a.1 (1)	**Time of Day enabling is excessive**	
	Finding Examples	
		• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
	Finding the Problem; Problem Identification Method(s)	
		• Observations of existing schedule and/or printed controls logic • Observation of HOA switch in hand position • Improper time/date settings in controls
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Observations of existing schedule and/or printed controls logic • Observation of HOA switch in hand position • Improper time/date settings in controls
	Peak Demand Opportunity	
	Preferred Data Collection Method	
		• Trend command signal and power / current during all operating modes (e.g., occupied and unoccupied operation).
	Other Allowable Method(s)	
		• Trend command signal during all operating modes, visually spot verify that equipment / lighting operation matches commanded state. Document observations. • Provide screenshots of equipment / lighting operating schedule. Provide screenshots of equipment / lighting operating status in all operating modes. • Provide screenshots of equipment / lighting operating schedule. Visually spot verify that equipment / lighting operation matches commanded state. Document observations.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Provide screenshots of equipment / lighting operating schedule, and visually spot verify that equipment / lighting operation matches commanded state. Document observations. Provide relevant before / after photos.

a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	
	Finding Examples	
		• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
	Finding the Problem; Problem Identification Method(s)	
		• Observe fan speeds during system operation. Note relevant system performance (e.g., duct static pressure, space static pressure, positions of VAV box dampers). Temporarily adjust variable (e.g., lower duct static pressure setpoint), observe system performance (e.g. confirm that boxes will not be starved).
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine the minimum static pressure setpoint possible to maintain design flow conditions. Empirically determine the relationship between static pressure and fan energy at existing setting and proposed setting. (As an option, RCx Provider may calculate additional heating and cooling plant savings due to reduced airflow.) • Airflow can be calculated using measured fan power, speed, and duct static pressure values, if no design drawings are present. • Note that other values beyond zone temperatures may need to be trended for the savings calculations (e.g., OAT).
	Peak Demand Opportunity	
		• May be opportunity for peak demand reduction if fan speeds are lowered significantly, even during on-peak conditions.
	Preferred Data Collection Method	
		• Trend command signal and power / current along with any independent variables (e.g., outside air temperature) during all operating modes (e.g., occupied and unoccupied operation).
	Other Allowable Method(s)	
		• Trend command signal and relevant independent variables during all operating modes, visually spot verify that equipment / lighting operation matches commanded state. Document observations. • Provide screenshots of equipment / lighting operating status and relevant independent variables in all operating modes. • Provide screenshots of equipment / lighting operating schedule, or command signal in all operating modes. Visually spot verify that equipment / lighting operation matches commanded state. Document observations.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Provide screenshots of control logic, and visually verify that equipment / lighting operation matches commanded state. Document observations. • Provide relevant before / after photos.

a.3 (3)	Lighting is on more hours than necessary	
	Finding Examples	
		• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
	Finding the Problem; Problem Identification Method(s)	
		• Observations of existing schedule and/or printed controls logic. • Trends of equipment current or status show that lights are on more than needed. • Evidence of overridden automated lighting controls.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine existing lighting schedules. Develop load shapes for representative day types. Determine revised schedule and load shapes. Calculate savings based on load shapes and day types (kW savings * annual hours per day type). • Note that other values beyond those mentioned above may need to be trended or spot measured for the savings calculations (e.g., lighting kW).
	Peak Demand Opportunity	
		• Occupancy sensors may reduce peak demand if implemented in areas such as cafeterias
	Preferred Data Collection Method	
		• Trend command signal and power / current during representative day types.
	Other Allowable Method(s)	
		• Trend command signal during representative day types, visually spot verify that lighting operation matches commanded state. Document observations. • Provide screenshots of lighting operating schedule and operating status in all operating modes. • Provide screenshots of lighting operating schedule and operating command signal in all operating modes. Visually spot verify that lighting operation matches commanded state. Document observations.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Provide screenshots of lighting operating schedule, and visually spot verify that lighting is operating as expected. Document observations. • Provide relevant before / after photos

a.4 (4)	**OTHER Equipment Scheduling and Enabling**	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

b.1 (5) Economizer Operation – Inadequate Free Cooling

Finding Examples

- Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer)
- Economizer linkage is broken
- Economizer setpoints could be optimized
- Plywood used as the outdoor air control
- Damper failed in minimum or closed position

Finding the Problem; Problem Identification Method(s)

- Observation of integrity of components and sensors
- Functional tests to observe actuation of dampers
- Trending to observe dynamic performance and coil load.

Calculating Energy, Demand, and Cost Savings; Examples / Guidelines

- Determine the air handler airflow correlation based on driving independent variables (e.g., outside air temperatures). Correlation can be estimated using design capacities and fan speed or power / current monitoring. Determine baseline and optimum economizer operation. Use bin data of outside air temperature or wet-bulb temperature to calculate savings using the difference between the baseline and optimum mixed air temperature/enthalpy, airflow, and estimated or measured cooling plant efficiency. Account for OA and RA damper leakage in the savings calculations (e.g., 5% leakage for older dampers with no seals, 1% leakage for newer dampers with blade and jamb seals).
- Note that other values beyond temperatures may need to be trended / measured for the savings calculations (e.g., chiller kW/ton, fan speeds).

Peak Demand Opportunity

- Opportunity for peak demand reduction very low unless economizer was observed in a failed-open position (Finding Type 5).

Preferred Data Collection Method

- Trend supply air temperature (SAT), mixed air temperature (MAT), outside air temperature (OAT), return air temperature (RAT), economizer damper command, and call for cooling

Other Allowable Method(s)

- Trend MAT, OAT, RAT, economizer damper command.
- For implementation verification, if OA is too high or too low to observe economizer operation, perform functional testing. Document observations.
- If OA dampers are non-functional and fully closed, document conditions with a photo at different operating conditions (e.g., different OA temps). For verification, perform trending / functional testing or provide screenshots.
- Provide screenshots of system performance during all relevant operating conditions. Visually verify that system performance matches commanded state, where applicable. Document observations.
- Trend economizer damper command signal and relevant independent variables (e.g., OAT and RAT), visually spot verify that damper moves to commanded position. Perform tests at multiple damper positions and multiple fan speeds (if a VAV system) to establish the relationship between damper position and outside air fraction. Document all observations.

Other Allowable Method(s) Low savings measures (<25,000kWh) Only

- Provide screenshots of controls sequences, if measure consists solely of modifying sequences.
- Provide relevant before / after photos.

b.2 (6)	Over-Ventilation
	Finding Examples
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
	Finding the Problem; Problem Identification Method(s)
	• Observation of integrity of components and sensors • Functional tests to observe actuation of dampers • Spot measurement of airflow. • Spot measurement or trending of CO2 levels. • Trending to observe dynamic performance and coil load.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines
	• Determine the baseline minimum outside air fraction at different outside air temperatures based on actual occupancy according to ASHRAE Standard 62. Determine optimum minimum outside air fraction and schedule. Use bin data of outside air temperature to calculate savings using the difference between the baseline and optimum mixed air temperature, airflow, and estimated or measured cooling plant efficiency. • Note that other values beyond temperatures may need to be trended / measured for the savings calculations (e.g., valve positions, fan speeds).
	Peak Demand Opportunity
	• Determine reduced cooling coil load due to reduced outside air during utility system peak.
	Preferred Data Collection Method
	• Trend mixed air temperature (MAT), outside air temperature (OAT), return air temperature (RAT), supply air temperature (SAT), economizer damper position, and any related independent variables (e.g., CO2 level).
	Other Allowable Method(s)
	• Perform functional testing to simulate system performance at different relevant independent variable values (e.g., OAT, CO2). Document observations. • For the baseline, if OA dampers are non-functional and fully closed, document conditions with a photo at different operating conditions (e.g., different OA temps). Then for verification, perform trending / functional testing or provide screenshots. • Provide screenshots of system performance during all relevant operating conditions. Visually spot verify that system performance matches commanded operation, where applicable. Document observations. • Trend economizer damper command signal and relevant independent variables (e.g., OAT, CO2), visually spot verify that damper moves to commanded position. Perform tests at multiple damper positions and multiple fan speeds (if a VAV system) to establish the relationship between damper position and outside air fraction. Document all observations
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only
	• Provide screenshots of controls sequences, if measure consists solely of modifying sequences. • Provide relevant before / after photos.

b.3 (7)	**OTHER Economizer/Outside Air Loads**	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	Finding Examples
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
	Finding the Problem; Problem Identification Method(s)
	• Trending to identify extent of problem. • For leaking valves, trend the air temperature difference across the coil or use functional test to determine leakage. All sensors must be calibrated relative to each other so that the temperature difference attributed to leaking valve is not a result of sensor error.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines
	• Quantify both the wasted heating energy and the wasted cooling energy. For gas heat, determine the load on the heating coil and use the boiler efficiency at part load to determine the wasted gas. The wasted cooling energy is equal to the excess heating energy. The cooling electrical energy is calculated using the cooling plant efficiency. • Note that other values beyond temperatures may need to be trended / measured for the savings calculations (e.g., chiller kW/ton). • For leaking HW valves, calculate reduced cooling coil load and subsequent reduced cooling plant demand. Note that there will not be any savings unless the system has sufficient capacity (and provides sufficient comfort) in the baseline situation, otherwise the increased capacity from elimination of the extra load will go toward comfort rather than demand savings.
	Peak Demand Opportunity
	• Opportunity for peak demand reduction depends on time of simultaneous heating and cooling.
	Preferred Data Collection Method
	• For electric heat, trend reheat power / current. For gas / hot water heat, trend hot water coil differential temperature. For both, trend call for cooling. • For pre-heat, trend air temperature before the preheat coil, after the preheat coil, and after the cooling coil. For leaking valves, trend air temperatures on both sides of the coil.
	Other Allowable Method(s)
	• Perform functional testing, including spot measurements. • Provide screenshots of system performance during all relevant operating conditions. Visually spot verify that system performance matches commanded state, where applicable. Document observations.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only
	• Provide screenshots of controls sequences, if measure consists solely of modifying sequences.

c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**	
	Finding Examples	
		• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
	Finding the Problem; Problem Identification Method(s)	
		• Compare sensor / thermostat readings to an independent calibrated standard (e.g., NOAA real-time weather data or calibrated hand held device).
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine the type of energy saving opportunity this problem would create, and calculate savings by comparing the demand and energy consumption of the system with the uncalibrated sensor to the system with the calibrated sensor.
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend sensor reading and independent calibrated reading of same parameter.
	Other Allowable Method(s)	
		• Perform spot measurements at multiple times of day and under various operating scenarios (as appropriate), to make certain that solar effects or flow variations don't cause errors in readings. Document observations / readings.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Provide screenshots showing measured temperatures, along with calibrated reading. • Provide relevant before / after photos.

c.3 (10)	Controls "hunt" and / or need Loop Tuning or separation of heating / cooling setpoints	
	Finding Examples	
		• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
	Finding the Problem; Problem Identification Method(s)	
		• Observation of existing control feedback loop strategies. Trend loop setpoint versus control feedback data inputs and affected equipment power / current and status.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine optimum control loop strategy. Calculate savings based on revised control scheme and effect on equipment.
	Peak Demand Opportunity	
		• May be opportunity for peak demand reduction if cycling is severe and affects large equipment.
	Preferred Data Collection Method	
		• Trend loop set-point, control feedback data inputs, and affected equipment power / current
	Other Allowable Method(s)	
		• Trend loop set-point, control feedback data inputs, and performance of affected equipment.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

c.4 (11)	OTHER Controls	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

d.1 (12)	Daylighting controls or occupancy sensors need optimization	
	Finding Examples	
		• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
	Finding the Problem; Problem Identification Method(s)	
		• Observations of existing daylighting system operation and/or printed controls logic.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine existing lighting operation. Develop load shapes for representative occupancy and ambient light levels. Determine revised operation and load shapes. Calculate savings based on load shapes and proposed operation. (kW savings * annual hours per day type).
	Peak Demand Opportunity	
		• Daylighting controls can reduce peak demand. Occupancy sensors may reduce peak demand if implemented in areas such as cafeterias.
	Preferred Data Collection Method	
		• Trend lighting control circuit for activation and sense occupancy in room
	Other Allowable Method(s)	
		• Please contact PBEEEP Project Engineer for approval
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Determine existing lighting operation. Develop load shapes for representative occupancy and ambient light levels. Determine revised operation and load shapes. Calculate savings based on load shapes and proposed operation. (kW savings * annual hours per day type).

d.2 (13)	Zone setpoint setup / setback are not implemented or are sub-optimal	
	Finding Examples	
		• The cooling setpoint is 74 ºF 24 hours per day
	Finding the Problem; Problem Identification Method(s)	
		• Observe zone temperature set points during each occupancy period, and optimum start/stop schedule.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Obtain information regarding the system on/off time, compared to the zone temperature set point deadband and outside air temperature. Develop a relationship between unit run time and outside air temperature. Calculate reduced unit operation and associated savings with "increased deadband" during setback/setup periods. • Note that other values beyond temperatures may need to be trended for the savings calculations (e.g., DAT, OAT, heating/cooling mode).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend zone temperature set points. Obtain and document zone temperature set point deadband.
	Other Allowable Method(s)	
		• Provide screenshots of zone temperatures, zone temperature setpoints, and HVAC system status during each system operating mode.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Provide screenshots of zone temperature setpoints during each system operating mode

d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**	
	Finding Examples	
		• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
	Finding the Problem; Problem Identification Method(s)	
		• Observe fan speeds during system operation. Note relevant system performance (e.g., duct static pressure, space static pressure, positions of VAV box dampers). Temporarily adjust variable (e.g., lower duct static pressure setpoint), observe system performance (e.g. confirm that boxes will not be starved).
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine the minimum static pressure setpoint possible to maintain design flow conditions. Empirically determine the relationship between static pressure and fan energy at existing setting and proposed setting. (As an option, RCx Provider may calculate additional heating and cooling plant savings due to reduced airflow.) • Airflow can be calculated using measured fan power, speed, and duct static pressure values, if no design drawings are present. • Note that other values beyond zone temperatures may need to be trended for the savings calculations (e.g., OAT).
	Peak Demand Opportunity	
		• May be opportunity for peak demand reduction if fan speeds are lowered significantly, even during on-peak conditions.
	Preferred Data Collection Method	
		• Trend relevant points (e.g., static pressure, static pressure setpoint, VAV box positions), and fan power / current. Submit results of any temporary overrides performed as part of system testing.
	Other Allowable Method(s)	
		• Provide screenshots of relevant points (e.g., static pressure setpoint) and fan speed. If setpoint is reset, provide screenshots at all relevant operating conditions. • Perform functional testing, including spot measurements.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

d.4 (15)	Pump Speed Doesn't Vary Sufficiently	
	Finding Examples	
		• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
	Finding the Problem; Problem Identification Method(s)	
		• Observe pump speeds during system operation. Note relevant system performance (e.g., differential pressure, positions of valves). Temporarily adjust variables (e.g., differential pressure setpoint), observe system performance (e.g., confirm that valves will not be starved).
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine the minimum differential pressure setpoint possible to maintain design flow conditions. Empirically determine the relationship between differential pressure and pump energy at existing setting and proposed setting. (As an option, RCx Provider may calculate additional heating and cooling plant savings due to reduced water flow • Note that other values beyond temperatures may need to be trended for the savings calculations (e.g., OAT).
	Peak Demand Opportunity	
		• May be opportunity for peak demand reduction if pump speeds are lowered significantly, even during on-peak conditions.
	Preferred Data Collection Method	
		• Trend relevant points (e.g., differential pressure, differential pressure setpoint), and pump power / current. Submit results of any temporary overrides performed as part of system testing. • For chiller plants with low ΔT, trend the primary and secondary pump flow, if available, or current and kW. Also trend primary and secondary supply and return temperatures.
	Other Allowable Method(s)	
		• Provide screenshots of relevant points (e.g., differential pressure setpoint) and pump speed. If setpoint is reset, provide screenshots at all relevant operating conditions. • Perform functional testing, including spot measurements.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary	
	Finding Example	
		• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
	Finding the Problem; Problem Identification Method(s)	
		• Observation of VAV box minimum airflow setpoints. • Observation of excessive reheat. • CO2 spot measurements
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine the existing VAV box minimum airflow setpoints. Calculate the optimized minimum setpoints according to ASHRAE Standard 62. Calculate reduced reheat at reduced minimum flow setpoint, and subsequent cooling and fan energy savings. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., fan speeds, chiller kW/ton, OAT).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend reheat power / current, valve position, or hot deck air flow, VAV terminal box airflow, and fan system performance. Spot measure CO2 levels in zones during non-economizer operation. Document observations.
	Other Allowable Method(s)	
		• Determine reheat at minimum VAV box flow through functional testing. Provide screenshots of VAV box and fan system performance at multiple operating conditions. Document observations.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

d.6 (17)	Other Controls (Setpoint Changes)	
	Finding Example	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	
	Finding Examples	
		• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
	Finding the Problem; Problem Identification Method(s)	
		• Observations and spot measurements of heating water supply and return temperatures.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine optimal reset temperature based on required system temperatures. Calculate reduced energy consumption of boiler with HW reset (energy savings from reduced piping and boiler shell heat loss due to cooler HWS / HWR temps), from engineering heat transfer calculations or data from functional tests. Account for potential increased pump usage (cooler HWS temps may require increased flow to deliver same amount of heating). • Engineering calculations: estimate piping length and amount of insulation to calculate heat transfer from piping. • Functional test: with no heating load (heating control valves in 100% bypass), trend / measure HWR temps at various HWS temps to determine piping and boiler shell heat loss. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., pump speeds).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend heating water supply and return temperatures and temperature setpoints, and whatever parameter the reset is or will be based upon (such as outside air temperature and/or heating water valve positions). Also perform functional testing if independent variables at the time of trending don't cover the range covered by the reset.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	
	Finding Examples	
		• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
	Finding the Problem; Problem Identification Method(s)	
		• Observations and spot measurements of chilled water supply and return temps.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine optimal reset temperature based on required system temperatures. Calculate reduced energy consumption of chiller plant at reset CHW temperature, and subsequent increase / decrease in fan and pump energy. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., fan and pump speeds).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend chilled water supply and return temperatures and temperature setpoints, and whatever parameter the reset is or will be based upon (e.g., OAT, valve positions). Also perform functional testing if independent variables at the time of trending don't cover the range covered by the reset.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**	
	Finding Examples	
		• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
	Finding the Problem; Problem Identification Method(s)	
		• Observations that interior loads do not dominate heating and cooling needs year round and that reset does not exist or is not optimized.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine energy savings from cooling plant and reduced reheat at zone level, and potential fan energy penalty due to increased airflow at warmer supply air temperatures. • Airflow can be calculated using design fan flow and trended fan speeds. Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., fan speeds).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend supply air temperature and temperature setpoint, and whatever parameter the reset is or will be based upon (e.g., OAT, space temperature offset). Also perform functional testing if independent variables at the time of trending don't cover the range covered by the reset.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is suboptimal	
	Finding Examples	
		• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
	Finding the Problem; Problem Identification Method(s)	
		• Reset does not exist or is not optimized.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine energy savings from reducing the fan power during low zone demand. • Duct Static Pressure Setpoints and fan power can be determined by functional performance testing. Savings calculations would be based on the proposed pressure reset and trended demand or OAT, whichever is being used for basis of the reset. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g. VAV Box damper position)
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction is very low.
	Preferred Data Collection Method	
		• Trend supply fan speed, DSP and DSP setpoint, and whatever parameter the reset is or will be based upon (e.g. OAT, VAV box damper position). Also perform functional testing if independent variables at the time of trending that don't cover the range covered by the reset.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal	
	Finding Examples	
		• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
	Finding the Problem; Problem Identification Method(s)	
		• Observations and spot measurements of condenser water supply and return temps.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine optimal reset temperature based on required system temperatures, and chiller temperature requirements. Calculate reduced energy consumption of chiller plant due to improved efficiency at lower condenser water temperatures, and subsequent increase in cooling tower fan energy. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., chiller kW/ton).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend condenser water supply temperature and temperature setpoint, and whatever parameter the reset is based upon (e.g., outside air wet bulb temperature). Also perform functional testing if independent variables at the time of trending don't cover the range covered by the reset.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

e.6 (22)	**Other Controls (Reset Schedules)**	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

f.1 (23)	Lighting system needs optimization - Spaces are overlit	
	Finding Examples	
		• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
	Finding the Problem; Problem Identification Method(s)	
		• Measurement of lighting levels.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine power density of existing and reduced light levels. Determine existing schedules. Develop load shapes for representative day types. Calculate savings based on reduced lighting power density, load shapes and day types.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend lighting status, power / current, occupancy, and lighting levels in each space.
	Other Allowable Method(s)	
		• Functionally test daylighting system. Note locations of sensors and lighting zones. Document observations / results.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

f.2 (24)	**Pump Discharge Throttled**	
	Finding Examples	
		• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
	Finding the Problem; Problem Identification Method(s)	
		• Observations of valve position at pump discharge.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use pump curves to determine pump motor savings due to reduced pump head pressure, assuming the valve at the discharge of the pump wide open and pump impeller trimmed. Estimate annual hours of operation and calculate potential savings.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Measure pump power / current and differential pressures at different operating modes (as-found, dead head, wide open, etc.). • For verification, if measure consisted of an impeller trim, redo deadhead test to verify new impeller size and note final balanced position of discharge valve. If measure consisted of adding a VFD, see Finding Type 23.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

f.3 (25)	Over-Pumping	
	Finding Examples	
		• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
	Finding the Problem; Problem Identification Method(s)	
		• Observation of pump mismatched to equipment served, or observation of low ΔT across a chiller or in a piping loop serving heat transfer equipment
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use pump curve to determine reduced pump power at reduced speed. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., chiller operation).
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend pump motor power / current. For variable volume systems, also trend water flow. For constant volume systems, spot measure water flow or pump differential pressure.
	Other Allowable Method(s)	
		• Trend pump speed. For variable volume systems, also trend water flow. For constant volume systems, spot measure water flow or pump differential pressure during all relevant operating conditions. • Perform functional testing, including spot measurements, at all relevant operating conditions. • For constant volume systems, submit screenshots of system performance and spot measure pump differential pressure during all relevant operating conditions.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Provide screenshots of controls sequences.

f.4 (26)	Equipment is oversized for load	
	Finding Examples	
		• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity
	Finding the Problem; Problem Identification Method(s)	
		• Observation that equipment cycles unnecessarily, or other signs that the equipment is mismatched to the load it is serving.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use change in existing (trended baseline) and proposed part-load performance to properly calculate equipment usage at a given load. Estimate annual hours at different loads based on trended baseline, and compare existing and proposed energy use.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend equipment current and pertinent variables that define equipment load and run-time.
	Other Allowable Method(s)	
		• NA
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

g.1 (28)	VFD Retrofit Fans	
	Finding Examples	
		• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
	Finding the Problem; Problem Identification Method(s)	
		• Observation that airflow varies, but adding a VFD could result in energy savings
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use power / current as a surrogate measurement of motor load. Compare existing fan curve to VFD fan curve to estimate annual energy savings. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., temperatures, cooling load).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend motor power / current and any other relevant independent variables (e.g., OAT, IGV position). For verification phase, trend fan speed and other relevant independent variables.
	Other Allowable Method(s)	
		• For baseline, spot measure fan motor power / current. Note system performance, document observations. • For verification, submit photo of installed VFD. Submit screenshots of system performance, showing speed of VFD. • Perform functional testing, including spot measurements where necessary, to simulate system performance. • Align with utility requirements for retrofits
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

g.2 (29)	VFD Retrofit - Pumps	
	Finding Examples	
		• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
	Finding the Problem; Problem Identification Method(s)	
		• Pump serves variable flow system, but does not have a VFD. • Observation that there is an opportunity to change 3-way valves to 2-way valves. Usually applicable to secondary loops
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Trend temperature differential and spot measure flow to determine existing load. Compare existing load shape to VFD pump curve to estimate annual energy savings. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., temperatures, cooling load).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend motor power / current and any other relevant independent variables (e.g., OAT, temperature differential). For verification phase, trend pump speed and other relevant independent variables.
	Other Allowable Method(s)	
		• For baseline, spot measure pump motor power / current. Note system performance, document observations. • For verification, submit photo of installed VFD. Submit screenshots of system performance, showing speed of VFD. • Perform functional testing, including spot measurements where necessary, to simulate system performance. • Align with utility requirements for retrofits
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

g.3 (30)	VFD Retrofit - Motors (process)	
	Finding Examples	
		• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
	Finding the Problem; Problem Identification Method(s)	
		• Observe that load varies. Monitor current on motor to determine existing load shapes. Application is for systems with variable-flow present (without VFD control).
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use current as a surrogate measurement of motor load. Compare existing motor usage to proposed energy usage.
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low.
	Preferred Data Collection Method	
		• Trend motor power / current and pertinent variables to define load
	Other Allowable Method(s)	
		• Spot measure motor power / current at various motor speeds. • Perform functional testing, including spot measurements where necessary, to simulate system performance. • Align with utility requirements for retrofits
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

g.4 (31)	OTHER VFD	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

h.1 (32)	**Retrofit - Motors**	
	Finding Examples	
		• Efficiency of installed motor is much lower than efficiency of currently available motors
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use current as a surrogate measurement of motor load. Compare existing motor efficiency to proposed motor efficiency. Input data into the Department of Energy's MotorMaster+ Software. Supply output as supporting documentation.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend motor power / current. Submit photo and invoice of new motor.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.2 (33)	Retrofit - Chillers	
	Finding Examples	
		• Efficiency of installed chiller is much lower than efficiency of currently available chillers
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use ambient air temperature as a surrogate measurement of cooling load. Compare existing chiller efficiency to proposed chiller efficiency.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend chiller power / current, chiller load, and ambient air temperature. Submit photo and invoice of new chiller.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)	
	Finding Examples	
		• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use temperatures to determine cooling load. Compare existing unit efficiency to proposed unit efficiency.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend unit power / current and ambient air temperature. Submit photo and invoice of new air conditioner.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.4 (35)	Retrofit - Boilers	
	Finding Examples	
		• Efficiency of installed boiler is much lower than efficiency of currently available boilers
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use ambient air temperature as a surrogate measurement of heating load. If appropriate, check annual load with a curve-fit of gas use (from bills) vs. heating degree days. Compare existing boiler efficiency to proposed boiler efficiency.
	Peak Demand Opportunity	
		• NA
	Preferred Data Collection Method	
		• Trend ambient air temperature and return and supply water temperature. Include flow if available. Submit photo and invoice of new boiler
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.5 (36)	**Retrofit - Packaged Gas-fired heating**	
	Finding Examples	
		• Efficiency of installed heaters is much lower than efficiency of currently available heaters
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use temperatures to determine heating load. If appropriate, check annual load with a curve-fit of gas use (from bills) vs. heating degree days. Compare existing unit efficiency to proposed unit efficiency.
	Peak Demand Opportunity	
		• NA
	Preferred Data Collection Method	
		• Trend ambient air temperature, supply air temperature, return air temperature and economizer operation. Submit photo and invoice of new heater.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.6 (37)	Retrofit - Heat Pumps	
	Finding Examples	
		• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use temperatures to determine heating and cooling load. Compare existing unit efficiency to proposed unit efficiency.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend compressor power / current and ambient air temperature. Submit photo and invoice of installed heat pump
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.7 (38)	Retrofit - Equipment (custom)	
	Finding Examples	
		• Efficiency of installed equipment is much lower than efficiency of currently available equipment
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use temperatures to determine heating and cooling load. Compare existing unit efficiency to proposed unit efficiency.
	Peak Demand Opportunity	
		• The opportunity for peak demand savings varies by improvement. If the equipment efficiency improves during peak load conditions there is good opportunity for demand savings
	Preferred Data Collection Method	
		• Trend equipment power / gas consumption and heating / cooling load. Submit photo and invoice of installed equipment.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.8 (39)	**Retrofit - Pumping distribution method**	
	Finding Examples	
		• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that pump distribution configuration can be improved.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use the current at varying operating conditions to develop a load profile, taking into consideration tradeoffs between loop temperatures and pump energy. Use this profile to determine the existing and proposed system energy use.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings
	Preferred Data Collection Method	
		• Trend motor power / current, pump flow or differential pressure. Trend loop supply and return water temperatures for all pumps in the distribution loop. Submit photo and invoice of any installed equipment
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.9 (40)	Retrofit - Energy / Heat Recovery	
	Finding Examples	
		• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
	Finding the Problem; Problem Identification Method(s)	
		• Visual observation
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use temperatures to determine heating and cooling load. Calculate amount of sensible or sensible and latent heat recovered based on flow and psychrometrics of return air against flow and psychrometrics of the outside air. Compare existing unit effectiveness to proposed unit effectiveness.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend unit power / current and ambient air temperature. Also measure supply air and return air temperature or document economizer operation. Submit photo and invoice of installed equipment.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.10 (41)	**Retrofit - System (custom)**	
	Finding Examples	
		• Efficiency of installed system is much lower than efficiency of another type of system
	Finding the Problem; Problem Identification Method(s)	
		• Observation through visual inspection or trend analysis that equipment is not operating efficiently.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Use temperatures to determine heating and cooling load. Compare existing and proposed system energy use.
	Peak Demand Opportunity	
		• The opportunity for peak demand savings varies by improvement. If the equipment efficiency improves during peak load conditions there is good opportunity for demand savings.
	Preferred Data Collection Method	
		• Trend equipment demand, status or energy consumption and heating / cooling load. Submit photo and invoice of installed system / equipment.
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.11 (42)	Retrofit - Efficient lighting	
	Finding Examples	
		• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.
	Finding the Problem; Problem Identification Method(s)	
		• Visual inspection of the current lighting system
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine existing lighting operation; develop load shapes for representative occupancy and current light levels. Determine revised operation and load shapes. Calculate savings based on load shapes and proposed operation. (kW savings * annual hours per day type).
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings.
	Preferred Data Collection Method	
		• Trend demand, status or energy consumption and lighting levels in each space. Submit photo and invoice of installed lighting
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.12 (43)	**Retrofit - Building Envelope**	
	Finding Examples	
		• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
	Finding the Problem; Problem Identification Method(s)	
		• Observation of installed components • Inspection of design documents • Whole-building pressurization testing • Troubleshoot from building symptoms (e.g. heating/cooling loads are not met)
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine existing building level load profile through trending or consumption data. Model or calculate revised operation and load profile with the building envelope retrofit. Calculate the savings based on the differences between the load profiles.
	Peak Demand Opportunity	
		• Good opportunity for peak demand savings
	Preferred Data Collection Method	
		• Photos of current system configuration. • Energy analysis pre / post retrofit using at least 12 months of data for baseline
	Other Allowable Method(s)	
		• Align with utility requirements for retrofits; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• NA

h.13 (44)	**Retrofit - Alternative Energy**	
	Finding Examples	
		• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
	Finding the Problem; Problem Identification Method(s)	
		• Potential opportunities identified through inspection of building energy systems
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine existing building level load profile through trending or consumption data. Model or calculate revised operation and load profile with the selected alternative energy retrofit. Calculate the effective utility savings based on the differences between the load profiles.
	Peak Demand Opportunity	
		• The peak demand reduction observed by the utility might be significant; however, the building level demand will likely not be affected.
	Preferred Data Collection Method	
		• For baseline: Energy analysis of the past 12-36 months of utility interval or billing data. • For verification: trend energy output of new installation
	Other Allowable Method(s)	
		• Align with state and utility requirements for qualifying alternative energy measures; include photos, invoices, and follow-up trending where applicable.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

h.14 (45)	**OTHER Retrofit**	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

i.1 (46)	Differed Maintenance from Recommended/Standard	
	Finding Examples	
		• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
	Finding the Problem; Problem Identification Method(s)	
		• Problem identification will be dependent on differed maintenance type. Typically identified as a result of in-depth investigation of individual equipment and sub-systems.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Calculation will depend on type of differed maintenance. Please contact PBEEEP engineer for information on approved calculation method.
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

i.2 (47)	Impurity/Contamination	
	Finding Examples	
		• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
	Finding the Problem; Problem Identification Method(s)	
		• Dependant on impurity/contamination. Chemical analysis of fluid systems may be performed. Results of analysis submitted for proof of problem.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Dependant on impurity/contamination. Consult with PBEEEP engineer
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

i.3 ( )	**Leaky/Stuck Damper**	
	Finding Examples	
		• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
	Finding the Problem; Problem Identification Method(s)	
		• Comparing temperature before and after dampers at different operating conditions.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
		• Determine the air handler airflow correlation based on driving independent variables (e.g., outside air temperatures). Correlation can be estimated using design capacities and fan speed or power / current monitoring. Determine baseline and optimum damper operation. Use bin data of outside air temperature or wet-bulb temperature to calculate savings using the difference between the baseline and optimum mixed air temperature/enthalpy, airflow, and estimated or measured cooling plant efficiency. Account for OA and RA damper leakage in the savings calculations (e.g., 5% leakage for older dampers with no seals, 1% leakage for newer dampers with blade and jamb seals). • Note that other values beyond temperatures may need to be trended / measured for the savings calculations (e.g., chiller kW/ton, fan speeds).
	Peak Demand Opportunity	
		• Opportunity for peak demand reduction very low unless damper was observed in a failed-open position.
	Preferred Data Collection Method	
		• Trend RAT, MAT, DAT, OAT, Fan Status(es), Fan Speed(s), Damper Positions, and Coil Valve Positions.
	Other Allowable Method(s)	
		• Functional performance testing the AHU and dampers to determine airflow across damper at different operating conditions.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	
		• Functional performance testing the AHU and dampers and verifying temperature readings on both sides of dampers.

i.4 ( )	**Leaky/Stuck Valve**
	Finding Examples
	• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
	Finding the Problem; Problem Identification Method(s)
	• Comparing temperature before and after coils at different operating conditions.
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines
	• Quantify both the wasted heating energy and the wasted cooling energy. For gas heat, determine the load on the heating coil and use the boiler efficiency at part load to determine the wasted gas. The wasted cooling energy is equal to the excess heating energy. The cooling electrical energy is calculated using the cooling plant efficiency. • Note that other values beyond temperatures may need to be trended / measured for the savings calculations (e.g., chiller kW/ton). • For leaking HW valves, calculate reduced cooling coil load and subsequent reduced cooling plant demand. Note that there will not be any savings unless the system has sufficient capacity (and provides sufficient comfort) in the baseline situation, otherwise the increased capacity from elimination of the extra load will go toward comfort rather than demand savings.
	Peak Demand Opportunity
	• Opportunity for peak demand reduction depends on time of simultaneous heating and cooling if present. • An open heating coil valve will add to the cooling load in the building and it is a good opportunity for peak demand reduction, but only if the boiler and heating water loop is running.
	Preferred Data Collection Method
	• Trend MAT, DAT, OAT, Fan Status(es), Fan Speed(s), Damper Positions, and Coil Valve Positions. • Note that other values beyond those mentioned above may need to be trended for the savings calculations (e.g., fan and pump speeds).
	Other Allowable Method(s)
	• Functional performance testing the AHU and coils and verifying temperature readings across coils.
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only
	• Functional performance testing the AHU and coils and verifying temperature readings across coils.

i.5 (48)	**OTHER Maintenance**	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	

j.1 (49)	OTHER	
	Finding Examples	
		• Please contact PBEEEP Project Engineer for approval
	Finding the Problem; Problem Identification Method(s)	
	Calculating Energy, Demand, and Cost Savings; Examples / Guidelines	
	Peak Demand Opportunity	
	Preferred Data Collection Method	
	Other Allowable Method(s)	
	Other Allowable Method(s) Low savings measures (<25,000kWh) Only	