

Aligning an Economizer System focus “Sector Strategy” with Title 24, Standard 180 and CQM Programs

If California is to reach or even approach its energy efficiency goals for commercial buildings, stakeholders must encourage adoption and mainstream usage of advanced HVAC technologies, quality installation and quality maintenance practices. Economizer systems account for a very large portion of typical rooftop unit energy waste because a majority were improperly installed or do not currently operate as designed or are actually inoperable. Advanced economizer systems are readily available. Utilization and adoption are not occurring at anywhere near the rate required to attain energy efficiency goals. Even when installed, most economizer systems receive little to no maintenance and a majority of systems waste, rather than save energy. Serious barriers exist which hinder wide spread adoption of advanced economizer technologies as well as quality installation and system maintenance. These barriers will only be addressed and overcome with a state-wide effort - both within and beyond the scope of existing programs and individual IOU incentives.

Summary of Economizer Energy Efficiency Barriers

1. Title 24-2013 will require advanced economizer features but impact only a small % of California non-residential buildings.
2. ASHRAE/ACCA Standard 180-2008 established a minimum standard approach to maintenance of commercial building HVAC service but initially did not include economizer systems in the system tasking tables.
3. ASHRAE/ACCA Standard 180-2011 expanded maintenance tasks to include economizer systems. Eleven (11) of the thirty eight (38) maintenance tasks in the Standard 180 Task Tables that apply to packaged HVAC systems are focused on economizers. However, Standard 180 describes the minimum maintenance solution economizers, e.g., repair and replacement of what might be antiquated economizer controls.
4. California IOU Commercial Quality Maintenance (CQM) programs based on Standard 180 have been launched but do not yet promote or focus on economizer system upgrades or advanced features. Programs in each IOU territory currently only involve a limited number of contracting firms and their customers. There is emphasis on a general "energy savings" benefit but no focused training or use of existing tools to develop and deliver an effective "value proposition" to decision-making customers.
5. Significant energy efficiency and savings gains could be achieved through attention on and aggressive promotion of advanced economizer technologies and quality installation and maintenance practices to:
 - Reach both the new construction and the larger existing buildings market through focus on service sectors
 - Reach CQM program participating contractors and also the much broader base of light commercial service contractors
 - Support light commercial contractors re-defining their role to include energy efficiency consultation
 - Deliver effective economizer technical training which, though essential, is insufficient
 - Deliver market adoption which requires defining a convincing "value proposition" both for contractors and their clients
 - Produce projections of credible energy consumption, potential energy savings and focused sales training

Barrier 1. Within Title 24 - 2013

Title 24 - 2013 advances. New, required economizer functionality to include:

1. Economizer controls interlocked with mechanical system cooling controls to maximize suitable outdoor air for free cooling or to assist mechanical cooling and base economizer strategy on occupied/unoccupied schedules
2. Integrated economizer systems with occupancy based demand control ventilation (DCV) to reduce load on both the cooling and heating systems which will improve energy savings while maintaining adequate ventilation
3. Improved climate adjusted outdoor air (OA) control by utilizing OA relative humidity and/or temperature fixed high limits
4. Incorporating new fault detection and diagnostic capability for economizer system operation

These advances will make a significant step-change in rooftop unit operation, increase energy efficiency and include new capability to detect when economizer systems are not functioning properly.

LIMITATIONS:

- Title 24 only effects new construction and retrofits requiring permits - about 5% of buildings
- Compliance rates for securing permits to help ensure compliance historically are low - 5% to 10%
- Title 24 estimated to have an impact on approximately 1% to 2% of new buildings utilizing rooftop units
- No direct impact on existing buildings - 95% of the market and 95% of rooftop units in California
- No current known plan for training code enforcement officials on advanced economizer functionality or means to inspect for compliance determination

Barrier 2. Within ASHRAE/ACCA Maintenance Standard 180 - 2008

1. Major advancement in establishing ANSI approved national standard for commercial HVAC maintenance.
2. Limited to establishing a "minimum" level of maintenance, NOT intended for energy efficiency improvements or recommendations by itself.
3. The implementation plan called for component repairs or replacement only (same generation or type) if system inspections revealed unacceptable performance or operation.
4. Did not include economizer systems in maintenance task tables.

Barrier 3. Within ASHRAE/ACCA Maintenance Standard 180 - 2011

1. Standard 180-2011 added Table 5-22 for 27 Economizer System maintenance tasks largely as a result of WHPA Commercial Quality Maintenance Subcommittee direct input.
2. The standard is still based on establishing a "minimum" level of maintenance - a huge advancement for maintenance service in general but did not address or suggest making any updates or improvements to system or components.

Result: contractors following the standard would most likely replace a single broken or inoperable component with a direct replacement - the same older generation sensor or controller. This would perpetuate the use of a less accurate or much older technology and ignore improved, current technology components readily available in the marketplace or the consideration for upgrading the economizer control system to a more advanced system - such as those to be required by Title 24 - 2013.

Think enthalpy/RH controller utilizing horse hair or nylon sensing elements which cannot be calibrated and are known to be highly inaccurate almost immediately after installation. The rooftop unit could be assumed to be as inefficient after the "repair" as it was before service.

Barrier 4. Within CA IOU Commercial Quality Maintenance (CQM) Programs

1. SCE and PG&E programs were both established based on Standard 180-2008 which could have a huge impact on overall HVAC energy efficient operation of buildings participating in their programs.
2. Both programs have attempted to incorporate economizer system maintenance tasks adopted in Standard 180-2011.
3. Neither program, to date, has incorporate any technical training, requirements or incentives to encourage upgrading failed or antiquated economizer systems to currently available technologies with advanced features and which meet Title 24 - 2013 requirements. Both are operated according to the Standard 180 inspection approach of "repair, adjust, lubricate or replace components to ensure proper operation." This does not set a goal for attempting to reach "most energy efficient or optimal operation."
4. Neither program has yet developed detailed value propositions or sales training to support contractor sales of "quality maintenance" based contracts.
5. Neither program has yet developed value propositions, sales training or use of existing HVAC or economizer system building modeling and energy usage/savings estimation software to support economizer system upgrade sales.

Barrier 5. With Current Service and Maintenance Practices

What options exist when service contractors inspect commercial rooftop unit (RTU) economizer systems? Here are several approaches and practices. Which ones strongly support significantly improved energy efficiency?

1. Current common practice to neglect units, no maintenance agreement exists. No service is called for unless there is a cooling or heating failure. Energy cost and waste are just not a priority. The economizer system is totally ignored and not tested to determine whether dampers are frozen in place, sensors or changeover controller have failed, fan speed is inadequate for proper ventilation, whether the system is integrated with the commercial scheduling thermostat or interlocked with the mechanical cooling system. The result: maximum energy waste.
2. Minimal "inspection only" service typically limited to filter changes unless there is a heating or cooling failure. Typically, no operational test of the economizer system if heating/cooling systems function at all. Result: near maximum energy waste.
3. Scheduled maintenance agreements typically include some testing of the economizer/damper system just to see whether it operates, not whether it is an up to date or advanced system...just to see if whatever is there works.
4. Commercial Quality Maintenance program customer. Similar operational testing to the above. Program requires that rooftop units be returned to their original functionality. If inspection reveals that economizer components are either broken or non-functional, they are currently replaced with "like" generation components. The sensors and controllers are often from the 1970s and 1980s!
5. Optimized economizer system approach. The service provider would inspect the entire RTU including the economizer system. If the unit is very low EER, they would recommend a RTU replacement and conduct a cost of operation comparison and develop a payback or other financial basis for decision-making. If the RTU was of reasonably efficient EER, they would carefully inspect the economizer system, control system, dampers and thermostat/controller. They would evaluate the impact of the current system operation on HVAC energy consumption and also project a reasonable range of energy consumption and cost/savings which could be realized for installation of an advanced economizer system. In every case, energy and operational cost savings can justify installation of an advanced economizer system.

Which approach would you conclude has the greatest chance of helping meet California energy efficiency goals?