

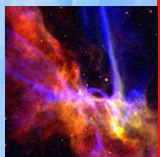
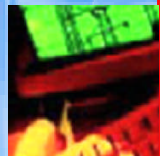
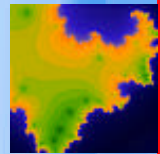
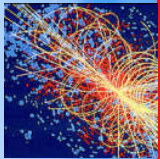
# Third Party Programs at SMUD

## Utility Energy Forum

April 30, 2008

Jim Parks

Energy Efficiency and Customer R&D Manager  
Sacramento Municipal Utility District



# SMUD Profile

- ◆ Service territory area: 900 sq mi (2331 sq km)
- ◆ Population: 1.4 million
- ◆ Board Members: 7 members elected by voters
- ◆ Revenues: \$1.4 Billion
- ◆ Employees: 2,200+
- ◆ Summer Peak: 3299 MW in July 2006
- ◆ 2<sup>nd</sup> largest muni in California, 6<sup>th</sup> in nation

# SMUD's Energy Efficiency Goals

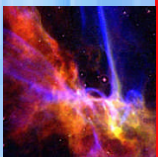
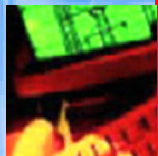
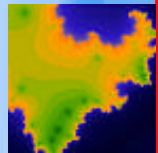
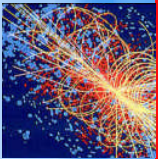
- ◆ SMUD's board of directors adopted aggressive energy efficiency goals – 15% over ten years
- ◆ 30% of EE goals are supposed to come from emerging technologies
- ◆ Most aggressive utility goal in the State

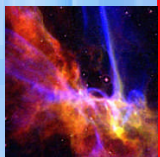
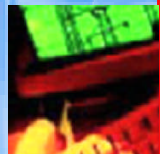
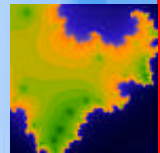
10-YEAR ENERGY EFFICIENCY TARGETS ADOPTED BY THE SMUD BOARD OF DIRECTORS

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Total	10-Yr Avg
<b>GWh</b>	70	107	145	196	200	205	209	213	217	222	226	1940	194
<b>MW</b>	18	28	40	58	59	60	62	63	64	66	67	568	57
<b>Budget (\$millions)</b>	\$ 25	\$ 34	\$ 40	\$ 45	\$ 45	\$ 46	\$ 46	\$ 47	\$ 48	\$ 49	\$ 50	\$ 450	\$ 45

The 10-year goals (2008-2017) were adopted by the SMUD Board of Directors on May 17, 2007

# Active Third Party Programs





# Refrigerator Recycling

- ◆ Recycled over 115,200 refrigerators since program started in 1990
- ◆ We ran our own program at first with technicians who dismantled the refrigerators
- ◆ Currently offer \$35 for old refer
- ◆ \$50 rebate for new E Star refer
- ◆ Jaco picks up old refrigerators and is responsible for recycling the refrigerant, insulating foam (HFCs), metal parts, compressor oil, mercury, PCBs
- ◆ Unrecycled portion should fit in a shoe box

# Components of a Refrigerator Manufactured Prior to 1995

## **Metal, Plastic, and Glass**

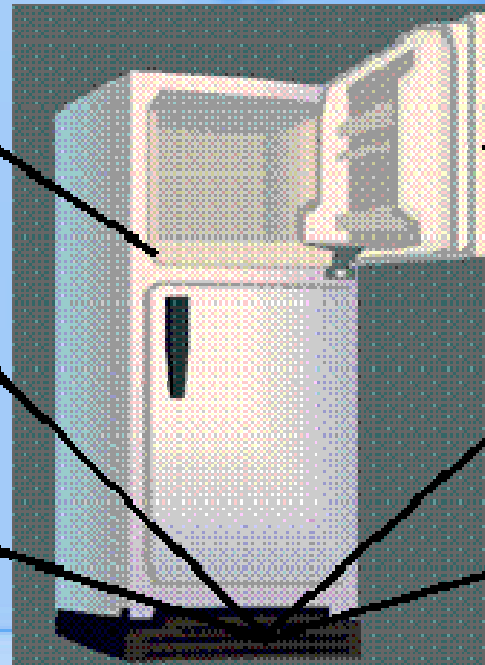
Casing/Refrigerator Shell  
159 lbs metal  
75 lbs plastic  
10 lbs glass

## **Used Oil**

(May be contaminated)  
0.47 lb

## **PCBs**

(May be contained in  
capacitor)  
Small quantities



## **CFC-11**

Foam Insulation  
1.0 lb

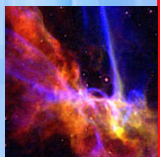
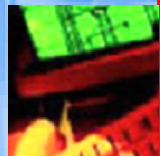
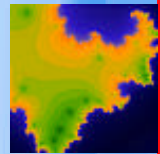
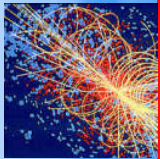
## **CFC-12**

Refrigerant  
0.5 lb

## **Mercury-Containing Components**

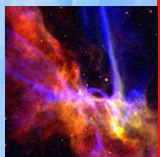
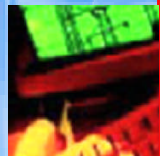
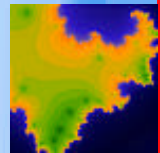
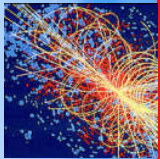
0.003 lb





# Living Wise

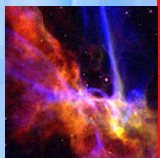
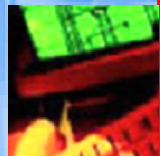
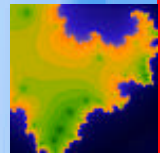
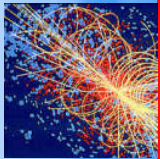
- ◆ Educational program directed at 6<sup>th</sup> graders.
- ◆ Kit contains easy to use, easy to understand energy and water efficiency curriculum and conservation devices such as low-flow showerheads, cfls, take home conservation kit with a simplified home energy audit a post test.
- ◆ Kit cost @ \$46.00 for materials and implementation.
- ◆ 728 participants.
- ◆ The program was implemented late in the school year so we do not have EE statistics at this point.
- ◆ Program funding shared in partnership with Sacramento Suburban Water District.



# SMUD Shade Tree Program

- ◆ The primary program objective is the Energy Savings (Demand Side Management or DSM program). The purpose is to provide residential and small business customers with free shade trees which when strategically sited and mature, will reduce air conditioning needs.
- ◆ The secondary and long-term objective is to create an urban forest that will mitigate the summer heat-island effect and reduce the ambient temperature 1 to 2°F and thus reduce air conditioning needs.
- ◆ The tertiary long-term objectives include improving the region's air quality, enhancing the aesthetics and quality of life in the region, and promoting a sense of community spirit and cooperation.

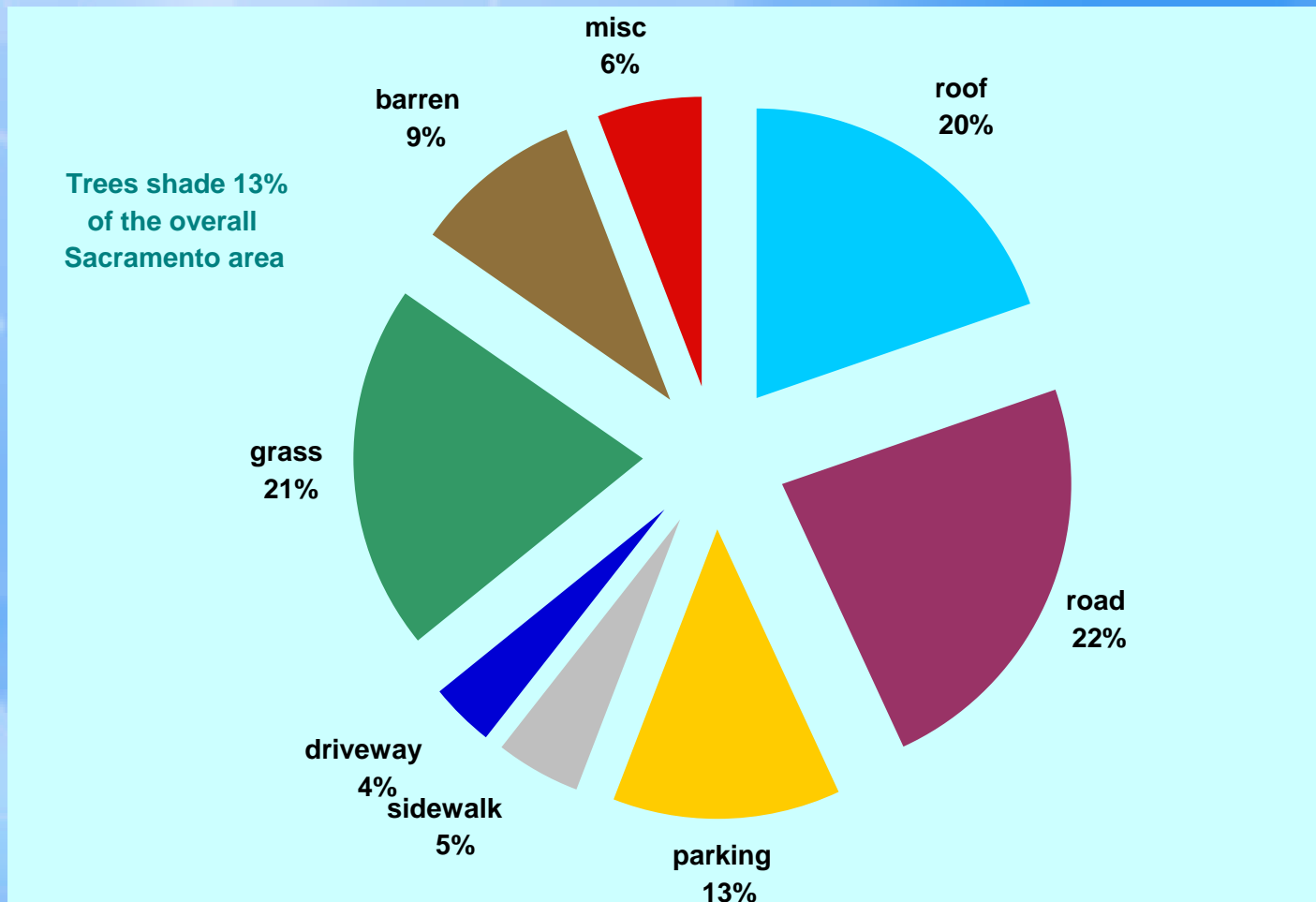


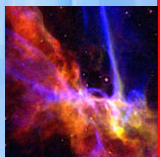
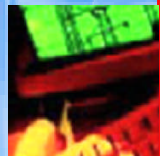
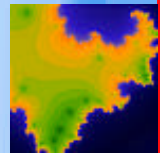


# Shade Tree Program

- ◆ Operated since 1990 – 18 years
- ◆ Planted over 400,000 shade trees in more than 140,000 residential back and front yards
- ◆ Planted 20,000 trees in public places, such as schools and parks.
- ◆ Generated a cumulative total of 4.9 MW and 12 million kWh per year in direct cooling load savings in 2007.
- ◆ Sequestered an estimated 6,130,140 lbs of annual carbon sequestration in 2007
- ◆ Savings have been determined for different trees based on orientation and canopy

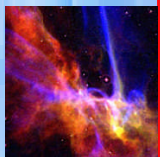
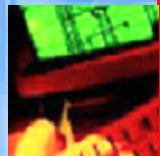
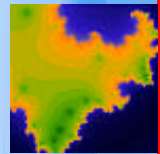
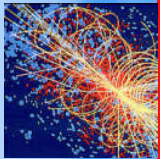
# Sacramento Land Cover Distribution





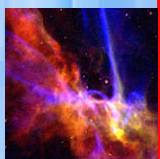
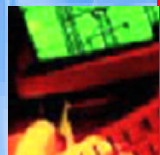
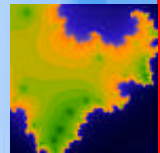
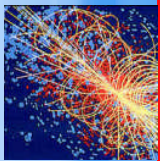
# SMUD Sacramento Shade

- ◆ Implemented in collaboration with the Sacramento Tree Foundation (STF)
- ◆ The program is 100% funded by SMUD
- ◆ Program provides free trees (5 gallon), stakes, ties, fertilizers and expert advice (STF)
- ◆ Annual budget over \$1.5 million
- ◆ Over \$25 million invested since 1990
- ◆ Received several national and state awards
- ◆ Pay-for-performance contract with STF based on observed Present Value Benefits (PVB)



# SMUD Community Shade

- ◆ Implemented in 1998 (trees for public places)
- ◆ Implemented in collaboration with the Sacramento Tree Foundation (STF)
- ◆ The 100% funded by SMUD
- ◆ Program provides free trees (15 & 5 gallon), stakes, ties, fertilizers and expert advice (STF)
- ◆ Program participants: Schools & Park Districts
- ◆ Over 20,000 trees planted since 1998
- ◆ Annual budget about \$200,000
- ◆ Over \$1.5 million invested since 1998



# MOA With the Tree Foundation

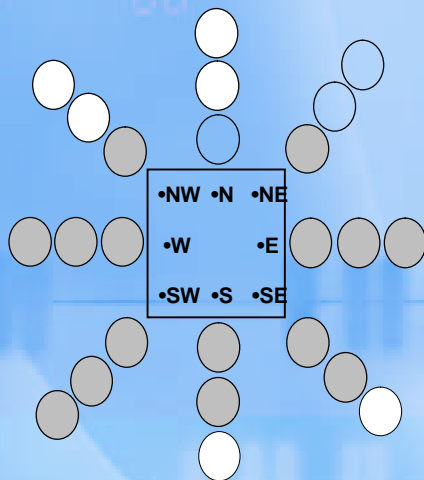
- ◆ The annual MOA cost in 2007 is \$839,000.
- ◆ STF can earn an additional \$50,000 in 2007 as a performance incentive. SMUD will pay STF \$0.74 per \$1 of observed PVB above the annual PVB goal.
- ◆ MOA cost with the STF is estimated to reach approximately \$850k in 2008.
- ◆ Total annual budget for the Sacramento Shade Program for 2007 was \$1,349,000.
- ◆ \$510,000 from the annual Sacramento Shade budget is set aside for the purchase of trees, ties, stakes, marketing activities, and SMUD staff.
- ◆ In addition, the total annual budget for the Community Shade Program for 2007 was \$197,000.



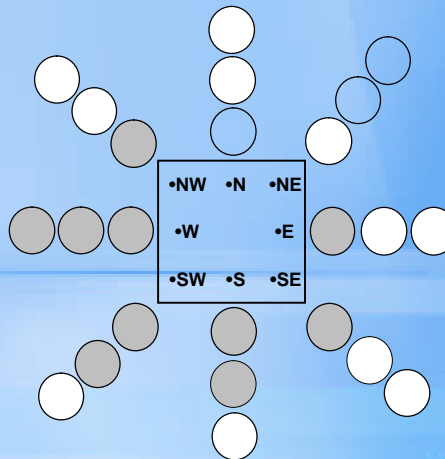
# SMUD Shade Tree Program

## •What is Allowed Under the 1996 Tree-Siting Guidelines

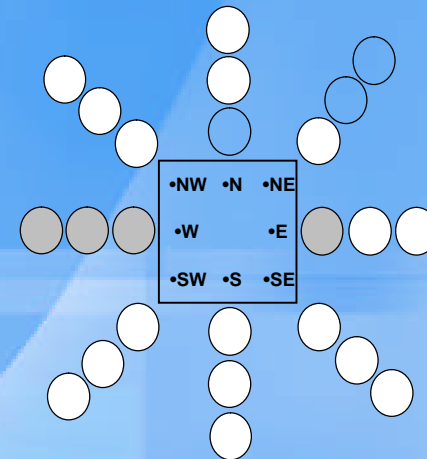
### •LARGE TREES



### •MEDIUM TREES

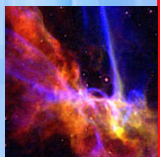
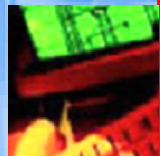
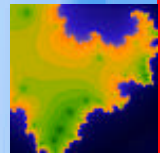


### •SMALL TREES



•*Shaded sites have higher than the minimum \$20 per tree PVB.*

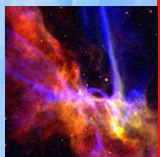
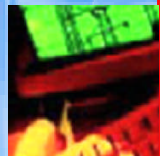
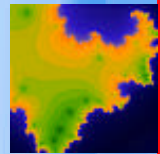
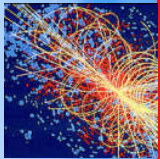




# SMUD Shade Tree Program

## Estimates of Savings for mature trees

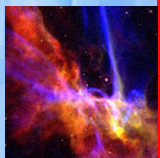
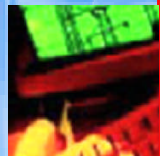
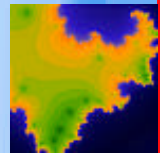
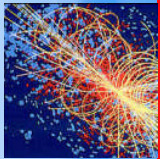
- ◆ Average energy cooling load savings are 153 kWh/year/ per tree
- ◆ Average demand savings are 0.056 kW
- ◆ When 400,000 trees are mature = about 16 MW
- ◆ Present Value Benefit (PVB) per tree includes:
  - ❖ Direct Shading benefits (KWh and KW saved)
  - ❖ Indirect Shading benefits—evapotranspiration
  - ❖ Air Quality Benefits at the power generation side



# SMUD Shade Tree Program

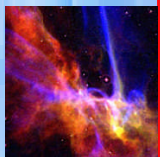
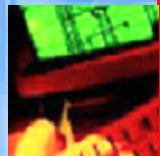
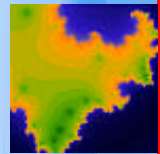
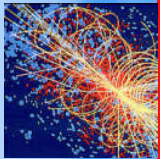
## Lessons Learned

- ✓ Cost effective strategies for SMUD
- ✓ Programs valued highly by utility customers
- ✓ Continuous program refinements in design & operation
- ✓ SMUD Board & Management made enduring commitment to Urban Heat Island mitigation efforts
- ✓ Involve local trade allies (urban forestry organizations)



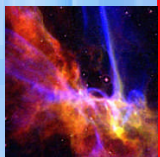
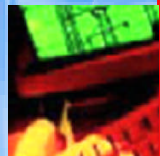
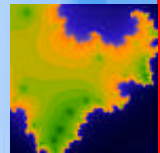
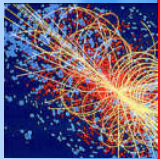
# Retrocommissioning (RCx): What Is It?

- ◆ A systematic process for improving building performance by identifying and implementing ***low-cost operational and maintenance improvements***
- ◆ Focuses on the operation of mechanical equipment, lighting, and related controls and is ***intended to optimize how equipment operates as an integrated system***



# Retrocommissioning

- ◆ PECl provides third-party retrocommissioning services to SMUD customers
- ◆ Pool of providers (~40) selected by PECl
- ◆ Incentives are paid in \$/sf



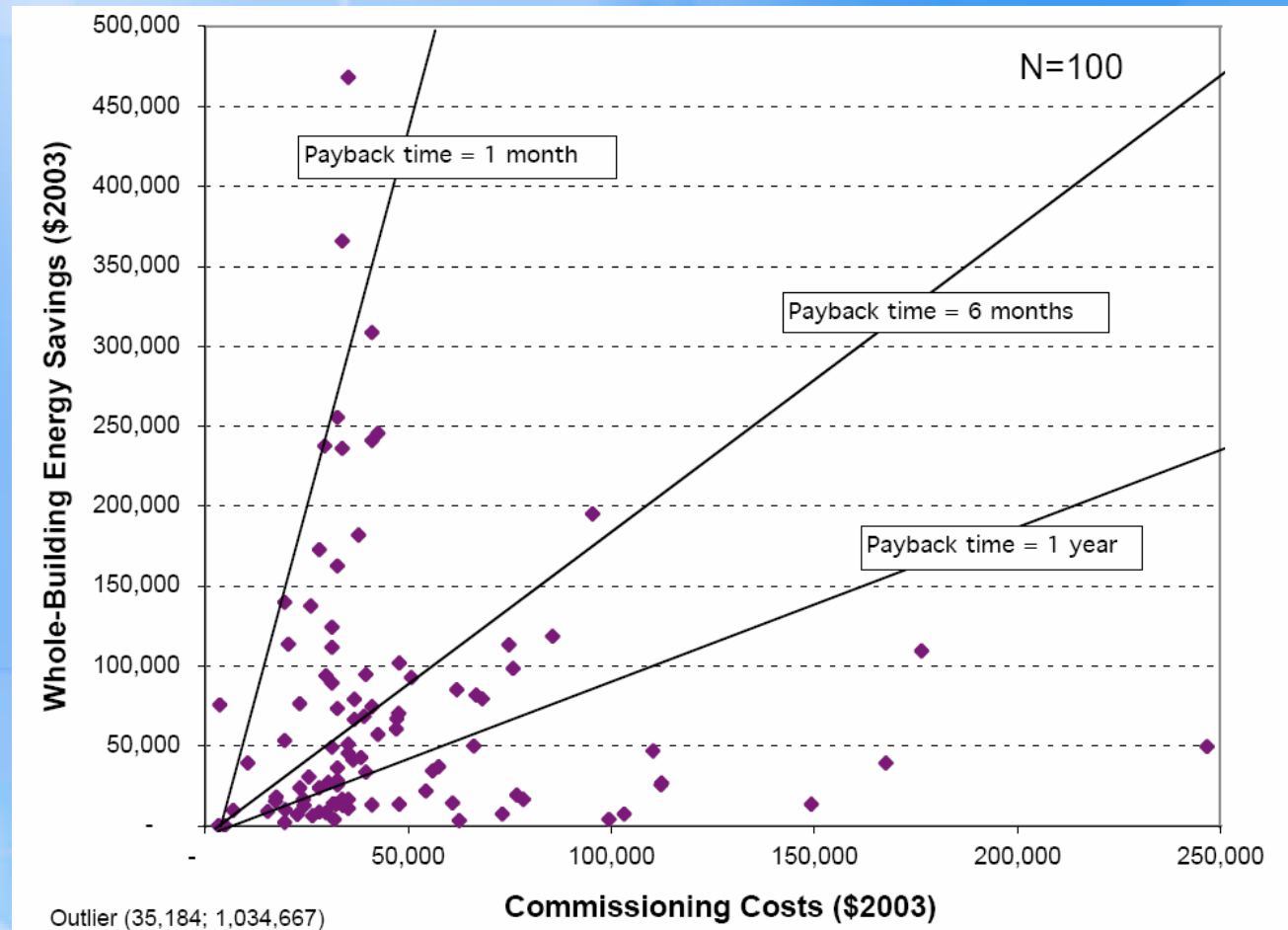
# Typical Problems Identified

- ◆ Simultaneous heating and cooling
- ◆ Lighting and HVAC running when not required
- ◆ Opening throttled discharge valves
- ◆ Controls needing to be retuned
- ◆ Critical control systems out of calibration
- ◆ Energy management systems not optimized
- ◆ Economizers not operating properly

# Commissioning Cost Effectiveness

0.2 to 1.7 year  
SPT

(median = 0.7)

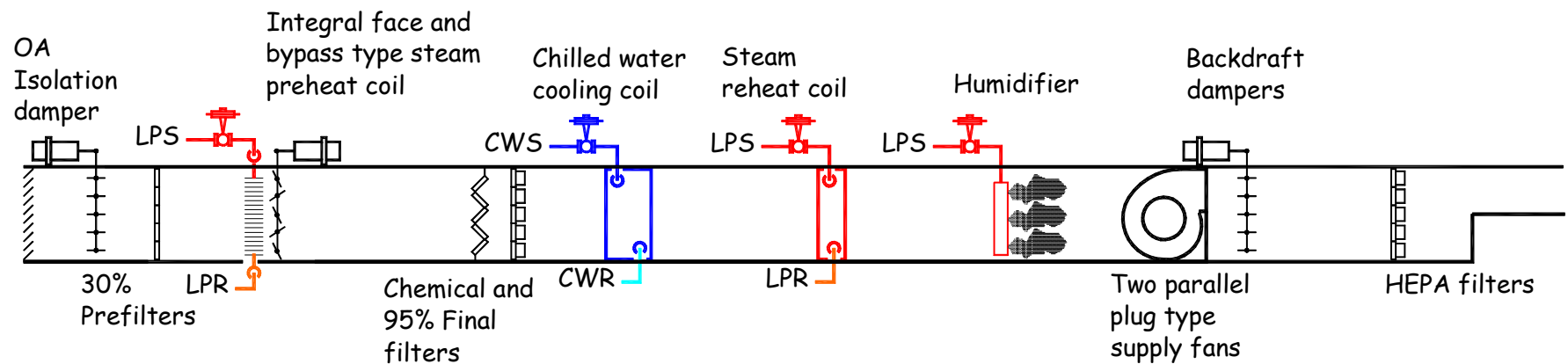


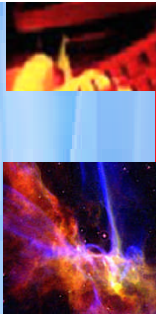
Mills, et al. 2004,  
"The Cost Effectiveness of Commercial Buildings Commissioning"  
LBNL 56637

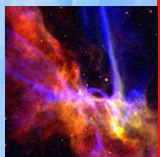
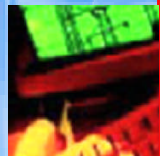
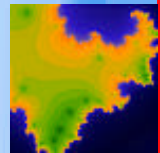




# Problem in a Lab

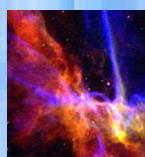
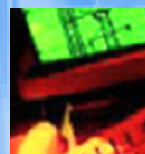
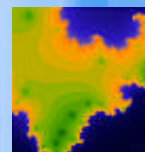
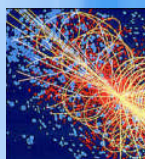
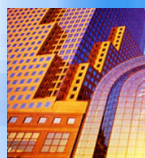


- 
- ◆ Cost of corrections: About \$500 in parts, 80-100 hours of labor.
  - ◆ Reduced operating cost – about \$7,000 per month.

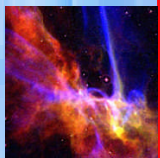
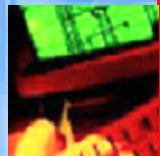
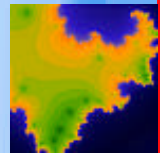
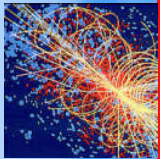


# What Can You Expect from RCx?

- ◆ Energy cost savings (5-20% on average) with little capital expense
  - Simple payback of < 2 years is common
- ◆ Increased equipment reliability
- ◆ Enhanced understanding of building systems
- ◆ Reduced environmental impact, particularly greenhouse gas emissions
- ◆ Complete documentation of the RCx measures implemented through the Program



Program Phase	Description of Program Services	Program Incentive
Screening	<ul style="list-style-type: none"><li>◆ Building review to determine eligibility for program</li><li>◆ ENERGY STAR® Benchmark</li></ul>	Fully covered
Investigation	In-depth investigation of building operations	80% of investigation cost, cost is typically capped at \$0.10 per square foot
Implementation	Implementation incentives and advice for implementing retrocommissioning measures	Custom incentive applied to measures with payback of longer than one year and less than four years
Follow-Up	<ul style="list-style-type: none"><li>◆ Documentation and training on selected measures</li><li>◆ Updated ENERGY STAR Benchmark</li></ul>	<p>Custom incentive of \$3,000-\$10,000</p> <p>One enrollment in Building Operator Certification Program</p>



# What are the Customer's Responsibilities?

- ◆ Sign the Owner Program Agreement (OPA)
  - Provide 20% of the pre-defined investigation cost
  - Commit to implementing measures with a payback of one year or less (commitment is capped at 8.5% of annual energy bill)
- ◆ Have funding available to implement measures within 12 months of the project start to begin the investigation
- ◆ Commit approximately 40 hours of senior building operations staff time to support the project
- ◆ Hire and oversee contractors to implement of selected measures

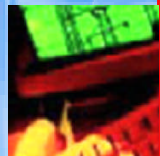
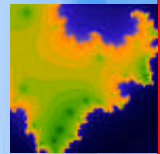
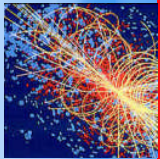


# What is the Program Process?

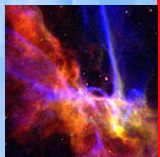


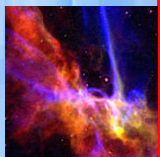
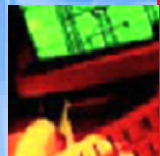
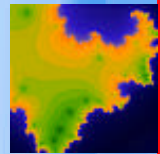
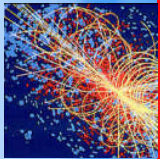
- ◆ The Program operates in six distinct phases:

- Application
- Screening
- Agreement Development
- Investigation
- Implementation
- Follow-Up



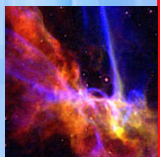
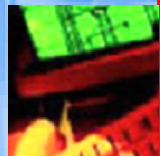
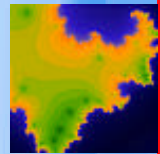
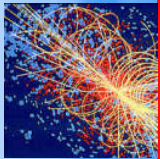
- ◆ RCx projects typically take 9-12 months to complete





# Third Party Programs – Coming Soon



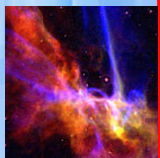
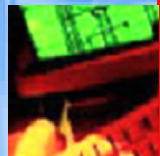
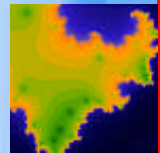
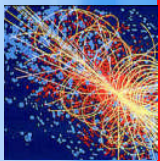


# Energy Use Displays

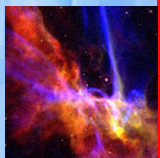
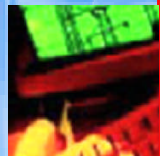
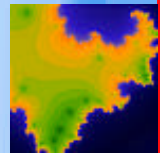
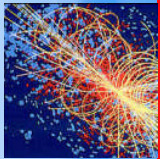
- ◆ Web sale of real-time energy use display through 3<sup>rd</sup> party program provider.
- ◆ Spec includes ability for customer to install.
- ◆ Solicitation for provider is now on the street.
- ◆ Promote primarily through web link & advertisements, and public relations media.
- ◆ Expected start by end of May 2008.



# Whole House Performance



- ◆ Home Performance with ENERGY STAR program.
- ◆ Based upon building science principles and diagnostic testing in/out.
- ◆ Two 3<sup>rd</sup> party solicitations in development:
  - ❖ Program provider – solicit/train trade contractors on business model & building science, mentor field work, ENERGY STAR coordination, provide quality control, report.
  - ❖ Quality Assurance
- ◆ Expected start 3<sup>rd</sup> Q 2008.



# Multi-Family Retrofit

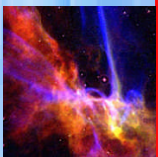
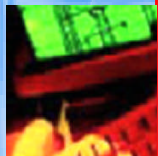
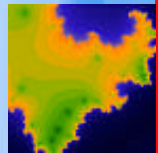
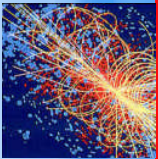
- ◆ We will ask for proposals for program design and implementation services.
- ◆ MF represents about 1/4 of Sacramento housing units. We have not had an energy-efficiency program that addresses this market for many years. Therefore, the savings potential is large.
- ◆ The RFP will be released within the next 2 months.



# Home Electronics

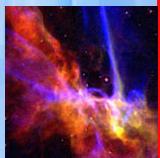
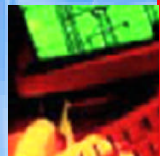
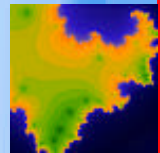
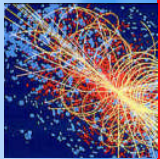
- ◆ ENERGY STAR product specifications for home entertainment and office equipment are basis.
- ◆ Program design in development:
  - ❖ CEE member committees for design, tiered product specifications and marketing/education.
  - ❖ California program coordination for expanded market influence.
- ◆ Likely start with 1-2 product types, not all.
- ◆ 3<sup>rd</sup> party solicitation development in 4<sup>th</sup> Q 2008.
- ◆ Expected start 1<sup>st</sup> Q 2009.  
(with 4<sup>th</sup> Q-2008 holiday and back-to-school campaigns)

# Other Corollary Activities

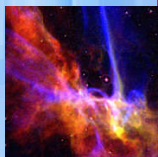
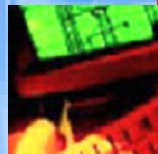
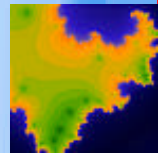
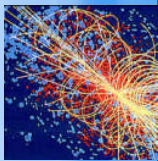
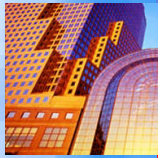




# Net Zero Energy Homes by 2020








# Base Energy Performance Specs

- ◆ 2x6/R19-R21 cavity/R12 insulating sheathing (R30 wall assembly)
- ◆ R50 12" low-density foam ceiling assembly
- ◆ Tight Envelope, .0002 SLA (4 ACH<sub>50</sub>), Third Party inspections & testing
- ◆ Low e/low SHGC glazing (0.3 U-value, 0.26 SHGC)
- ◆ 100% CFL/LED Lighting
- ◆ Evaporative Condenser with 15 EER and night ventilation (home); SEER 18/12.5 EER and 10 HSPF mini-split heat pump (apartment)
- ◆ Solar assisted hot water and hydronic heating with 97% efficient gas boiler
- ◆ Tested ducts inside conditioned space
- ◆ Gas clothes dryer and Energy Star dishwasher, clothes washer, and washing machine
- ◆ 3.86 kW AC PV with grid connected battery system
- ◆ Home automation system with energy display, communicating T-stat, lighting controls
- ◆ LEED Platinum

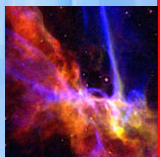
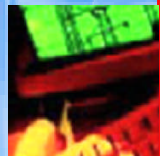
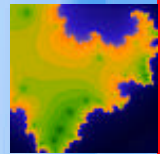
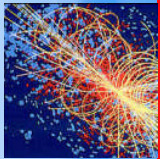
Estimated cost increase relative to standard home: +\$20.00/ft<sup>2</sup>



# Local Government Example - Solar Partners

- Partnership with local governments
- \$-0- Permit fee
- Streamlined application process
- Over the counter permit review
- Final inspection within 24 hours





# Conclusions

- ◆ We will likely increase the number of 3<sup>rd</sup> party programs over time
- ◆ 3<sup>rd</sup> Party programs provide —
  - ❖ Expertise
  - ❖ Staffing flexibility
  - ❖ Accountability – contracted savings
  - ❖ Cost management
  - ❖ Opportunities for increased savings