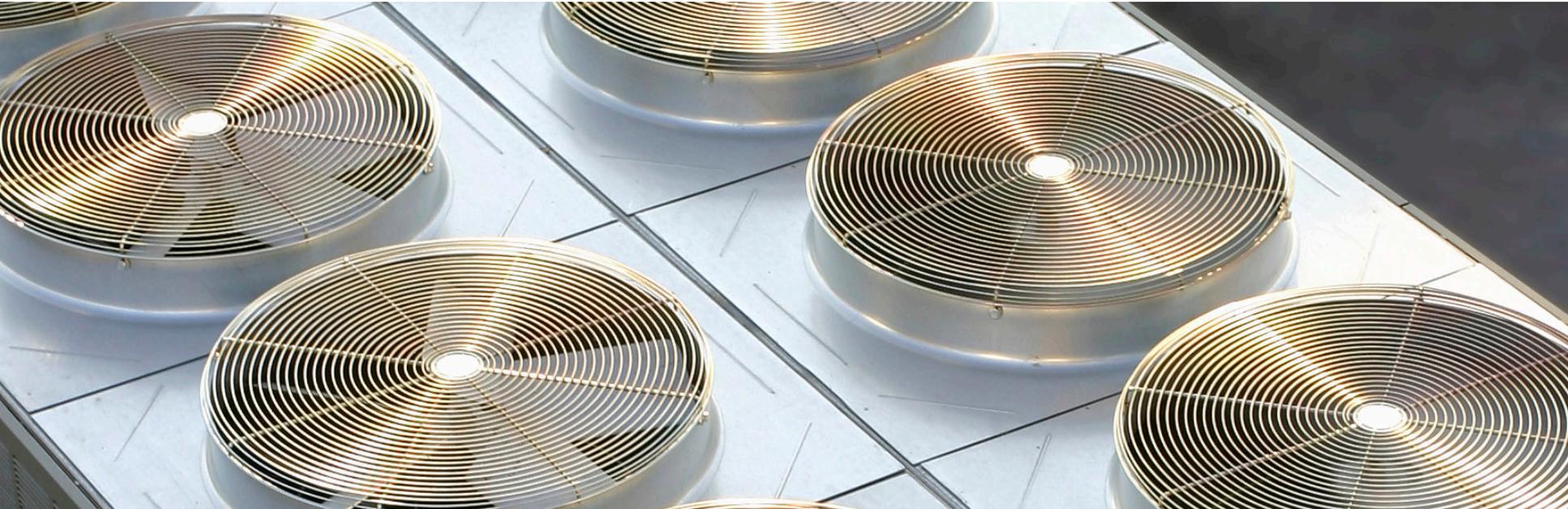




**PECI**<sup>®</sup>

# **New Energy Efficiency Conservation Measures for Energy Efficiency Implementation Project (EEIP)**

November 27, 2012



# Agenda

- Quick overview of PECl
- Data Centers
- RCx with Whole Building M&V
- Advanced HVAC Tune-up



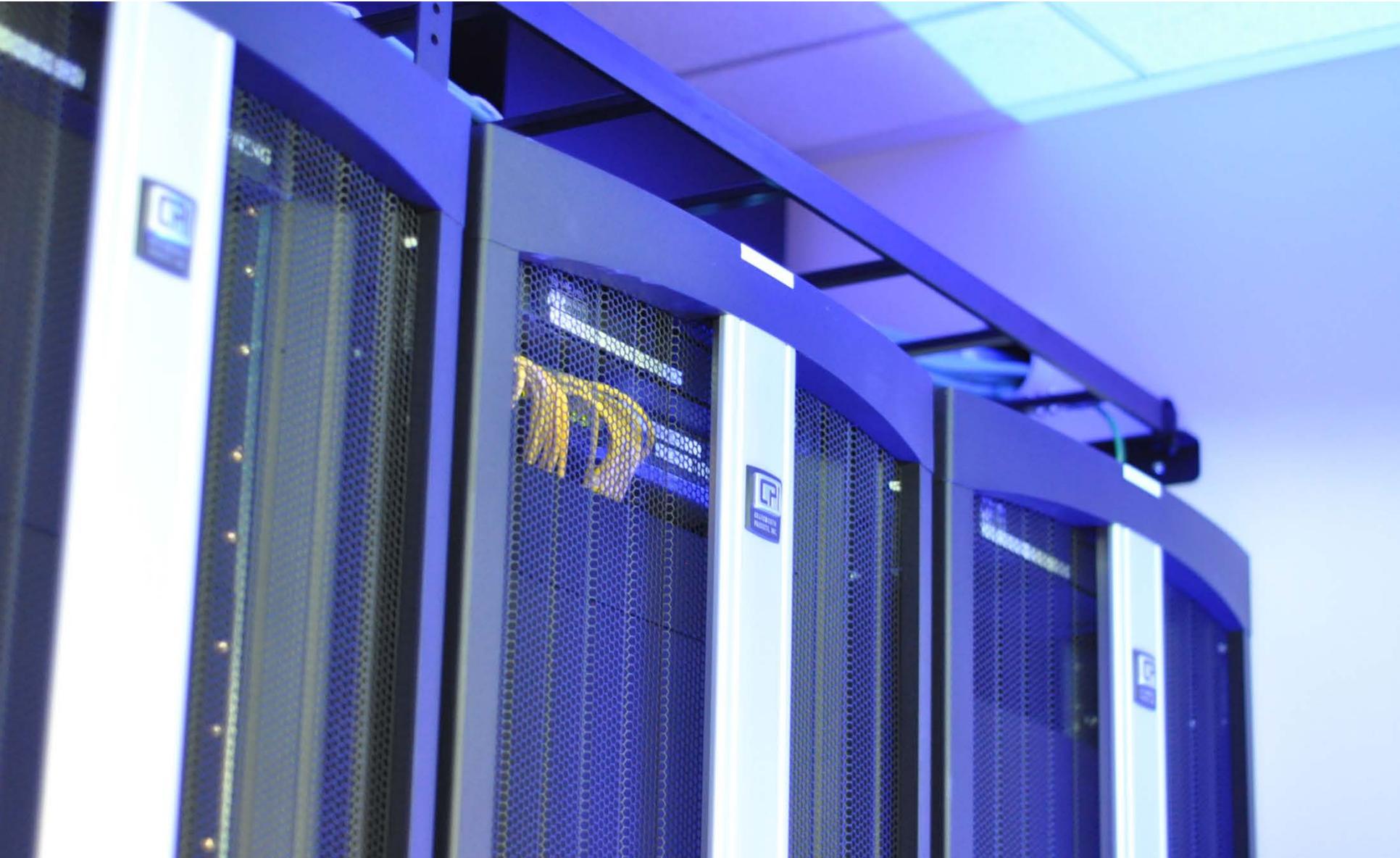
# About PECE

- Private nonprofit
- 305 staff
- Founded in 1980
- [www.peci.org](http://www.peci.org)

*To be a pivotal force in creating  
the new energy economy.*



# Data Center – Airflow Management





# Overview of DC Airflow Management Measures

With built-in measurement and verification protocols packaged in a program offering, the airflow management measure package is founded on the identification and implementation of a series of simple low- or no-cost measures that, when combined, result in more energy efficient facilities.

- Low or No-Cost Measures
- Designed to identify a series of simple measures related to airflow and thermal optimization.
- Represents 70 percent of the data center's facility-related energy use.
- Expected 30 to 50 percent energy savings from airflow-related improvements, a utility offering focused on airflow has potential to deliver high impact savings.
- Provides an “accessible” solution for utilities to help their customers achieve fast and real savings without impacting data center uptime and performance



# Example Target Markets

Segment	Data Center Square Footage	Annual Energy Savings
Small business	700 square feet	66,000 – 107,000 kWh
Hospital	1,000 square feet	94,000 – 153,000 kWh
Community college	1,500 square feet	140,000 – 230,000 kWh



# Measurement and Verification

- Airflow Management Calculator quickly calculates energy savings, is user friendly, and customized for the specific utility
- PECEI's AFM tool calculates the electric energy and demand savings related to optimizing data center HVAC unit supply airflow rates and supply air temperatures (SATs)
- Includes baseline operation, proposed/recommended operation, and installed operation inputs



# IPMVP

## Option A

- Retrofit Isolation with Key Parameter Measurement is appropriate for Data Center Airflow Management.
- Pre- and post-spot measurements will capture the IT equipment load, inlet temperatures, and airflow, along with the air conditioning unit (CRAC/H) temperatures, airflows and fan power required to calculate the baseline and reporting period energy and demand usage respectively.
- Results over varying IT load will be extrapolated outside of the metering period based on rack inlet temperature data gathered every 15 minutes throughout the pre- and post-measure installation periods.



# Barriers/Solutions

Market Barrier	Strategy to Overcome Barrier
<p>Uptime and performance. For data center owners, operators, and managers, maintaining data center uptime and performance is mission-critical. Downtime creates a risk aversion and reluctance to change.</p>	<p>Provide compelling technical information and develop case study that showcases the ability to implement energy efficient changes without affecting uptime and performance.</p>
<p>Split incentives. Energy inefficiencies and costs may be invisible or difficult to parse out. Between who pays the electric bills, who manages the building, who manages the data center, and the data center ownership or lease structure, there is an aggravated split-incentive problem.</p>	<p>Support project champions in reinforcing both energy and non-energy project benefits and making the business case for investment in energy efficiency measures.</p>
<p>Capital and resource constraints. Data center owners and operators frequently lack upfront investment dollars to put toward energy efficiency, and they lack or simply do not know how to access technical resources to implement efficiency solutions effectively.</p>	<p>Deliver targeted implementation support to motivate owners and move efficiency opportunities through the utility project pipeline.</p>



# Applicability

- AFM is targeted to the small-to-medium data center market
- Ideal data center size ranging from 500 to 5,000 square feet (representing about 48% of data centers nationally).
- Typical fan energy savings related to these measures have been quantified in the 40-50 percent range under PG&E's airflow management program, with overall project savings averaging in the 50,000-100,000 kWh per year range.
- Program type: Pilot, standard offer, and/or market transformation



# Conclusions

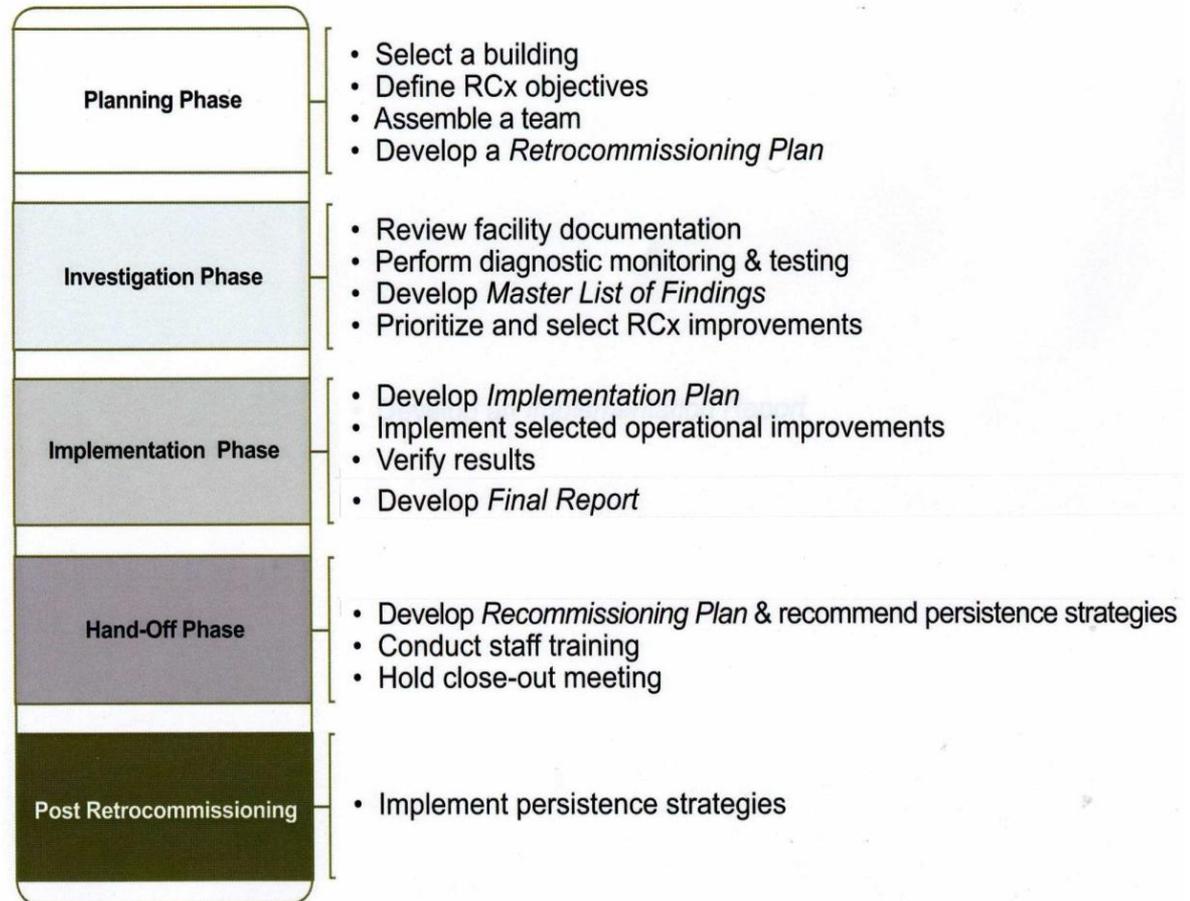
- Data Center Air flow Management technology is market ready
- Measures are low to no cost to implement for business owners
- PECEI's Airflow Management Calculator quickly calculates energy savings, is user-friendly and customized for the specific utility.
- Integrated M&V
- Highly supported implementation that engages the customer and helps ensure project conversion from audit to implementation.
  - » Express support
  - » Priority support
  - » Standard support
- Implemented by PECEI or in-house option led by trade allies

# Whole Building Retro-commissioning



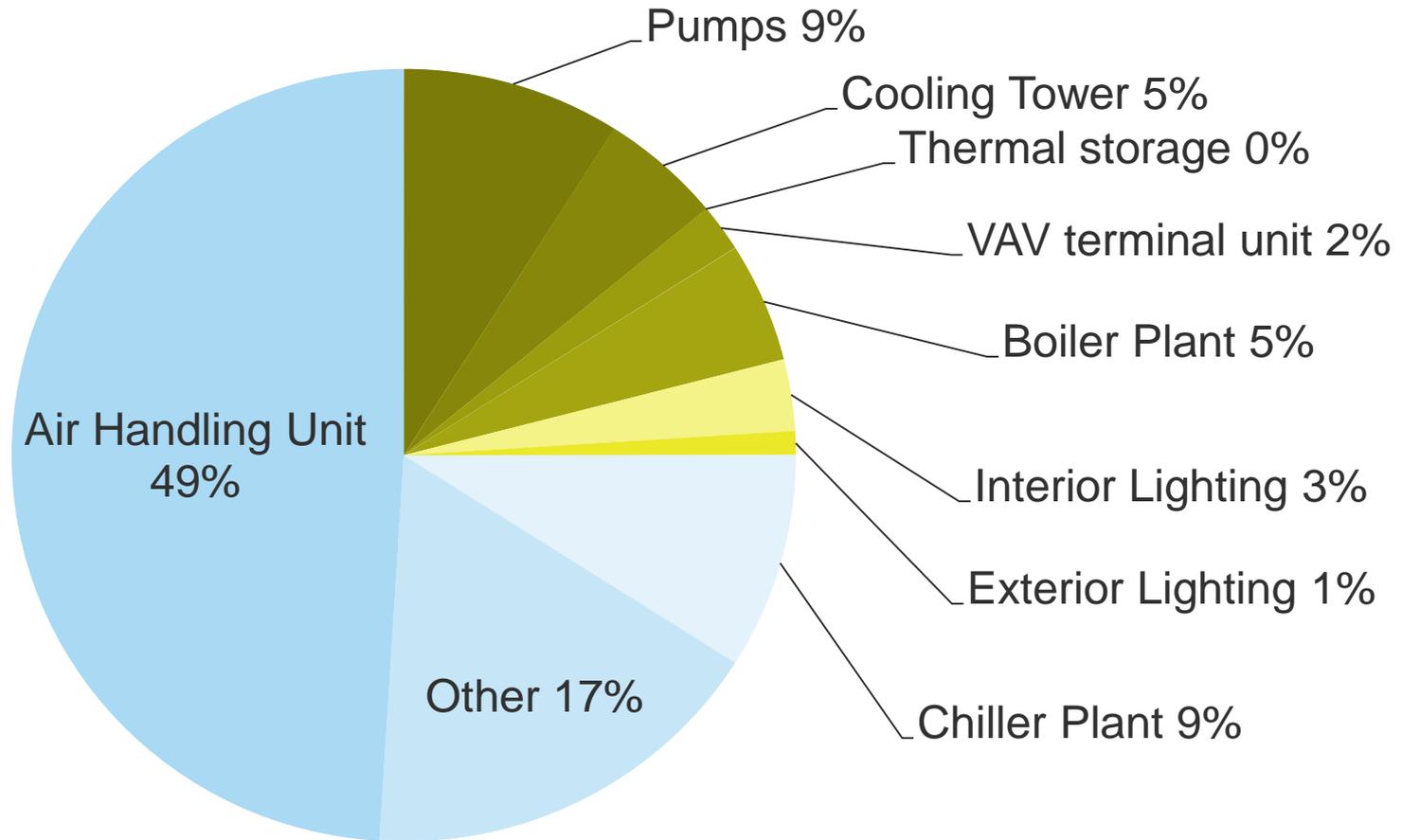
# The RCx Process

RCx ensures a building meets the requirements of the owner, provides a safe and comfortable environment for occupants and operates efficiently.





# ECMs





# Measurement & Verification

Traditional	Our Solution: IPMVP Option C
Usually limited to operational verification	Interval meter data: measured data to quantify savings
Measure level calculations are time intensive	Multivariate regression: significantly reduces calculation costs
Leaves savings on the table	Captures all energy impacts at meter
Estimate of interactive effects manually calculate, if included at all	Includes interactive effects
Accuracy dependent on quality of engineering assumptions	Quantifies uncertainty in savings estimates



# Applicability

## Risks:

- Program relies on commissioning provider network
- Persistence of O&M measures
- Unexplained changes in energy (non-routine adjustments)

## Benefits:

- Buildings are complex: holistic approach to drive deep low-cost savings
- Financial benefits to owners
  - » Direct: energy cost reduction, reduced maintenance costs
  - » Indirect: tenant retention, publicity, more engaged staff
- Non-energy benefits
- Spring board for better energy management practices

## Program type:

- Pilot program



# Barriers

Barrier	PECI Strategy
Difficult for smaller buildings	Parallel “tune-up” offering
Enrolling suitable buildings: RCx needs functioning control systems not in need of major retrofits	Proven screening strategies
Owner cost-share: owner budgeting cycles and structures	Financial incentives, incentive design
O&M staff availability time devoted to project and implementing	Provider support built into programs
Some buildings already running well	Screening with EMIS



# Market

Standard offer program for Medium to Large C&I customers with interval meter data

Examples of possible target markets:

Segment	Building Square Footage	Annual Energy Savings (kWh)
Large office	>75,000 – 100,000	173,000 – 312,000
Hospital	600,000 – 820,000	500,000 – 1,000,000
College/University	162,000 – 250,000	80,000 – 316,000
Grocery	25,000 – 50,000	8.5% 900,000 – 2,200,200



# Conclusions

- RCx with whole building M&V using interval meter data is a market-ready approach that reduces cost over traditional approaches
- Commissioning training will be important for the success of the program
- Highly supported program during ECM implementation
- Integrated M&V using IPMVP Option C



# Advanced HVAC Tune-up Measures



# Recommendations for TX

Package advanced measures within “technology-enabled” tune-up or Quality Maintenance (QM) program





# Recommended ECMs

## Packaged HVAC tune-up

- Airflow improvement
- Economizer repair
- Refrigerant charge adjustment
- Condenser coil cleaning
- Evaporator coil cleaning
- Thermostat replacement or schedule adjustment



# Recommended ECMs

## “Custom Express” low cost upgrades using operational characteristics

- Notched v-belt upgrade
- Reduction of excessive ventilation



# Recommended ECMs

## “Custom Express” advanced measures

- Bolt on advanced economizer retrofit
- Enhanced ventilation control
- Digital economizer controls
- DCV (CO2 sensor)
- Supply fan controls
- Multiple speed fan control (VFD retrofit)
- Code compliant fan cycling control



# Energy Savings Estimation Plan

- Energy savings (CA) have been modeled using eQuest/DOE2.2r
- Savings have been vetted and approved by the CPUC
- Savings for RTU tune-up measures compare well to savings in DEER
- PECl engineering would model savings for Texas CZs and building prototypes



# M&V Plan and IPMVP Option

## Option B

Retrofit isolation is appropriate for HVAC RTUs that operate in widely varying conditions. Metering will capture actual energy consumption data at the RTU to show efficiency gains. Results will have to be extrapolated outside of the metering period.



# Applicability

## Risks:

- Limited uptake
- Poor implementation
- Gaming

## Benefits:

- Huge potential for savings—50% HVAC savings when all measures applied
- Huge gap in the market—economizers frequently inoperable
- Low hanging fruit—HVAC tune-up and maintenance is neglected and costly
- Uplevel market through training and education



# Applicability

## Barriers/Strategies:

- Difficulty in reaching customers
  - » Wrap advanced measures in HVAC tune-up program
  - » Referral system
- Untrained/uneducated contractors/technicians
  - » Eg. economizers
  - » Implement training requirements for program enrollment
  - » Use expert field staff to train and recruit contractors and QA/QC their work
- Resistance to anything new or challenging
  - » Provide incentives to cover some or all of tune-up cost
  - » Utilize streamlined tools for measurement and data collection to ease burden on technicians, improve data integrity, and help automate QA and QC

## Program type:

- Pilot, standard offer, and/or market transformation



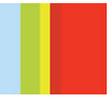
# Market

- CoolSaver program is a basic tune-up program with significant room for refinement.
- Advanced measures could be added to CoolSaver program or deployed with new tune-up program.



# Conclusions

- Advanced HVAC measures are market-ready
- These measures should be wrapped in a tune-up or QM program to reach a broader base and to ensure deployment on units that are functioning properly
- Contractor/tech training will be important for the proper deployment of a program and its associated measures
- Electronic data collection tools should be used to improve data integrity and help automate QA and QC and



# Next Steps/QA

