



RCx Made Easy: New Tools to Calculate RCx Energy Savings

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A Brief History of SCE's RCx Program

- SCE's 06-08 RCx Program ran from 2006 to end of 2009
- Both gas and electric (joint program with Southern California Gas)
- PECl served as the program implementer
- Program focused on operational measures (controls, scheduling, minor retrofits) with energy benefits
- Program paid for screening, investigation and follow up services
- Participant paid for implementation. Program paid financial incentives to buy down implementation for measures over a year in simple payback
- Program is continuing into the new, 2010-12 cycle

How Does SCE's RCx Work?

- Building owner submits application
- PEI screens building for compatibility
- PEI contracts with RCx Service Provider
- Service Provider investigates building
- Service Provider reports back to SCE with measure analysis and M&V data
- Owner implements measures, SCE pays financial incentives
- Service Provider delivers inspection and training



SCE's 06-08 RCx Program By the Numbers

17 Million kWh

\$8.5 Million

1.1 Peak MW

100,000 SF Minimum Building Size

209 Applications Received

28 Million SF Investigated

113 Investigations Completed

59 Completed Projects

SCE's 06-08 RCx Program By the Numbers

47



SCE's 06-08 RCx Program By the Numbers

14



Program Process Evaluation

- The California Public Utilities Commission requires a Process Evaluation for all EE programs
- A process evaluation looks at and reviews qualitative aspects of a program
- Research Into Motion and ASW Engineering conducted a Process Evaluation released in May 2009

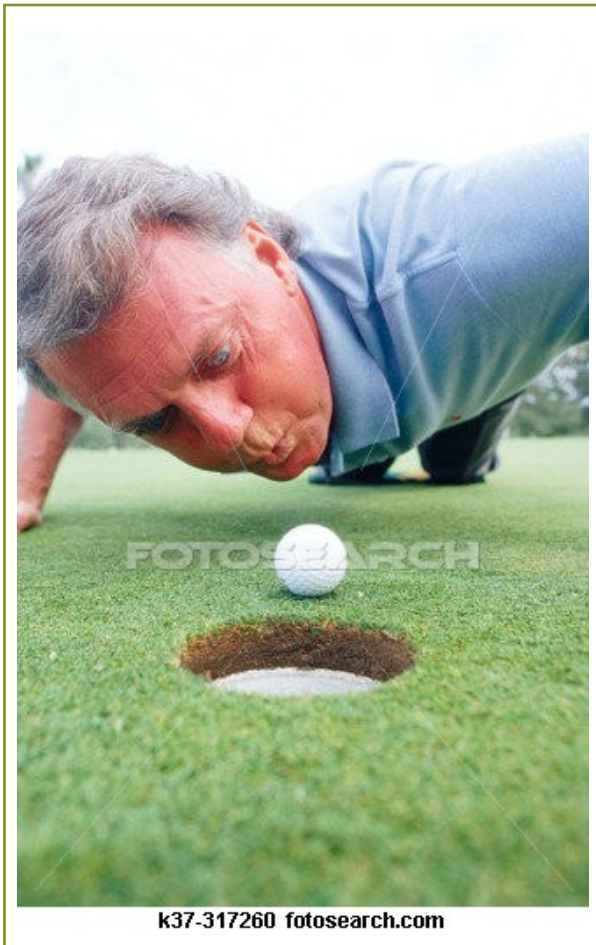


Key Findings

- RCx Providers are not providing consistent, adequate, explanatory data
- RCx Providers are frustrated with the review process and want more compensation
 - *“It’s way too much rigor that is required. It provides the appearance of more rigor without more rigor.”*
 - *“Any time you have two engineers look at a problem they will come up with two different approaches.”*
 - *“It took five or six weeks for the review of findings. The findings were returned with comments. I addressed the comments, then it took another five or six weeks for further review. It took six months to get our first payment.”*
- There is a need to streamline the process so that it is less burdensome to the Service Providers



Recommendations



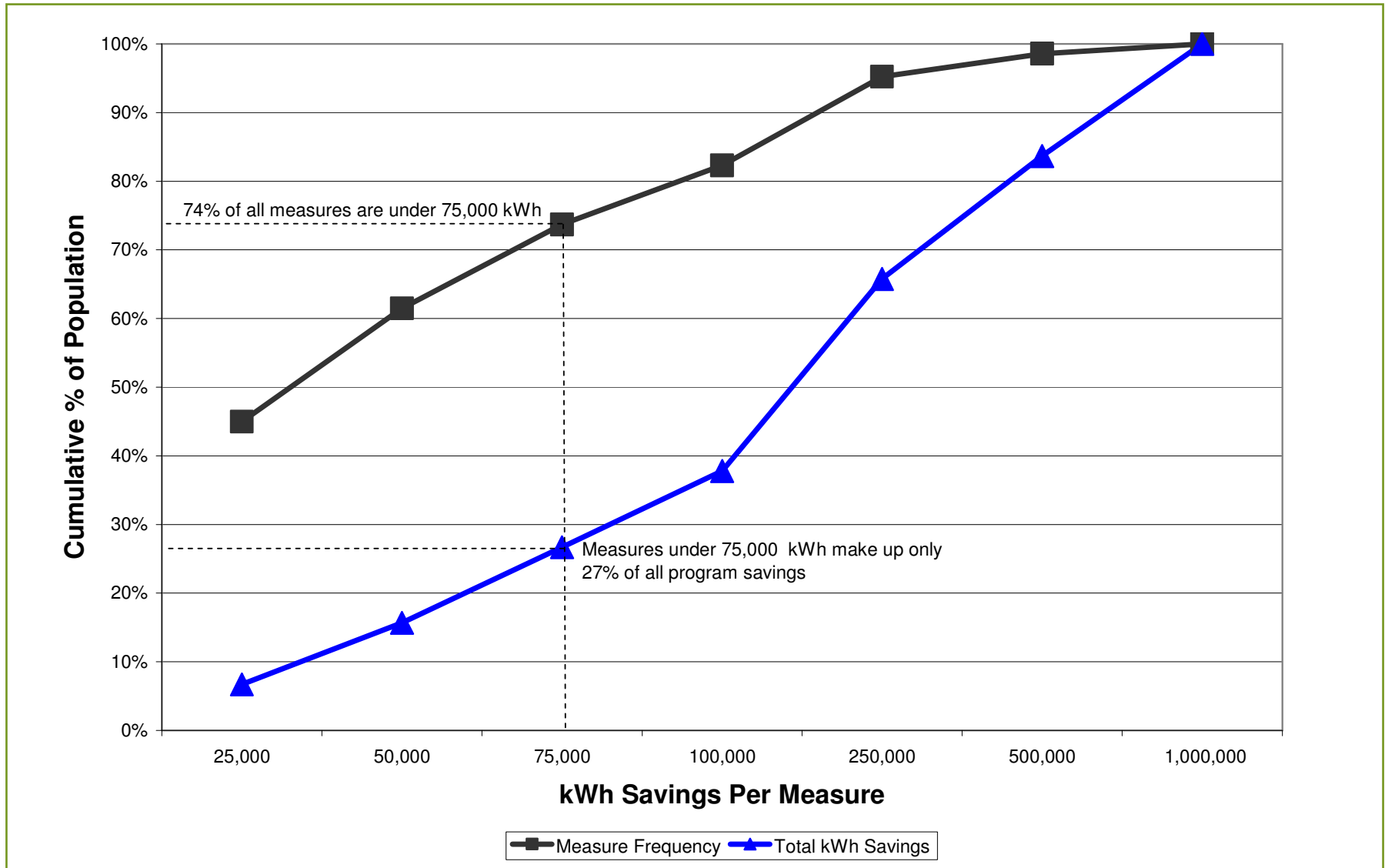
- Standardize service providers' energy savings calculations and conduct guiding workshop(s)
- Establish minimum level of baseline data collection
- Create a multi-tier protocol for analysis rigor based on impact

Program Response

- Assembled experts to address the recommendations:
 - ASW – Process Evaluator
 - PEI – Program Implementer
 - AESC – Internal Quality Control
 - SCE M&V and Program Staff
 - SCG M&V and Program Staff
- Held workshops to discuss implementation
- Particularly keen on the multiple-tier approach



Population of Measures



Two-Tier Calculation Approach

TIER I (optional) for measures $< 75,000$ kWh or $< 30\%$ of building gas consumption

- Commonly occurring measures
- M&V pre- and post-requirements
- Energy savings are pre-calculated / deemed based on several input parameters

TIER II - Mandatory for measures $> 75,000$ kWh

- All measures
- M&V pre- and post-requirements
- Energy savings go through full, customized analysis

Advantages of a Pre-Calculated Approach

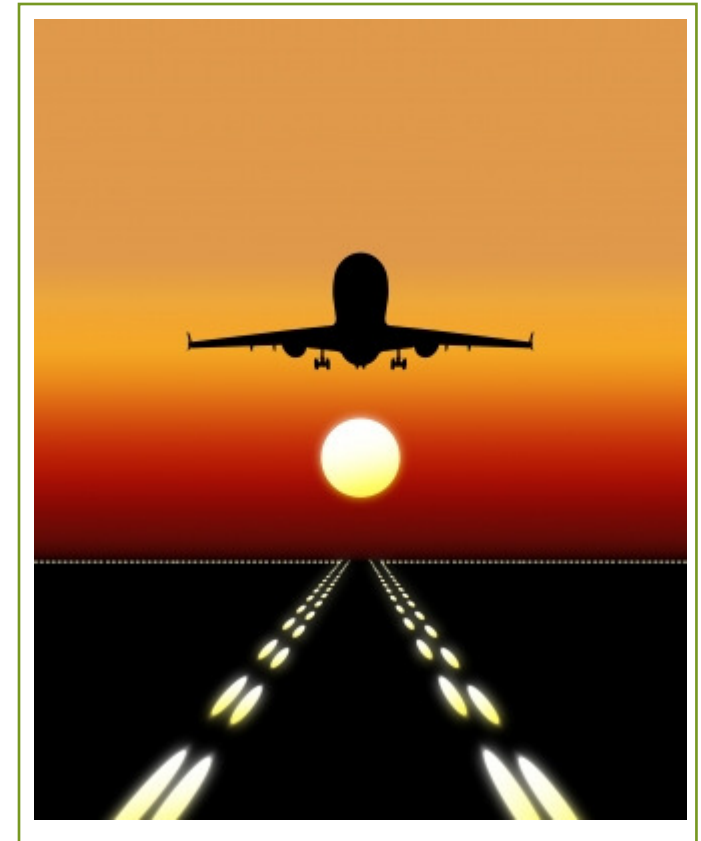


- Reduced overall project costs
- RCx provider can spend more resources in the field rather than in the office
- Reduced quality control costs
- Faster approval time
- Allows for a “mass-market” approach



Looking Into the Future

- Retrofit vs RCx
- So far, RCx is typically a “niche” program, need to make it “mass market”
- Utilities need to increase their participation in this market, standardizing is one of the keys
- Some RCx measures are no-brainers, and they should be treated as such, don’t get hung up with numbers
- RCx is a first step, the rest is behavioral that requires training, better documentation, follow up, etc.



Making the Case for Simplification

“When it comes time to do energy savings calculations, I feel like a kid in school being tested. It’s stressful.”

- A veteran RCx provider



<http://cdn.sheknows.com/articles/boy-taking-exam.jpg>

Solution: Simplified Savings Calculation Tool

“BOA Tool”

- Building Optimization Analysis Tool

Targeted at typical non-residential building types with typical HVAC systems

- Those found in most RCx projects



<http://www.treehugger.com/glass-box.jpg>



<http://liviaandbilly.files.wordpress.com/2010/01/emp.jpg>

Eleven HVAC Measures Included in Tool

Airside

- Reduce supply fan operating schedule
- Add supply air temperature reset
- Reduce supply duct static pressure
- Reset supply duct static pressure
- Add supply fan VFD
- Adjust zone temperature deadband
- Adjust airside economizers

Waterside

- Add boiler lockout
- Add chilled water supply temperature reset
- Add condenser water supply temperature reset
- Add chilled water pump VFD

Two Lighting Measures Included in Tool

- Reduce lighting operating schedule
- Add occupancy sensors for lighting control

- More HVAC than lighting measures
 - Most RCx measures in California utility RCx programs are HVAC-related



BOA Tool: Methodology

Simplified user interface accesses complex calc results

- Spreadsheet-based interface
 - Prompts users for a few basic inputs
- Software applies inputs to “pre-calculated” results from DOE-2 runs to calculate savings
 - Parametric eQuest runs were used to develop the pre-calculated savings factors

A “prescriptive” approach

But Wait ... What About DEER?

DEER = California's Database for Energy Efficient Resources

- Deemed energy savings values for efficiency measures
 - Based on building type, building vintage, and climate zone
- Includes some of those 13 measures already

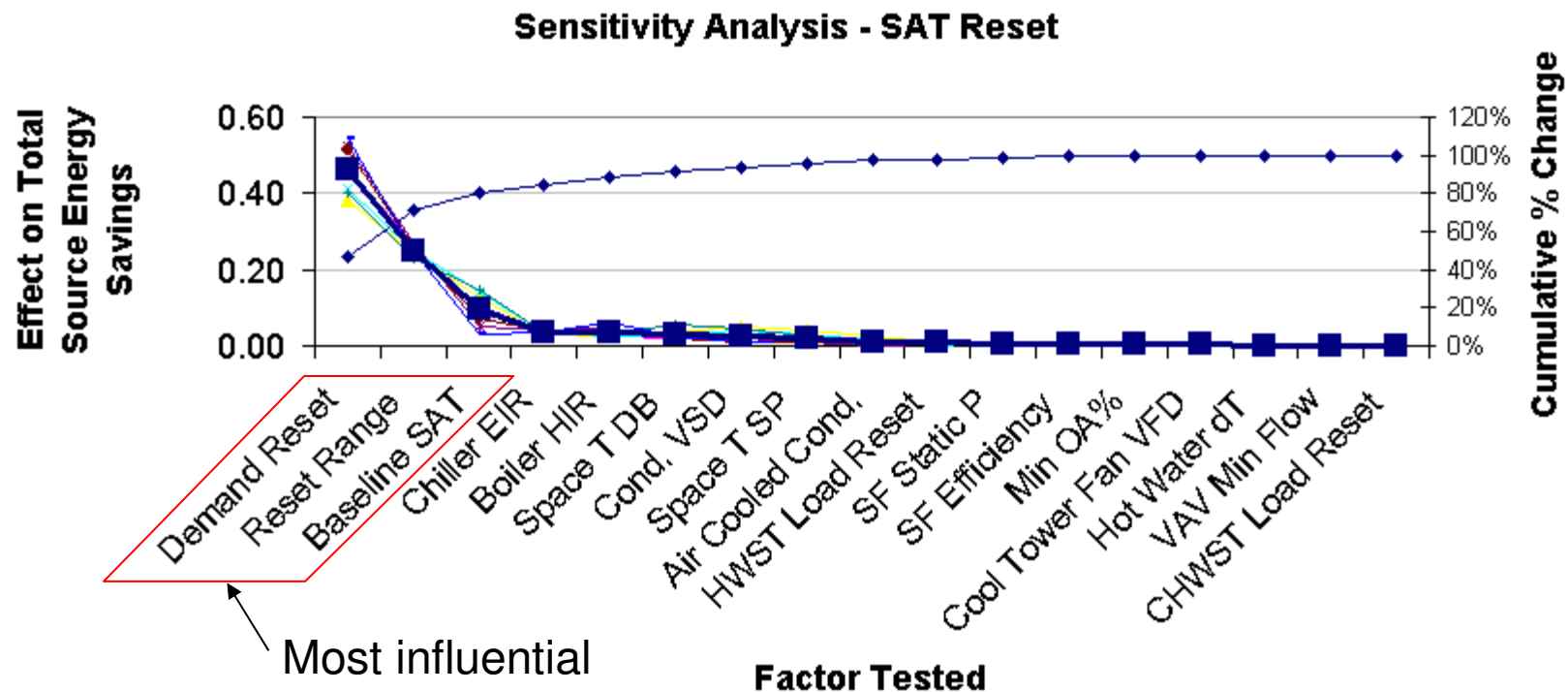
BOA Tool has more project-specific inputs

- For more project-specific savings estimates

What are the User Inputs?

Sensitivity analysis performed

- To determine the most significant variables, which become the tool inputs



What Building Types are Covered by the Tool?

Most common types found in RCx

- Large Office, Large Retail, Hotel, Hospital, Education
- Tool uses DEER baseline building types and building vintages, in California's 16 climate zones
 - Representative of typical building construction, HVAC systems, etc.

BOA Tool Interface: General Inputs

User input in yellow cells

General Inputs	
Building Type	Office - Large
Zip Code	90210
CA Climate Zone	9
Year Building Constructed	1985
Facility Gross Area (ft ²)	100,000

Baseline Building Energy Use	
Baseline Annual Electric Use (kWh)	1,400,000
Baseline Annual Gas Use (Therms)	40,000
Electric EUI (kWh/ft ²)	14.0
Gas EUI (therms/ft ²)	0.4
Total EUI (kBtu/ft ²)	87.8

Baseline usage used for error checks
in measure tabs

BOA Tool Interface: Measure-specific Inputs

Airsde economizer example

Non-discrete inputs

Discrete inputs as
pulldown menus

Inputs	
Building Type	Office - Large
CA Climate Zone	9
Year Building Constructed	1985
Lock-Out Temperature or % Outside Air	55 Deg Lockout
Air Handler Cooling Capacity (tons)	200

In this example, tool looks up savings factor for:

- Large Office
- California climate zone 9
- 1985 vintage building
- 55°F baseline economizer lockout temperature

BOA Tool Interface: Measure Savings Outputs

Airside economizer example

Savings =

(pre-calc'd savings factor)*(non-discrete inputs)

- E.g., $(281.4 \text{ kWh} / \text{ton}) * (200 \text{ tons}) = \underline{56,281} \text{ kWh}$

Savings Outputs				
Annual Electric Savings	56,281 kWh/yr		4.0%	% of Annual Use
DEER Peak Electric Demand Savings	0.1 kW			
Annual Natural Gas Savings	0 Therms/yr		0.0%	% of Annual Use

Warnings and Errors: No warnings or errors exist for this measure

Warnings / errors if savings are too high:

- For use of tool in utility program (e.g., >75,000 kWh)
- Compared to whole building usage

BOA Tool Strengths

Easy-to-use

- Only a few inputs required
- Immediate results
- Should give providers time to identify more measures / savings
- Should help streamline review process

Includes most common RCx measures and applies to most common building types

BOA Tool Limitations

Applies only to certain building types and
baseline / measure conditions

Includes only common, simple measures

- Other building types, measure conditions, and
measure types will require a custom analysis
 - E.g., spreadsheet calc, DOE-2 model



Future Versions of BOA Tool

More building types

- Target smaller buildings

More measure types

Embed energy simulation engine in tool

- Instead of parametric run look-ups
- Would increase applicability of tool



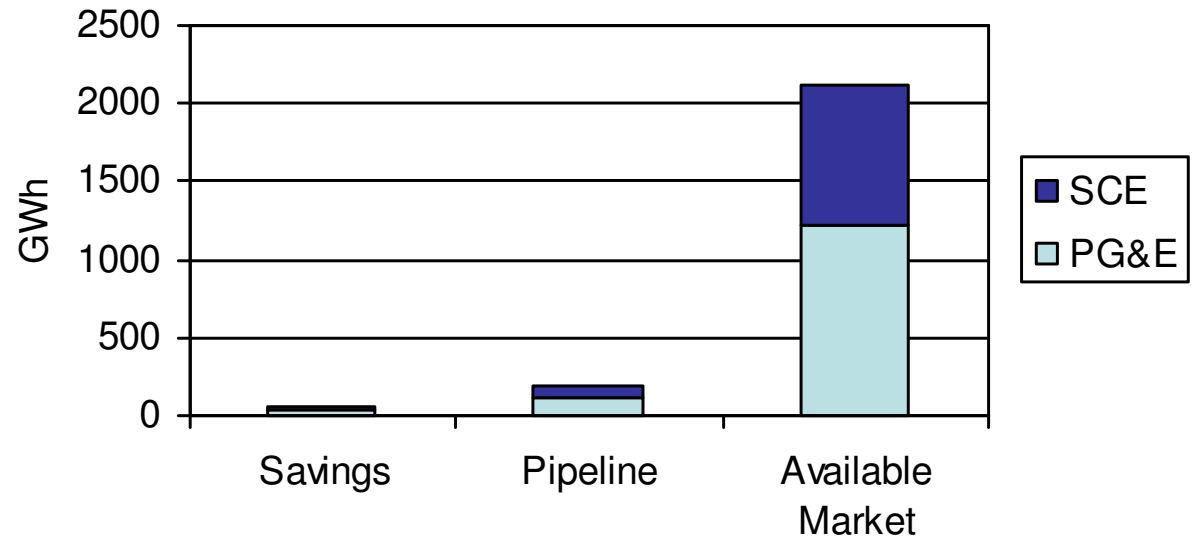
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Challenges Facing Commissioning

Market Adoption

- Cost & Mindshare
 - \$1.00 / sq ft.
 - Re-active maintenance
- Awareness



Ramping up the market curve

Extending Market Penetration with BOA

- Decrease time and cost for baseline analysis and calculated savings
- Increase reviewer confidence and consistency

Market success with BOA

- Increase overall Cx consistency / accuracy
- Decrease persistence issues with annual follow-ups
- Continued update of BOA to expand market

Questions?

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