Implementing Comprehensive and Effective RCx Programs
An Update from California’s Largest Utility

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Pacific Gas & Electric Company
Learning Objectives

1. Understand PG&E’s efforts to date to offer a large scale RCx Program
2. Review savings claimed and breakdown by customer and industry segment
3. Understand successes and lessons learned from a large scale RCx Program offering
4. Vital elements for the successful scale-up of a utility sponsored RCx Program and current issues faced with furthering program expansion
Retrocommissioning in California

Operating in a Regulated Environment

Decoupled and Deregulated

- IOU shareholders get paid for energy savings achieved not for energy sold
- Utilities incentivize customers to save energy

CPUC Concerns and Energy Efficiency

- PG&E mandated to expand capacity through efficiency
- Since ratepayer dollars at stake:
  - Persistence: will the change be undone?
  - Accuracy: are the savings real?
  - PG&E must deliver quality product
  - Programs must satisfy customer needs
Retrocommissioning in California

PG&E and Retrocommissioning

Target RCx Customers

- Minimum 2 million kWh annual usage or 100,000 sq ft (for large commercial office buildings)
- Non-residential customers

Requirements for Implementation

- Must implement the smaller of:
  - Measure with <1 year simple pay back
  - or $25,000 in implementation costs
- Must implement w/in 1 year of identification
Retrocommissioning in California

PG&E RCx Benefits to the Customer

- Core and Third Party programs
  - No-cost audit to identify RCx Potential
  - No-cost post-implementation report with verified energy savings
  - Cash incentive for customers for energy savings

<table>
<thead>
<tr>
<th>RCx Incentive Structure</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity</td>
<td>$0.09/kWh</td>
</tr>
<tr>
<td>Gas</td>
<td>$1/therm</td>
</tr>
<tr>
<td>Peak Demand</td>
<td>$100/peak kW</td>
</tr>
</tbody>
</table>

Incentive capped at 50% of implementation cost
PG&E Core RCx History

Early Retrocommissioning
- 2002-2003 Oakland Energy Partners targeting certain regions with RCx
- 2004-2005 QuEST runs statewide RCx contract

Third Party Expansion and Creation of Core
- 2006 Multiple 3rd Party Offerings
- 2006 Core RCx launched

Growth and Maturity
- 2006-2008 PG&E has multiple competing RCx programs
- 2010-2012 Specialized 3P RCx offerings and increase coordination with Core
PG&E Core RCx Structure Today

Application submitted with help of Account Rep → Scoping audit to determine eligibility → RCx Measure Investigation and Reporting → Investigation Report Review & Approval

Customer Implements → Verification and Reporting → Verification Report Review & Approval → Training & Payment

Two Deliverables: Investigation Report and Verification Report
## PG&E Core vs. 3rd Party RCx Offerings

<table>
<thead>
<tr>
<th></th>
<th>Core</th>
<th>3rd Party</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Market Segments</strong></td>
<td>All non-residential</td>
<td>Niche markets</td>
</tr>
<tr>
<td><strong>Marketing</strong></td>
<td>PG&amp;E Account Reps</td>
<td>3rd Party Firm</td>
</tr>
<tr>
<td><strong>Sales</strong></td>
<td>PG&amp;E Existing Sales Channels</td>
<td>3rd Party Firm</td>
</tr>
<tr>
<td><strong>Customer Relationship</strong></td>
<td>PG&amp;E Account Reps</td>
<td>3rd Party Firm Existing Relationships</td>
</tr>
<tr>
<td><strong>Eng. Resource Payment</strong></td>
<td>Time &amp; Materials</td>
<td>Performance- based</td>
</tr>
<tr>
<td><strong>Engineering Calcs</strong></td>
<td>Pool of certified engineering firms</td>
<td>3rd Party Firm</td>
</tr>
<tr>
<td><strong>Measure Type</strong></td>
<td>Majority RCx</td>
<td>RCx, Retrofit, Demand Response</td>
</tr>
<tr>
<td><strong>Independent Calc Review</strong></td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>
What started as a program focused on commercial office buildings has taken off in high tech and industrial sectors.
Large growth in therm savings projected to come from a variety of industries.
PG&E RCx CO2* and Customer Cost Savings

* CO2 calculated based on CPUC approved figures for PG&E’s electricity mix: 0.524 lb CO2/kWh and 13.446 lb CO2/therm
Customer Impact

Average $/SF Before and After Incentive for Project Implementation

<table>
<thead>
<tr>
<th>Target Market</th>
<th>kWh</th>
<th>therm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Office</td>
<td>6%</td>
<td>14%</td>
</tr>
<tr>
<td>High Tech</td>
<td>4%</td>
<td>18%</td>
</tr>
<tr>
<td>Industrial*</td>
<td>7%</td>
<td>0.2%</td>
</tr>
<tr>
<td>Retail</td>
<td>7%</td>
<td>10%</td>
</tr>
</tbody>
</table>

* Despite the low % of total savings, total therms saved from Industrial RCx are not insignificant
Customer Impact

Pre- and Post-Implementation Average Simple Payback

Years

2008 2009 2010 2011

Pre-Implementation Post-Implementation

0 1 2 3 4 5
## Successes and Lessons Learned: Case Study

<table>
<thead>
<tr>
<th></th>
<th>Project #1</th>
<th>Project #2</th>
<th>Project #3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Space Type</strong></td>
<td>5 Floor Shopping Mall</td>
<td>High Tech Facility Campus (7 Bldgs), Office + Data Centers</td>
<td>12 Floor Office Bldg</td>
</tr>
<tr>
<td><strong>Conditioned SF</strong></td>
<td>405,000</td>
<td>980,000</td>
<td>175,000</td>
</tr>
<tr>
<td><strong>Yearly Usage</strong></td>
<td>4.8 GWh</td>
<td>26 GWh, 51k Therms</td>
<td>2.8 GWh</td>
</tr>
<tr>
<td><strong>Measures Implemented</strong></td>
<td>- Optimization of Lighting Schedules and Control Sequences</td>
<td>- Economizer Repair - Optimization of Central Plant - VAV Box Turndown</td>
<td>- Optimization of Central Plant Sequences - Better Control with VFDs</td>
</tr>
<tr>
<td><strong>Projected Savings</strong></td>
<td>519MWh</td>
<td>1.1GWh, 9,300 Therms</td>
<td>543MWh</td>
</tr>
</tbody>
</table>
Successes and Lessons Learned: Case Study

Project #1: Completed as Expected

Measures
- Simple measure and limited scope
- Lighting scheduling & re-zoning

Execution
- Funding available; Measure installed in a timely fashion
- Schedules could not be implemented as aggressively as intended

Result
- Final savings decreased from 519 MWh to 485 MWh
- Customer incentive unchanged due to cost cap

Conclusion
- Limited & straightforward scope of project ensured its success
Successes and Lessons Learned: Case Study

Project #2: Drastic Decrease in Savings

**Measures**
- Customer immediately threw out large measure for high simple pay back

**Execution**
- Spider infestation clogged OA flow sensors
- Some chillers could not reset as intended
- VAV zones oversized and could not be turned down

**Result**
- Final savings decreased from 1.1 GWh to 82 MWh
- Incentive decreased from $58,000 to $6,200
Successes and Lessons Learned: Case Study

Project #2: Lessons Learned

**Involve Your Customer and Their Controls Contractor Early!**

- Co-develop measures with the customer
- Keeping the customer updated as measures are investigated manages their expectations when things go wrong

**Customer Relations Skills and Communication Just as Important as Good Engineering**

- Customer understanding is key when things go awry
- They are a valuable ally in problem solving

**Know When to Cut Your Losses**

- Unforeseen circumstances may derail savings at any time
Successes and Lessons Learned: Case Study

Project #3: Increased Savings

**Measures**
- Co-developed with customer to ensure buy-in from the start
- Robust EMS easily provided trend logging

**Execution**
- Cooperative customer provided access & data
- All measures implemented as intended
- Trended data showed measures could be implemented more aggressively

**Result**
- Final savings increased from 543 MWh to 867 MWh!
- Energy savings: $100,000+ annually, SPB: 1.3 Yrs
Successes and Lessons Learned: Case Study

Project #3: Lessons Learned

There is No Substitute for a Motivated Customer

- Makes data collection easier
- Avoids project delays when the customer puts high priority on the RCx effort
- Likely to implement more measures and ensure savings persist

A Robust EMS Goes a Long Way

- Reduces project costs from data collection to implementation
- Direct contact with the controls contractor is helpful
Successes and Lessons Learned

Because of a regulated environment...

Program Efforts Shift to Reflect Evaluation Methodology

• High savings measures are more important focus of verification efforts
• More resources allocated to verify high savings measures

Rate-payer Funding Requires Smart Spending

• All program efforts must be scalable for expected energy saved (M&V, Project Budgets)
Successes and Lessons Learned

Because of a regulated environment...

**Savings Must be Verified and Persist**

- Minimum documentation and engineering rigor required
- Pre- and Post-Installation measurement
- Customer training is a key component to persistence

**Efficiency Projects Should be Properly Staged**

- Customer should be led through capital intensive measures first, then RCx
- Avoids undoing RCx efforts and double counting savings
- Staging should accommodate customer priorities too
## Successes and Lessons Learned

### Popular RCx Question Areas:

<table>
<thead>
<tr>
<th>Measure Life Estimates</th>
<th>Ensuring Utility Influence</th>
<th>Market Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>• EEMs are assigned a “measure code” (42 RCx specific)</td>
<td>• Certain “easy” maintenance measures are not being done</td>
<td>• In 2009, commercial RCx was less than 0.5% of PG&amp;E’s Energy Savings Portfolio</td>
</tr>
<tr>
<td>• Each measure code has an EUL associated with it</td>
<td>• PG&amp;E has piloted projects where regular system maintenance is an issue (steam &amp; air leaks)</td>
<td>• However, RCx continues to attract large &amp; high profile customers</td>
</tr>
<tr>
<td>• EUL ranges from 3-8 years depending upon nature</td>
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</tr>
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Elements for Scale Up

Expansion into New Sectors

Which Sectors Have a lot of RCx Potential?
• PG&E is targeting Federal, Industrial, and Agricultural

Can Program Requirements be Met in New Sectors?
• Data collection requirements
• Are they cost effective and does the traditional M&V approach make sense?

Customer Motivations and Priorities Change
• For some, $500k of measure cost is insignificant
• For others, operational cost is a non-issue
Elements for Scale Up

Why Develop Tools?

Make Existing Analysis More Cost Effective

- Streamlines calculations for a set of common measures
- Ensures consistency in calculation
- Easier to review and approve

Expansion into New Markets

- Large industrial customer currently uses software to optimize pumps, but not primarily for energy savings
- Successful vetting of tool will allow streamlined and more cost effective projects
Elements for Scale Up

Building Optimization Analysis (BOA) Tool

**Tool Launched in November 2010**
- Mandatory use in Core RCx, where applicable
- Optional use in 3P RCx, where applicable

**Designed to Standardize Analysis**
- Typical RCx measures with small savings (<75,000 kWh/year)

**A Handful of Projects Have Successfully Used It**
- Tool is still in its infancy
- Long project cycle time means sample size currently limited
## Elements for Scale Up

### Building Optimization Analysis (BOA) Tool

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Improvements</th>
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<tr>
<td>• Standardization</td>
<td>• Expand measures that are included</td>
</tr>
<tr>
<td>• Cost &amp; time savings on energy calcs and verification</td>
<td>• Expand building and HVAC types served</td>
</tr>
<tr>
<td>• Providers can spend more time on larger measures (aligns engineering resources with anticipated savings)</td>
<td></td>
</tr>
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</table>
Fault Detection and Diagnostics (FDD)

- PG&E recognizes the potential of Automated FDD tools to collect and analyze data.
- Currently running pilot projects and technology assessments on a handful of technologies to evaluate:

  - **Initial Investigation:** Additional savings due to volume of data available.
  - **Savings Persistence:** Protects against gradual savings degradation.
  - **Further Tune-up:** Continued data analysis finds additional savings in years 2 and beyond.
Elements for Scale Up

Educate Everyone!

For successful roll out, everyone must be able to knowledgeably explain program offerings to customers.

Misaligned expectations cause easily avoidable problems.

Educated customers see the value in RCx and are motivated customers.
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Thank You!

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