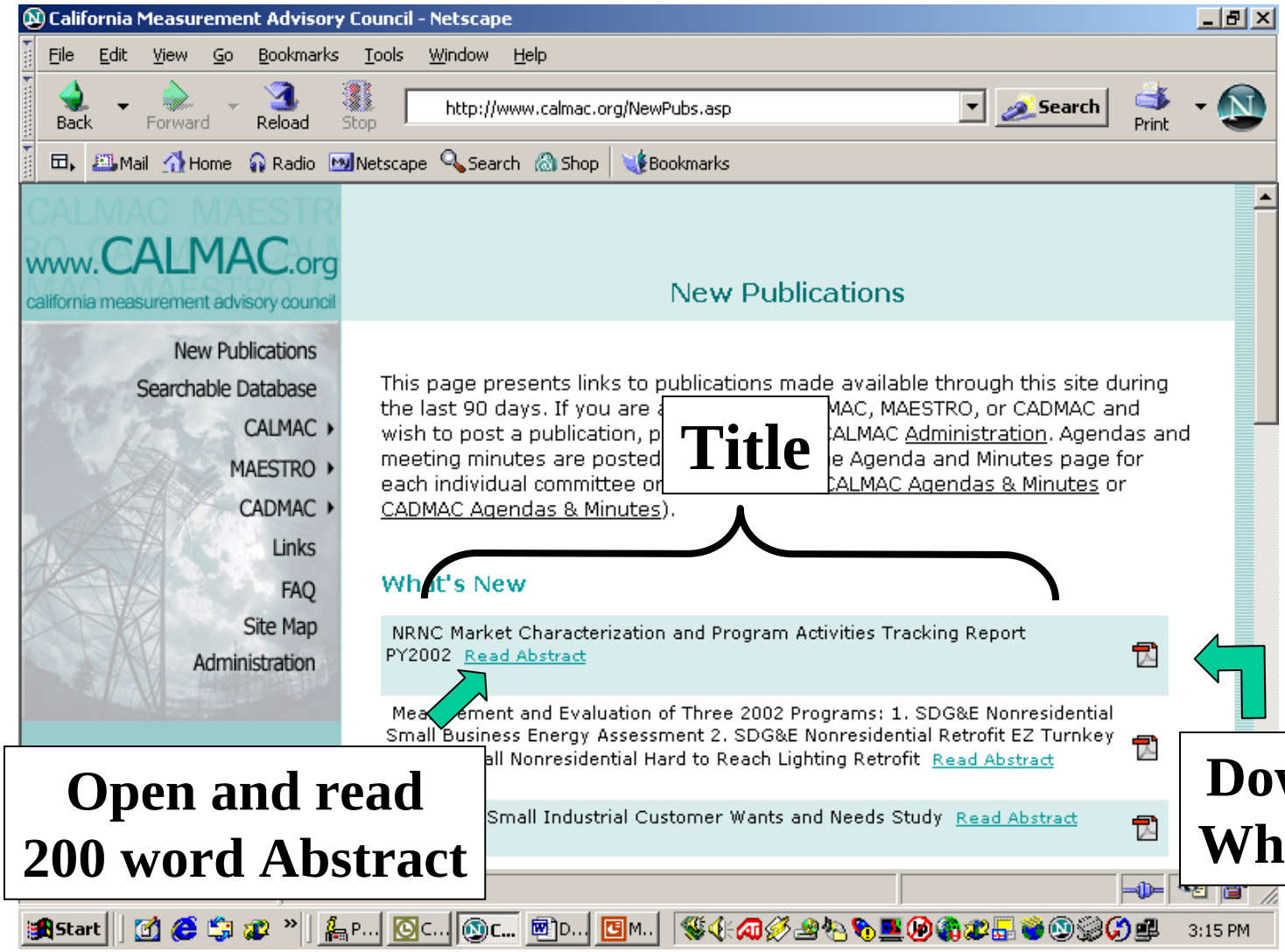
CALMAC Website



New Publications



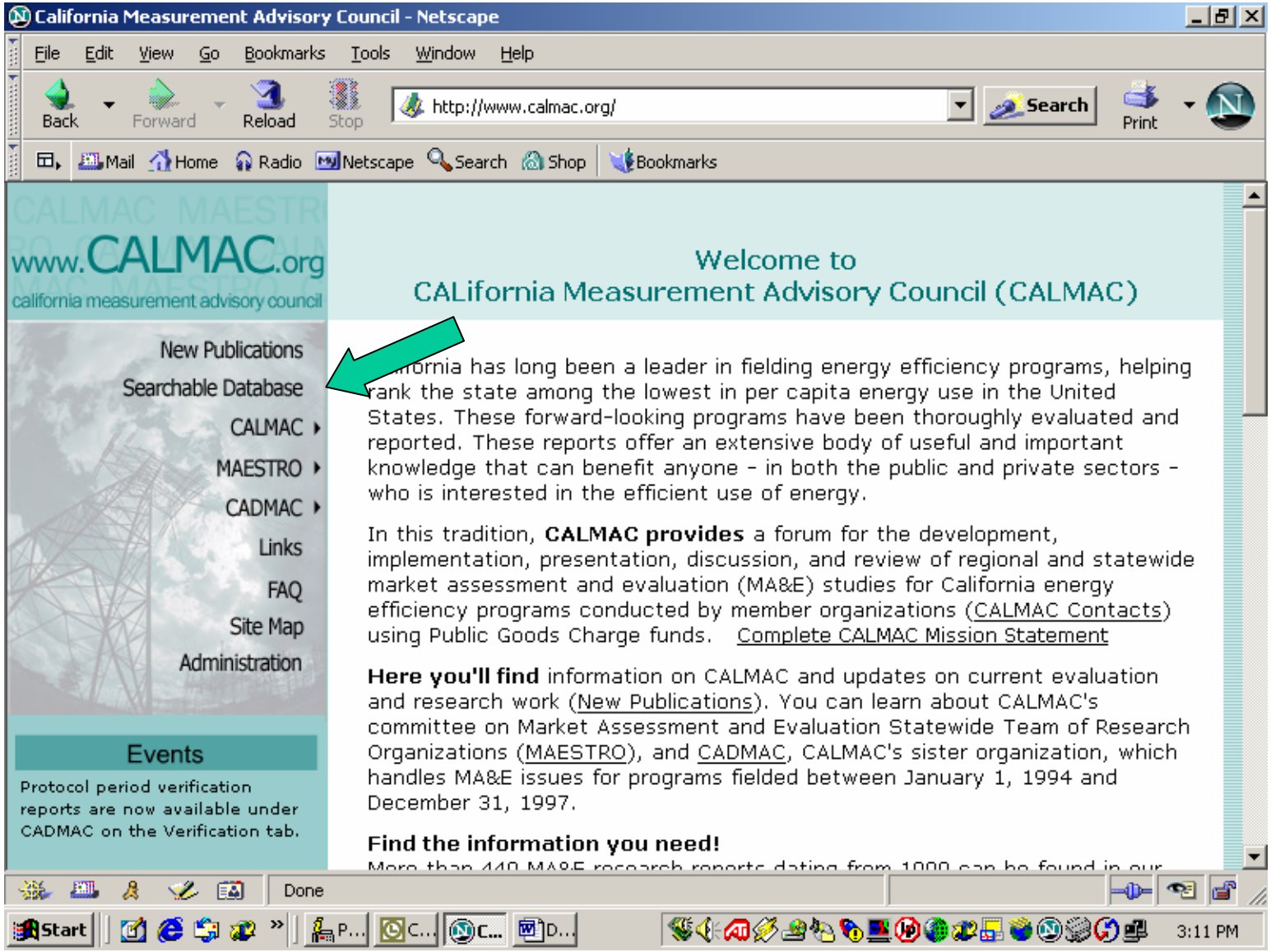
Posted within Last 90 Days



Open and read 200 word Abstract

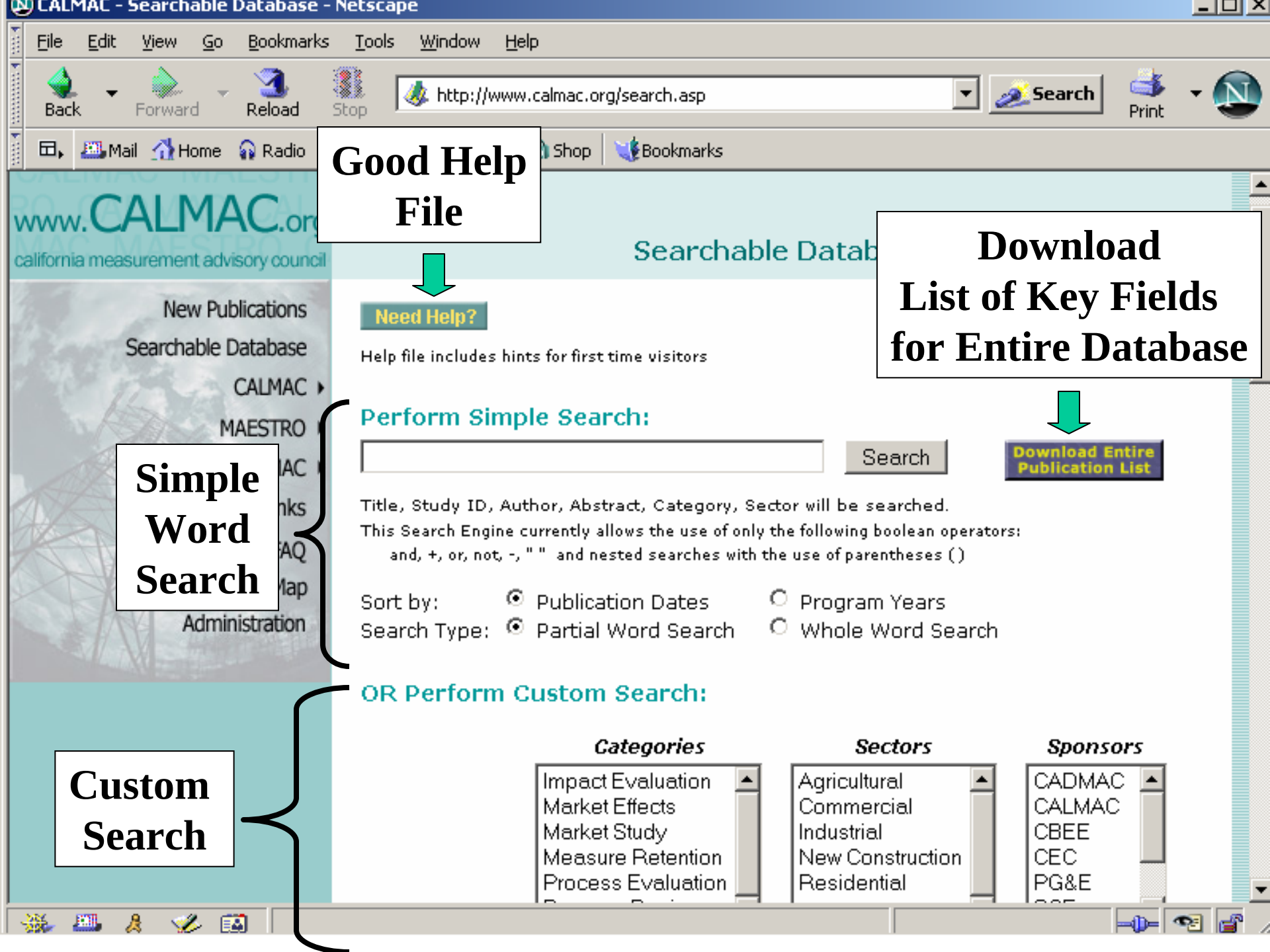
Download Whole File

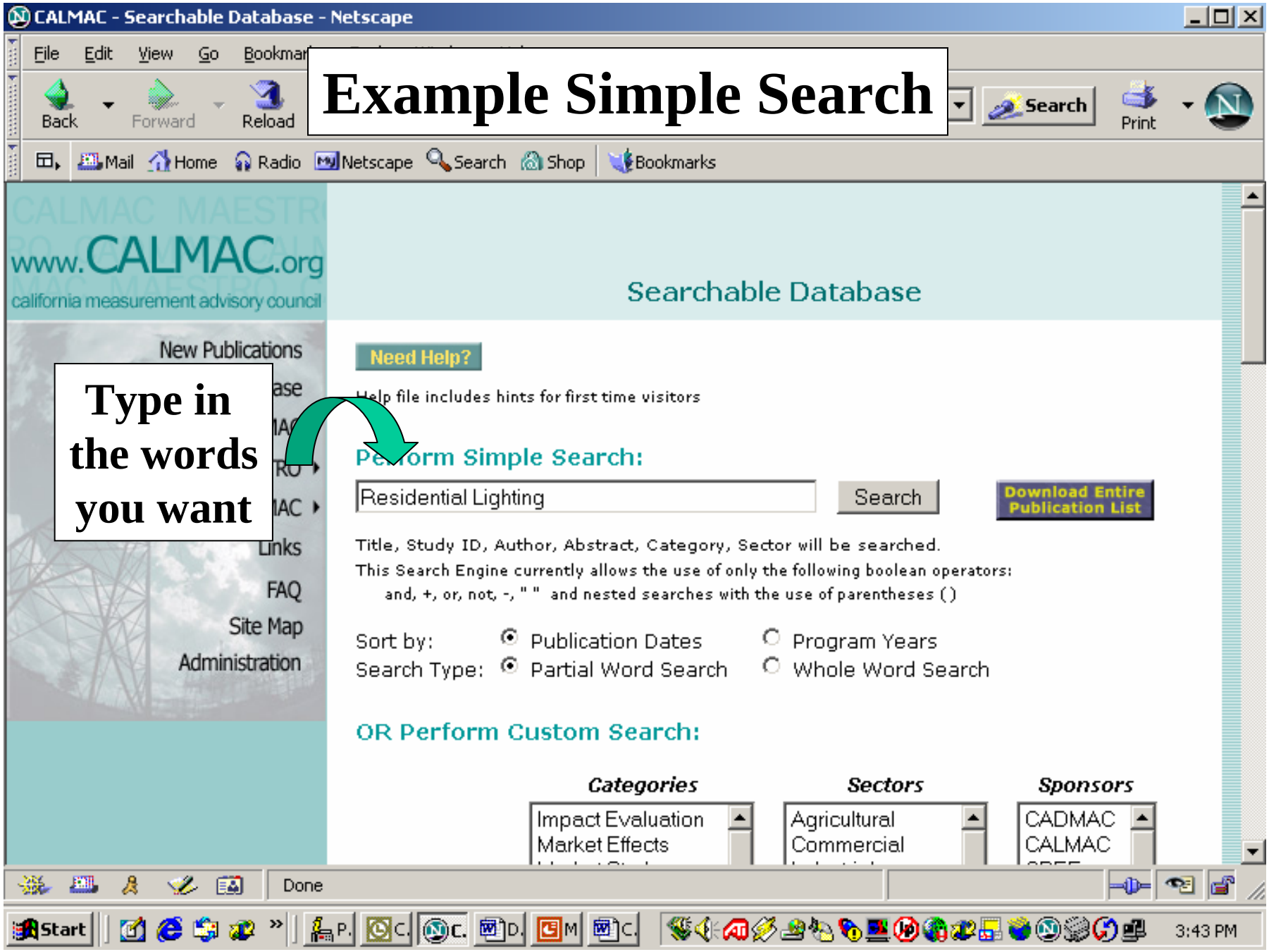
Powerful Search Engine

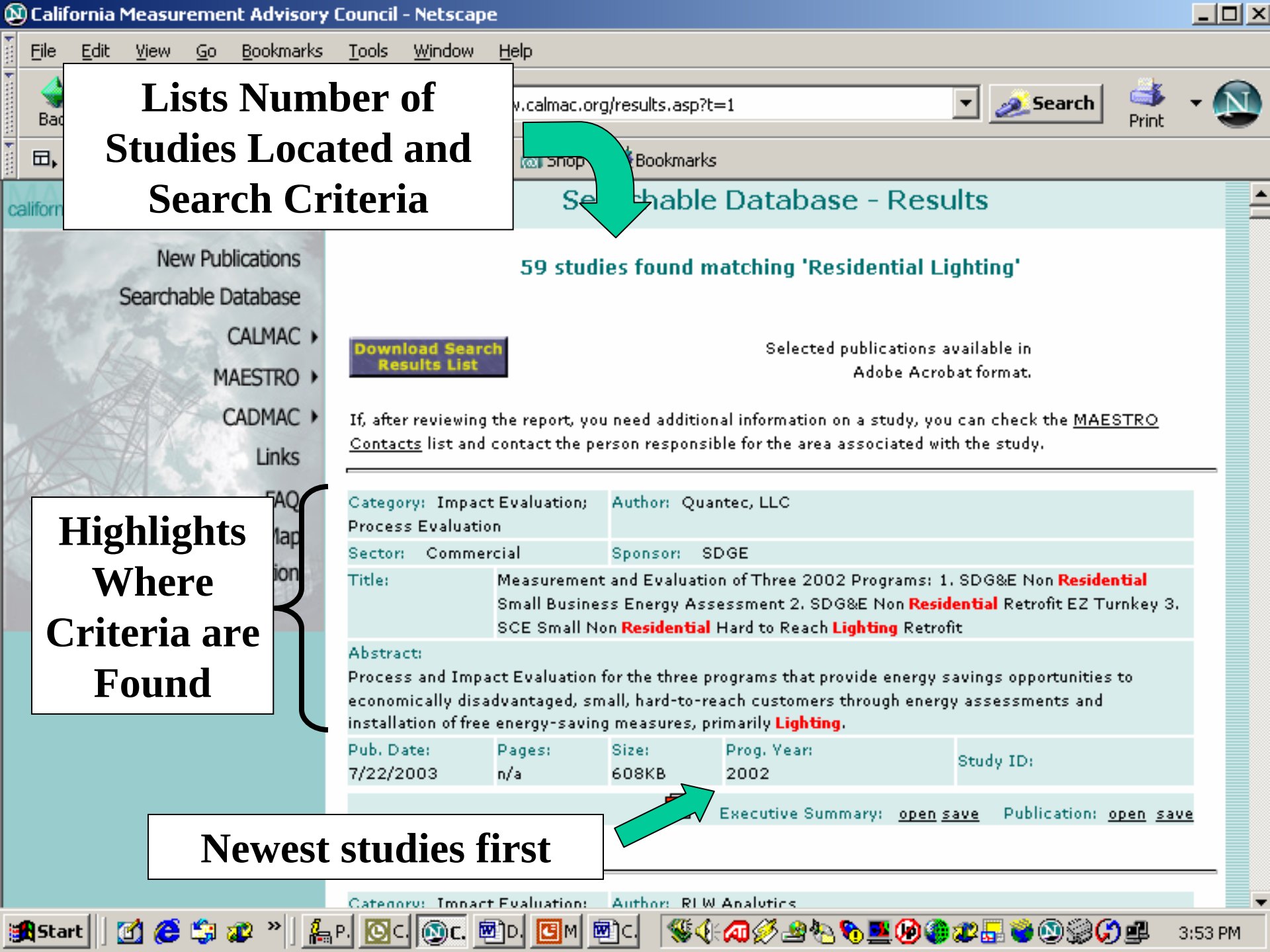


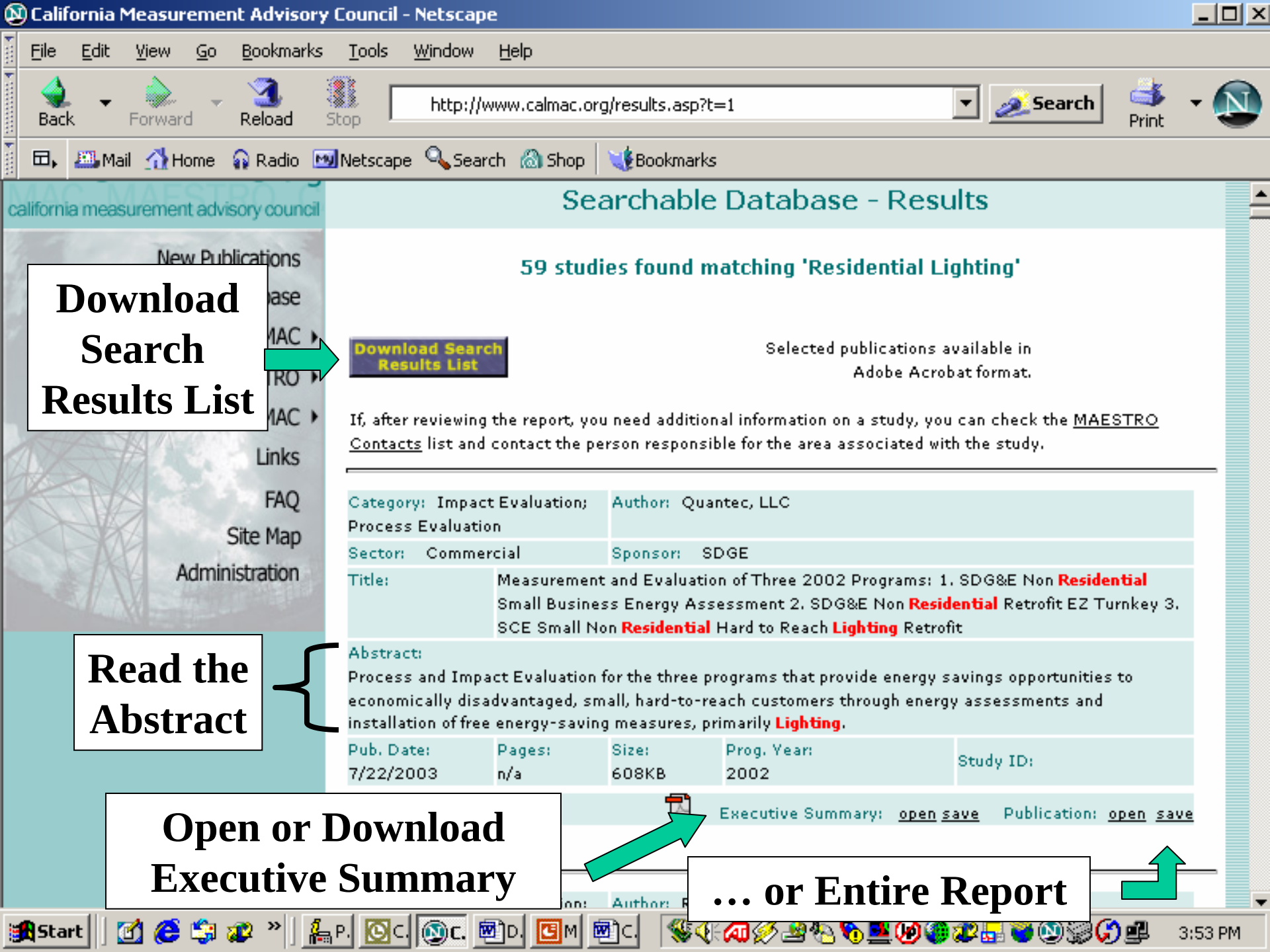
Searchable Database Features

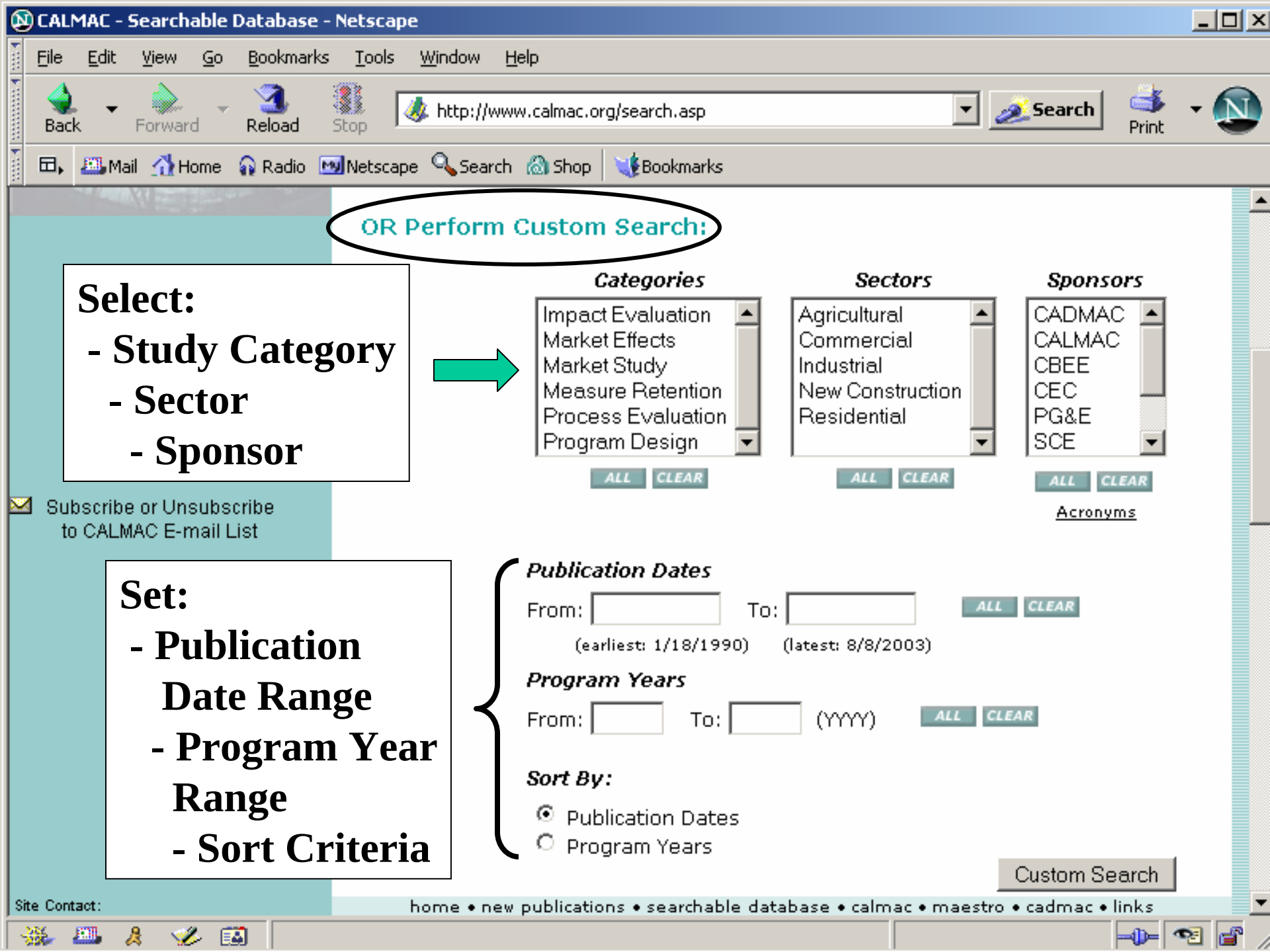
- ~500 studies from 1990 on. Studies since Jan. 1, 1994 all have electronic files for download.
- Cleaned database for more accurate searches.
- Simple search by key word with Boolean operators (Help tells how to use operators).
- Custom search by category.
- Search by whole or partial words.
- Sorting results by program year or publication date.

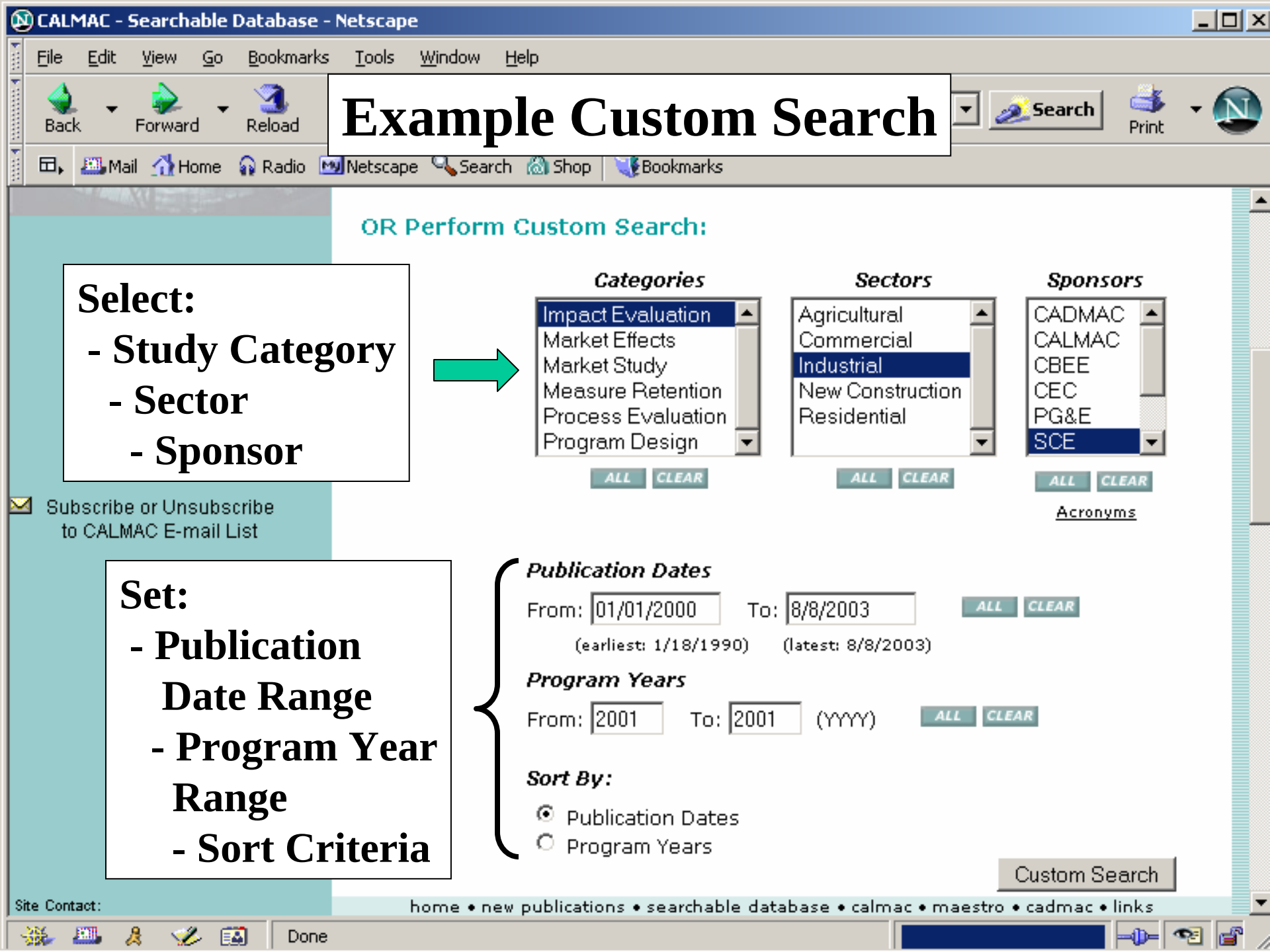

CALMAC - Searchable Database - Netscape
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
http://www.calmac.org/search.asp
Search
Print
Mail Home Radio Shop Bookmarks
Good Help File
www.CALMAC.org
california measurement advisory council
Searchable Datab
Download List of Key Fields for Entire Database
New Publications
Searchable Database
CALMAC
MAESTRO
Need Help?
Help file includes hints for first time visitors
Perform Simple Search:
Search
Download Entire Publication List
Simple Word Search
Title, Study ID, Author, Abstract, Category, Sector will be searched.
This Search Engine currently allows the use of only the following boolean operators:
and, +, or, not, -, " " and nested searches with the use of parentheses ()
Sort by: Publication Dates Program Years
Search Type: Partial Word Search Whole Word Search
OR Perform Custom Search:
Custom Search
Categories
Impact Evaluation
Market Effects
Market Study
Measure Retention
Process Evaluation
Sectors
Agricultural
Commercial
Industrial
New Construction
Residential
Sponsors
CADMAC
CALMAC
CBEE
CEC
PG&E

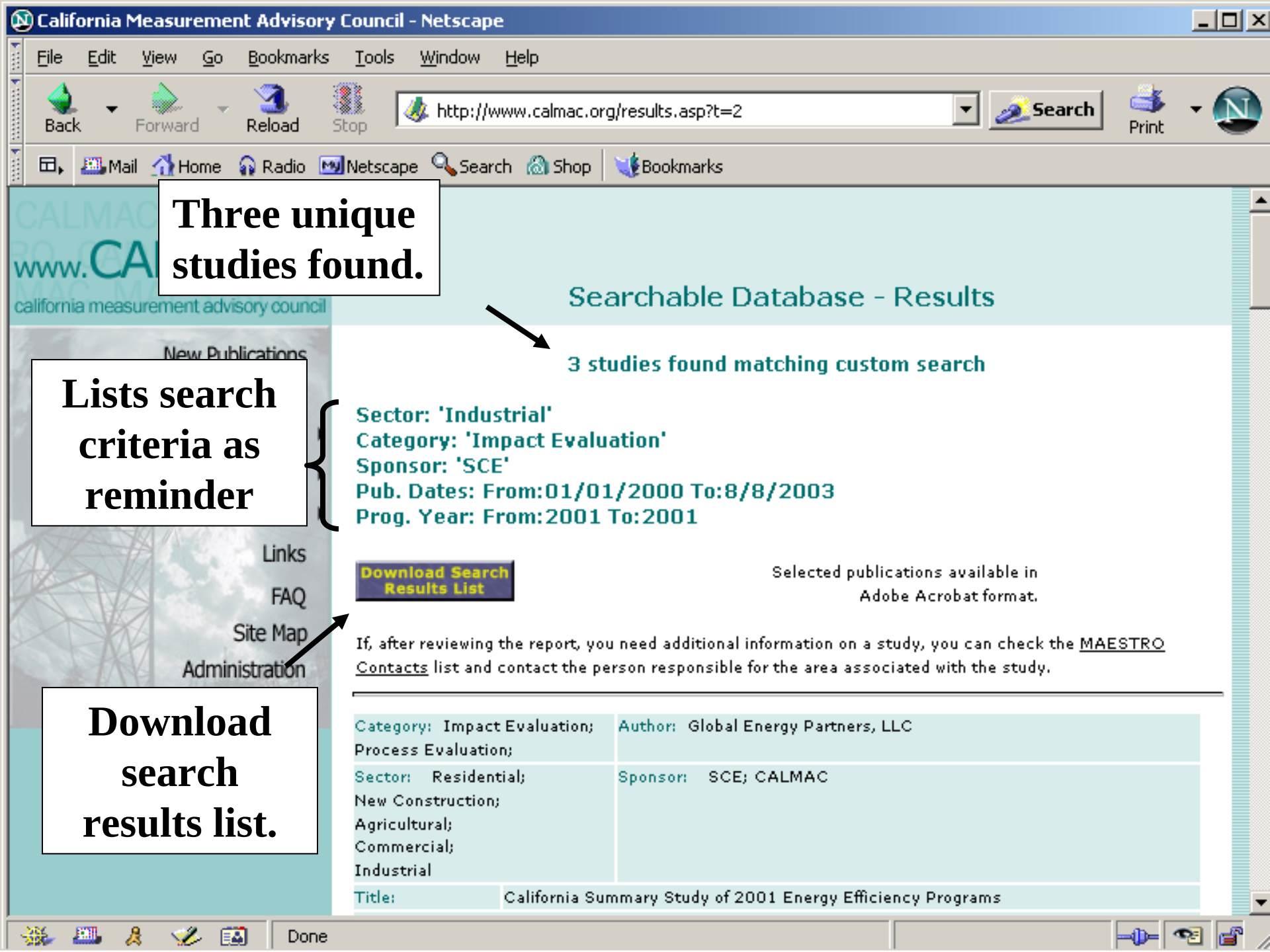

CALMAC - Searchable Database - Netscape
File Edit View Go Bookmar
Back Forward Reload
Search Print
Mail Home Radio Netscape Search Shop Bookmarks
Example Simple Search
www.CALMAC.org
california measurement advisory council
Searchable Database
New Publications
Links
FAQ
Site Map
Administration
Type in the words you want
Need Help?
Help file includes hints for first time visitors
Perform Simple Search:
Residential Lighting
Search
Download Entire Publication List
Title, Study ID, Author, Abstract, Category, Sector will be searched.
This Search Engine currently allows the use of only the following boolean operators:
and, +, or, not, -, " " and nested searches with the use of parentheses ( )
Sort by: Publication Dates Program Years
Search Type: Partial Word Search Whole Word Search
OR Perform Custom Search:
Categories
Impact Evaluation
Market Effects
Sectors
Agricultural
Commercial
Sponsors
CADMAC
CALMAC
Done
Start
3:43 PM


California Measurement Advisory Council - Netscape
File Edit View Go Bookmarks Tools Window Help
Search
Print
Bookmarks
Lists Number of Studies Located and Search Criteria
Searchable Database - Results
New Publications
Searchable Database
CALMAC
MAESTRO
CADMAC
Links
59 studies found matching 'Residential Lighting'
Download Search Results List
Selected publications available in Adobe Acrobat format.
If, after reviewing the report, you need additional information on a study, you can check the MAESTRO Contacts list and contact the person responsible for the area associated with the study.
Highlights Where Criteria are Found
Category: Impact Evaluation; Process Evaluation
Author: Quantec, LLC
Sector: Commercial
Sponsor: SDGE
Title: Measurement and Evaluation of Three 2002 Programs: 1. SDG&E Non Residential Small Business Energy Assessment 2. SDG&E Non Residential Retrofit EZ Turnkey 3. SCE Small Non Residential Hard to Reach Lighting Retrofit
Abstract:
Process and Impact Evaluation for the three programs that provide energy savings opportunities to economically disadvantaged, small, hard-to-reach customers through energy assessments and installation of free energy-saving measures, primarily Lighting.
Pub. Date: 7/22/2003
Pages: n/a
Size: 608KB
Prog. Year: 2002
Study ID:
Executive Summary: open save
Publication: open save
Newest studies first
Start
3:53 PM


California Measurement Advisory Council - Netscape
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
http://www.calmac.org/results.asp?t=1
Search Print
Mail Home Radio Netscape Search Shop Bookmarks
california measurement advisory council
New Publications
Links
FAQ
Site Map
Administration
Searchable Database - Results
59 studies found matching 'Residential Lighting'
Download Search Results List
Selected publications available in Adobe Acrobat format.
If, after reviewing the report, you need additional information on a study, you can check the MAESTRO Contacts list and contact the person responsible for the area associated with the study.
Category: Impact Evaluation; Process Evaluation
Author: Quantec, LLC
Sector: Commercial
Sponsor: SDGE
Title: Measurement and Evaluation of Three 2002 Programs: 1. SDG&E Non Residential Small Business Energy Assessment 2. SDG&E Non Residential Retrofit EZ Turnkey 3. SCE Small Non Residential Hard to Reach Lighting Retrofit
Abstract:
Process and Impact Evaluation for the three programs that provide energy savings opportunities to economically disadvantaged, small, hard-to-reach customers through energy assessments and installation of free energy-saving measures, primarily Lighting.
Pub. Date: 7/22/2003
Pages: n/a
Size: 608KB
Prog. Year: 2002
Study ID:
Executive Summary: open save
Publication: open save
Download Search Results List
Read the Abstract
Open or Download Executive Summary
… or Entire Report
Start
3:53 PM


CALMAC - Searchable Database - Netscape
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
http://www.calmac.org/search.asp
Search
Print
Mail Home Radio Netscape Search Shop Bookmarks
OR Perform Custom Search:
Select:
- Study Category
- Sector
- Sponsor
Categories
Impact Evaluation
Market Effects
Market Study
Measure Retention
Process Evaluation
Program Design
Sectors
Agricultural
Commercial
Industrial
New Construction
Residential
Sponsors
CADMAC
CALMAC
CBEE
CEC
PG&E
SCE
ALL CLEAR
ALL CLEAR
ALL CLEAR
Acronyms
Subscribe or Unsubscribe to CALMAC E-mail List
Set:
- Publication Date Range
- Program Year Range
- Sort Criteria
Publication Dates
From: To: ALL CLEAR
(earliest: 1/18/1990) (latest: 8/8/2003)
Program Years
From: To: (YYYY) ALL CLEAR
Sort By:
Publication Dates
Program Years
Custom Search
Site Contact:
home • new publications • searchable database • calmac • maestro • cadmac • links


CALMAC - Searchable Database - Netscape
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload
Search Print
Mail Home Radio Netscape Search Shop Bookmarks
Example Custom Search
OR Perform Custom Search:
Select:
- Study Category
- Sector
- Sponsor
Categories
Impact Evaluation
Market Effects
Market Study
Measure Retention
Process Evaluation
Program Design
Sectors
Agricultural
Commercial
Industrial
New Construction
Residential
Sponsors
CADMAC
CALMAC
CBEE
CEC
PG&E
SCE
ALL CLEAR
ALL CLEAR
ALL CLEAR
Acronyms
Subscribe or Unsubscribe to CALMAC E-mail List
Set:
- Publication Date Range
- Program Year Range
- Sort Criteria
Publication Dates
From: 01/01/2000 To: 8/8/2003 ALL CLEAR
(earliest: 1/18/1990) (latest: 8/8/2003)
Program Years
From: 2001 To: 2001 (YYYY) ALL CLEAR
Sort By:
Publication Dates
Program Years
Custom Search
Site Contact:
home • new publications • searchable database • calmac • maestro • cadmac • links
Done


California Measurement Advisory Council - Netscape
File Edit View Go Bookmarks Tools Window Help
Back Forward Reload Stop
http://www.calmac.org/results.asp?t=2
Search
Print
Mail Home Radio Netscape Search Shop Bookmarks
Three unique studies found.
www.CA
california measurement advisory council
Searchable Database - Results
3 studies found matching custom search
Lists search criteria as reminder
Sector: 'Industrial'
Category: 'Impact Evaluation'
Sponsor: 'SCE'
Pub. Dates: From:01/01/2000 To:8/8/2003
Prog. Year: From:2001 To:2001
New Publications
Links
FAQ
Site Map
Administration
Download Search Results List
Selected publications available in Adobe Acrobat format.
If, after reviewing the report, you need additional information on a study, you can check the MAESTRO Contacts list and contact the person responsible for the area associated with the study.
Download search results list.
Category: Impact Evaluation; Process Evaluation;
Author: Global Energy Partners, LLC
Sector: Residential; New Construction; Agricultural; Commercial; Industrial
Sponsor: SCE; CALMAC
Title: California Summary Study of 2001 Energy Efficiency Programs
Done

Example Custom Search Results

California Measurement Advisory Council - Netscape

File Edit View Go Bookmarks Tools Window Help

Back Forward Print

Mail Home Radio Netscape Search Shop Bookmarks

Open or download Executive Summary or Whole Report

Abstract

Category: Impact Evaluation; Process Evaluation;	Author: Global Energy Partners, LLC
Sector: Residential; New Construction; Agricultural; Commercial; Industrial	Sponsor: SCE; CALMAC
Title:	California Summary Study of 2001 Energy Efficiency Programs
Abstract:	Summary of the cost and savings impact of California's energy efficiency programs in 2001, both at the aggregate statewide level and program level. Assessment of program documentation and evaluation practices and recommendations for standard statewide protocols.

Pub. Date:	Pages:	Size:	Prog. Year:	Study ID:
3/13/2003	187	3999KB	2001	10019

Executive Summary: open save Publication: open save

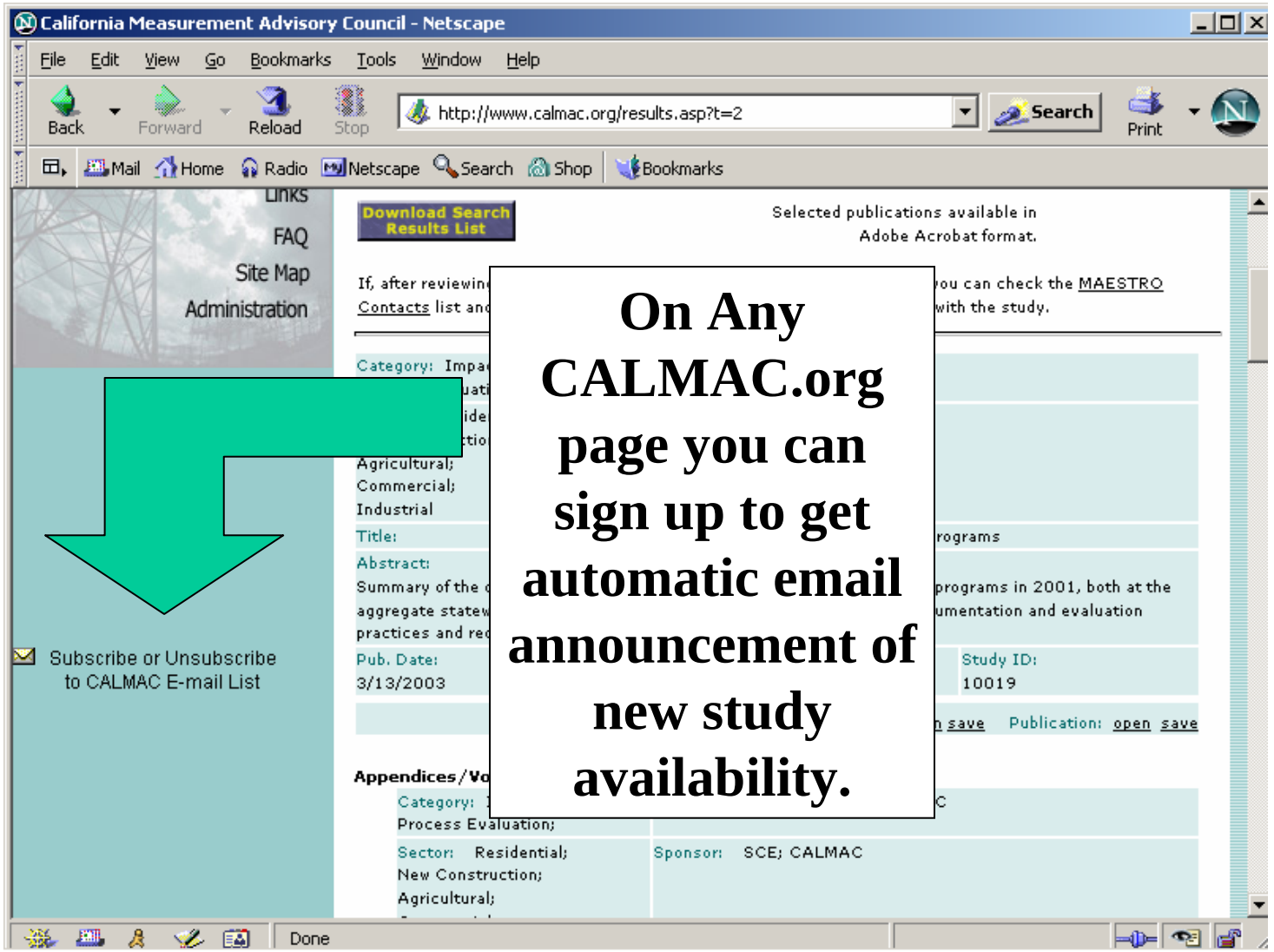
Appendices / Volumes

Appendices & Associated Volumes inset for easy identification

Category: Impact Evaluation; Process Evaluation;	Author: Global Energy Partners, LLC
Sector: Residential; New Construction; Agricultural; Commercial; Industrial	Sponsor: SCE; CALMAC
Title:	California Summary Study of 2001 Energy Efficiency Programs: Database
Abstract:	Spreadsheet database detailing the costs and savings associated with 218 programs implemented in California in 2001.

Done

Report Announcement Listserve



On Any CALMAC.org page you can sign up to get automatic email announcement of new study availability.

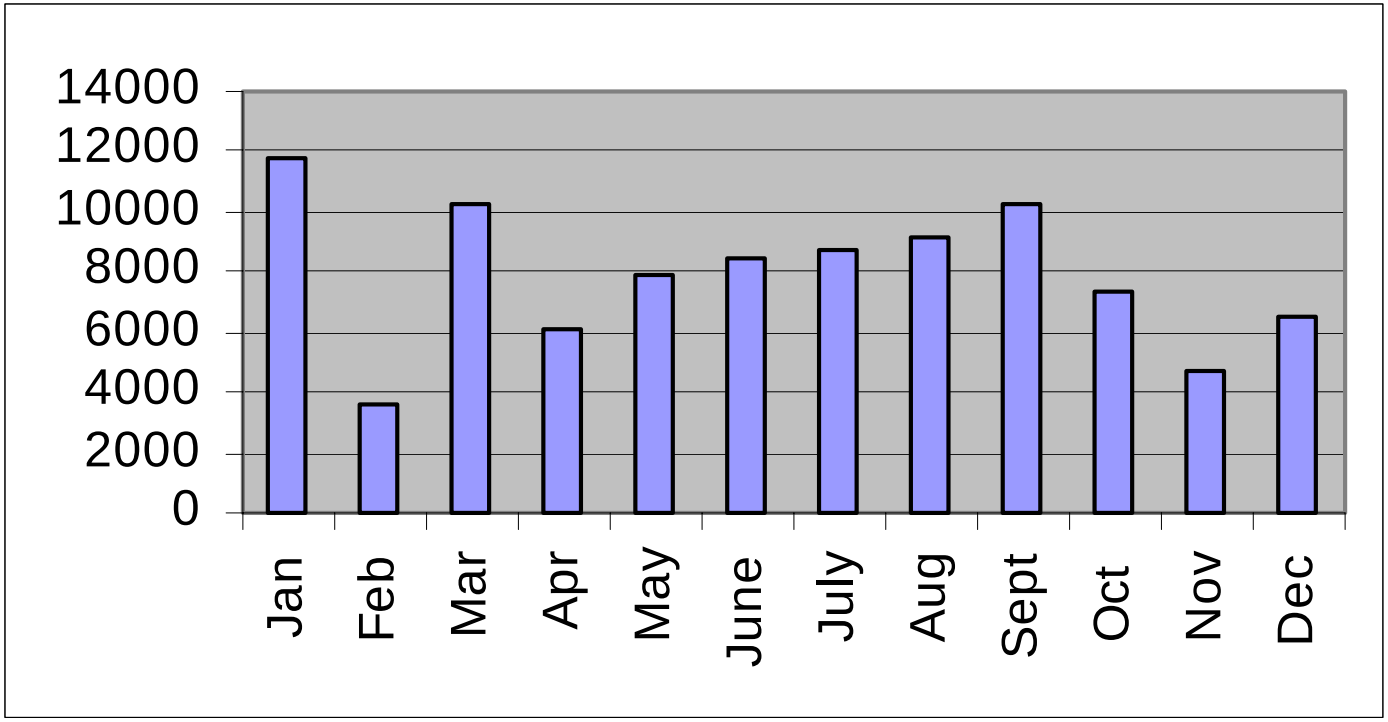
Summary

- Powerful tool available for finding background material.
- Search tool allows you to home in on what you need.
- Database is clean, making searches less frustrating.
- New studies are continually being posted.

2003 Website Statistics

2003 Report Requests

- 95,000 File request in 2003
- = 7,600 /mo, 260/day, or 11/hr.



2003 Website Page Requests

- 153,000 Web page requests in 2003
- = 12,800 /mo, 420/day, or 17/hr.