



Building Tune-up Program Manual

for

Participants

July 1, 2012
Version 2.0

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1.1 PROGRAM OVERVIEW

Most buildings have never gone through a formal, systematic commissioning or quality assurance process, and are likely performing below their potential. Efficient operation of existing major building systems presents a significant opportunity for energy and demand savings, usually with little or no capital investment. Recommissioning or retrocommissioning¹ is a “building tune-up” that not only identifies problems due to system operation deficiencies or design flaws that occurred during construction, just as traditional commissioning of a new building does, but it also identifies and recommends solutions to problems that have developed during the building’s existence. Retrocommissioning seeks to assist with equipment and system functionality, and optimizing their integrated operation to reduce energy waste and improve building performance and occupant comfort.

One of the primary objectives of Platte River Power Authority (Platte River), and its owner municipalities (Utility) of Estes Park, Fort Collins, Longmont, and Loveland (see Appendix M for service area map), energy efficiency portfolio is to offer our Customers every opportunity to help manage their energy expenses. Platte River’s suite of available program initiatives provides rebates for many energy efficient technologies and products available in today’s market. The *Building Tune-up Program* is uniquely suited to fit within Platte River’s existing rebate programs by offering energy analysis services to identify low-cost and no-cost energy and water efficiency measures through Retrocommissioning (RCx). In addition to being the electric utility, Utilities are also the water utility for most facilities in their electric service territory. Each municipality may have additional water efficiency rebates for Retro-Commissioning Measures (RCMs) identified in the RCx project that target water savings.

The *Building Tune-up Program* is an energy efficiency offering that provides Customers with expert building analysis and RCx services at a discount for services defined in this manual to help lower Customers’ energy and water costs by optimizing a facility’s energy using systems. Platte River’s *Building Tune-up Program* does not provide detailed engineering support or rebates for capital equipment measures – rebates for these types of measures may be available under other Platte River energy efficiency programs. Savings are realized through the systematic evaluation of facility systems and Customer’s implementation of cost-effective measures targeted to improve facility operation that, in many cases, also improve occupant comfort and production efficiency. The focus of the *Building Tune-up Program* is no- and low-cost RCx Measures (RCMs) that save energy and water.

Because of the variation in the types of systems in different types and sizes of buildings, the *Building Tune-up Program* offers three participant options to accommodate many types of buildings, which are described below:

- **Tier I – Direct Implementation:** designed to improve energy and water efficiency for simple building systems in commercial buildings. These simple systems are normally found in smaller to medium sized buildings less than 50,000 square feet (sq ft), but can be found in larger buildings as well. These building systems typically last 15 to 25 years with periodic preventative maintenance designed to keep the systems running, not necessarily in an efficient manner. The Tier I Option uses a direct implementation, prescriptive approach to enhance the performance of the building energy and water systems, allowing them to operate at their highest efficiency while maintaining occupant comfort and potentially extending the life of the building equipment. The Tier I Option also offers free technical services and minimizes the upfront studies, reporting, and paperwork usually associated with large building tune-up projects, instead focusing the majority of the costs on implementation (of those costs, 75% will be covered by the program). This option combines the Planning and Implementation/Investigation Phases (Phases defined below) into one comprehensive step. The program provides a rebate up to \$0.15 per sq ft of building and Customer must commit to \$0.05 per sq ft up to \$12,000 for implementation services.

¹ Recommissioning by definition is the commissioning of a building that has been previously commissioned in its life, Retrocommissioning by definition is the commissioning of a building that has NOT previously been commissioned. For purposes of the Platte River *Building Tune-up Program* documents, the term retrocommissioning will be used for both recommissioning and retrocommissioning.

- **Tier 2 – RCx Study and Implementation Support:** designed as a hybrid of the Tier 1 and Tier 3 Options to include a flexible, no-cost tune-up analysis of simple or complex systems likely found in, but not limited to, medium-sized buildings. This Option mimics Tier 3 but is reduced in scale and scope as the buildings are typically around 50,000 to 100,000 sq ft and allow for direct implementation of common, pre-defined measures for commercial buildings. This approach strikes a balance between the reporting and the field data collection and analysis associated with the Tier 1 and 3 Options. This option will include the Planning Phase, and then move into the Implementation Phase (either immediately or later) based on the planning survey results, with oversight provided by the Retro-commissioning Service Provider (RSP). Customer must commit to \$0.05 per sq ft up to \$12,000 for implementation services.
- **Tier 3- RCx Study, Implementation Support, and Verification:** offers a typical RCx four-phase approach (Application, Planning, Investigation/Implementation, Verification) to customers with facilities that have sophisticated, energy and water intensive building and control systems, usually (but not always) found in facilities of 100,000 sq ft or greater. The tune-up analysis will be a no-cost service, fully funded for the qualified customers. Qualified participants are expected to cover the costs associated with implementing the measures recommended by the tune-up analysis, attend meetings, and assist trade allies in acquiring facility information. Program participants are commercial and industrial facility owners who have demonstrated a commitment to spend \$0.05 per sq ft up to \$12,000 to implement identified retrocommissioning (RCx) measures with an estimated total project simple payback of two years or less based upon total energy savings. It should be noted that even though this rebate program is focused on electricity and water, Customers who are in Xcel Energy's gas service territory may also be considered for a gas savings rebate through Xcel's RCx program.

1.2 CONTACT INFORMATION

Platte River is the program administrator for Building Tune-up Program. Questions about the program can be directed to Platte River via:

- Website
 - <http://www.prpa.org/business/tuneup.htm>
- Telephone
 - Customer information: (970) 226-4000
- Fax
 - (970) 229-5244
- Email
 - Retrocommissioning Service Provider inquiries: tuneup@prpa.org
 - Customer inquiries: tuneup@prpa.org
- Mail
 - Platte River Power Authority
Building Tune-up Program
2000 E. Horsetooth Rd.
Fort Collins, CO 80525

1.3 MANUAL USE AND ORGANIZATION

This manual provides specific information about the program and the roles and responsibilities of participants in Platte River's *Building Tune-up Program* offering and is organized as follows:

- Section 2 Eligibility Requirements

- Section 3 Tier 1 Buildings – Target Buildings, Rebate Structure, Participation Process and Phases
- Section 4 Tier 2 Buildings – Target Buildings, Rebate Structure, Participation Process and Phases
- Section 5 Tier 3 Buildings – Target Buildings, Rebate Structure, Participation Process, and Phases
- Appendix A – BTU Project Application and Agreement
- Appendix B – BTU Project Plan Approval (including Customer Selection Form)
- Appendix C – BTU Work Order for Tier I
- Appendix D – BTU Report for Tier I
- Appendix E – RTU and OA Airflow Protocol
- Appendix F – Split System Protocol
- Appendix G – Building Site Assessment Form for Tier 2 and 3
- Appendix H – RCx Plan Template for Tier 2 and 3
- Appendix I – RCx Diagnostic and Calculation Plan for Tier 3
- Appendix J – RCx Verification Template for Tier 3
- Appendix K – Sample Electricity Utility Bill Figures
- Appendix L – Platte River and Owner Municipality Efficiency Programs
- Appendix M – Utilities’ Service Territory
- Appendix N – De-lamping Guide
- Appendix O – Computer Power Management Protocol

Section 2

Eligibility Requirements

To participate in Building Tune-up Program, Customers must purchase electricity from one of the four Utilities of Platte River (Town of Estes Park Light & Power Department, Fort Collins Utilities, Longmont Power & Communications, and Loveland Water and Power) on an eligible non-residential retail electric rate schedule. Table 2-1 lists eligible Customer price plans.

Table 2-1 Eligible Rate Schedules for Building Tune-up Program

Utility	Town of Estes Park Light & Power	Fort Collins Utilities	Longmont Power & Communications	Loveland Water and Power
ELIGIBLE RATE SCHEDULES	Large Commercial	E400 Series	CCD	Loveland – PS
	Small Commercial	E300 Series	CC	Loveland – LG
	Municipal	E250 Series	CD	Loveland – SG
		E200 Series	CE	
			GFE (municipal energy)	
			GFD (municipal demand)	

Customers can verify their rate schedule by looking on a recent bill. Appendix J shows where to find the rate schedule and account number on a typical Customer electric bill for Town of Estes Park, Fort Collins, Longmont, and Loveland. Customers with questions regarding their account should contact their utility Account Manager.

For the purposes of Platte River’s energy efficiency programs, a Customer is defined as a company or organization that receives electric service from one of the Utilities of Platte River: Town of Estes Park Light & Power Department, Fort Collins Utilities, Longmont Power & Communications, and Loveland Water and Power under an approved rate schedule. A Customer is a holder of a single account, multiple accounts in aggregate or corporate accounts. Multiple accounts or corporate accounts with a single Customer identification number will be considered a single Customer. An organization of this type can participate in multiple efficiency programs, but will be subject to any applicable Customer rebate caps.

The delivery of Program services follows a Phase schedule (detailed below) that scales in scope based on the Tier that eligible participants fall into. Table 2-2 represents an overview of each activity per phase, and its applicability per Tier; more detailed Phase explanations follow in subsequent sections.

Table 2-2: Tier Applicability per Phase

Phases	Tier 1	Tier 2	Tier 3
Application Phase (No Cost to Customer)			
Buildings <50,000 sq ft of conditioned space	✓		
Buildings with >50,000 sq ft , but <100,000 sq ft of conditioned square feet		✓	
Buildings >100,000 sq ft of conditioned space; including industrial processes;			✓
Building owner must authorize work to be performed if applicant is not the owner of the building,	✓	✓	✓
Free of major problems requiring costly repairs or replacements, with no planned major system renovations or retrofits	✓	✓	✓
Building must have a functioning BAS with trending/storage capabilities or ability to substitute this function with data logging equipment (if approved by Platte River)		✓	✓
System receives periodic preventative maintenance (e.g., filter replacement, coil cleaning, refrigerant charge, and belt tension checks) and demonstrates general	✓	✓	✓
Provide facility access, personnel time to meet with RSP	✓	✓	✓
Provide and assist with the reporting and collection of information		✓	✓
Application is submitted to Platte River with signed agreement	✓	✓	✓
Planning Phase (No Cost to Customer)			
Fully funded technical services	✓	✓	✓
Must be performed by a qualified RSP	✓	✓	✓
RSP conducts a technical review, building and system conditions are further gauged, potential tune-up opportunities evaluated		✓	✓
RCx Plan Report is developed for presentation to customer and inputted into BTU Plan Approval Form of the application (Page 4 – Addendum #1)	✓	✓	✓
BTU Work Order is completed for presentation to customer and inputted into BTU Plan Approval Form of the application (Page 4 – Addendum #1)	✓		
BTU Plan Approval Form including the Customer Selection Form are submitted to customer for review and approval of RCMs for implementation	✓	✓	✓
Commitment to fund at least \$0.05 per sq ft (up to \$12,000), based on building size in the tune-up measures, with an estimated total project simple payback of two years or	✓	✓	✓
Investigation / Implementation Phase			
Immediate implementation and completion of selected measure tabs in BTU Application. BTU Work Order is adjusted based on actual implementation of the	✓		
Vendor quotes or staff work load estimates obtained, if applicable		✓	✓
Field data collection and functional testing			✓
Activities minimized to focus on implementation		✓	
Facility staff or vendor and RSP engaged to help facilitate the tune-up activities		✓	✓
Tune-up testing of the systems completed, incorporating measured and verified data, estimating the potential energy savings for identified measures using custom calculators, and documenting the work			✓
Diagnostic and Calculation (D&C) plans developed; measures implemented after they are identified and/or summarized in the D&C plans			✓

Verification Phase and completion of project (No Cost to Customer)			
Verification sampling of entire building group (i.e., not all buildings get M&V), pre- and post-monitoring after the measures have been implemented	✓		
RSP, staff, and vendor (if applicable) revisits the site to verify that the measures have been		✓	✓
Final BTU Report is completed and submitted to customer (located in BTU Application) –	✓		
Updated RCx Plan submitted to customer for review and approval		✓	
Verification report submitted to customer for review and approval			✓
RSP conducts a technical review of all verification reports		✓	✓

Eligible Customers include existing facilities that are:

1. Planning no major renovation or large capital investments for the facility shall be pending, and owner/O&M staff shall express a commitment for active involvement in the process.
2. Considered to have energy and water savings opportunities and measures that result in less than two year simple payback.

Platte River retains the right to make final determination of Customer eligibility and which Tier is most applicable to the building.

The facility owner and O&M staff must express a commitment to be actively involved in the RCx process. Active involvement will include:

- Providing access to the facility.
- Providing time for facility personnel to interface with the Retro-commissioning Service Provider (RSP).
- Providing and assisting with the reporting and collection of information pertaining to the RCx of the facility.
- A commitment to spend at least: \$0.05 per sq ft up to \$12,000.

Program Dates

Building Tune-up Program became effective on April 1, 2010 and is on-going. RCx rebates are not eligible for prior Customer-funded RCx activities or without necessary pre-approvals.

2.1 REBATE AVAILABILITY

Customer Applications to participate in *Building Tune-up Program* will be reviewed on a first-come, first-served basis until all rebate funding has been committed. Current availability of rebate funds can be checked by contacting Platte River or your Utility.

2.2 PARTNERSHIP WITH XCEL ENERGY (TIER 3 ONLY)

Platte River's Building Tune-up Program is partnering with Xcel Energy's RCx program in order to maximize program benefits. Xcel Energy offers rebates for both RCx studies and for gas measures implemented during a RCx project. Xcel Gas Customers that participate in the program will be required to submit applications to Xcel Energy's RCx program and should follow Xcel's requirements for submitting and obtaining the RCx rebate. Platte River will work with Xcel RCx rebate to supplement the total cost of the RCx Study. For example, if the cost of the RCx is \$20,000 and Xcel's rebate for the gas portion is \$2,000, Platte River will supplement the remaining \$18,000 for the cost of the study. Any rebates obtained from Xcel for implementation of gas saving measures will not be factored in Platte River's program, and will be handled directly through Xcel Energy.

The following section describes the targeted buildings, rebate structure and phases associated with the Tier I Buildings.

3.1 TARGETED BUILDINGS

The following typical characteristics are associated with the Tier I buildings:

- Conditioned floor area: up to 49,999 sq ft
- HVAC equipment shall be between 2-20 years old and must not be at the end of their useful life
- Typically single zone thermostats – manual or programmable
- Single zone packaged equipment or split systems
- Other systems targeted: water fixtures, PCs, Domestic Hot Water, lighting and plug load controls, custom measures.
- **Example of other unique circumstances that may target a building for this tier:**
 - Building is a 60,000+ square foot building conditioned only with Roof Top Units (RTU's) with economizers and single zone thermostats.
 - Building is 30,000 sq ft and is conditioned by two constant or variable volumes, built up, air handling units with DX cooling, economizers, and terminal units. Building may have single zone thermostats (or sensors and central control) per terminal unit with no trending capability and/or front end customer access.

3.2 REBATE STRUCTURE

In this option, services are performed exclusively by qualified RSP that specialize in services that are offered through the Tier I Option. To encourage participation of small buildings in the Tier I Option, Platte River and its Utilities offer 75% of the measure implementation cost as a rebate. Once Platte River screens a facility for the Tier I Option, the customer will select and schedule the RSP to perform the Tier I RCx services. The RSP will submit the final paperwork to Platte River on behalf of the customer for the rebate equal to 75% of the cost of the services performed, or \$0.15/sq ft. If the customer chooses, Platte River will pay the rebate directly to the RSP and the RSP will invoice the remainder to the customer; which is \$0.05/sq ft. Platte River will send the rebate check directly to the contractor (or the authorized third party) within 4-6 weeks of the receipt of the contractor invoice. If tune-up costs exceed this amount, written approval is required by Platte River and the participant and the participant agrees to pay the additional cost. Work is performed by the qualified RSP with some engineering support available by Platte River.

The customer will have to complete and show clear documentation (like invoice, maintenance log sheet, building maintenance records, etc.) of preventative maintenance before tasks pertaining to the Tier I Option can be implemented. If Platte River or the selected RSP discover that preventative maintenance has not been performed according to the evidence provided or condition of the equipment, the services will cease, and the participant will be responsible for a \$200 charge to cover the contractor's time for the assessment.

The customer may pursue additional measures that are identified during the Retrocommissioning process and will be responsible for the costs of these measures that exceed the \$0.15 per sq ft rebate offered by Platte River. Other identified energy and water efficiency measures may qualify for rebates through other Platte River or the service area Municipality rebate programs.

3.3 PARTICIPATION PROCESS

The Tier I Option participation process is outlined in Figure 3-1 below.

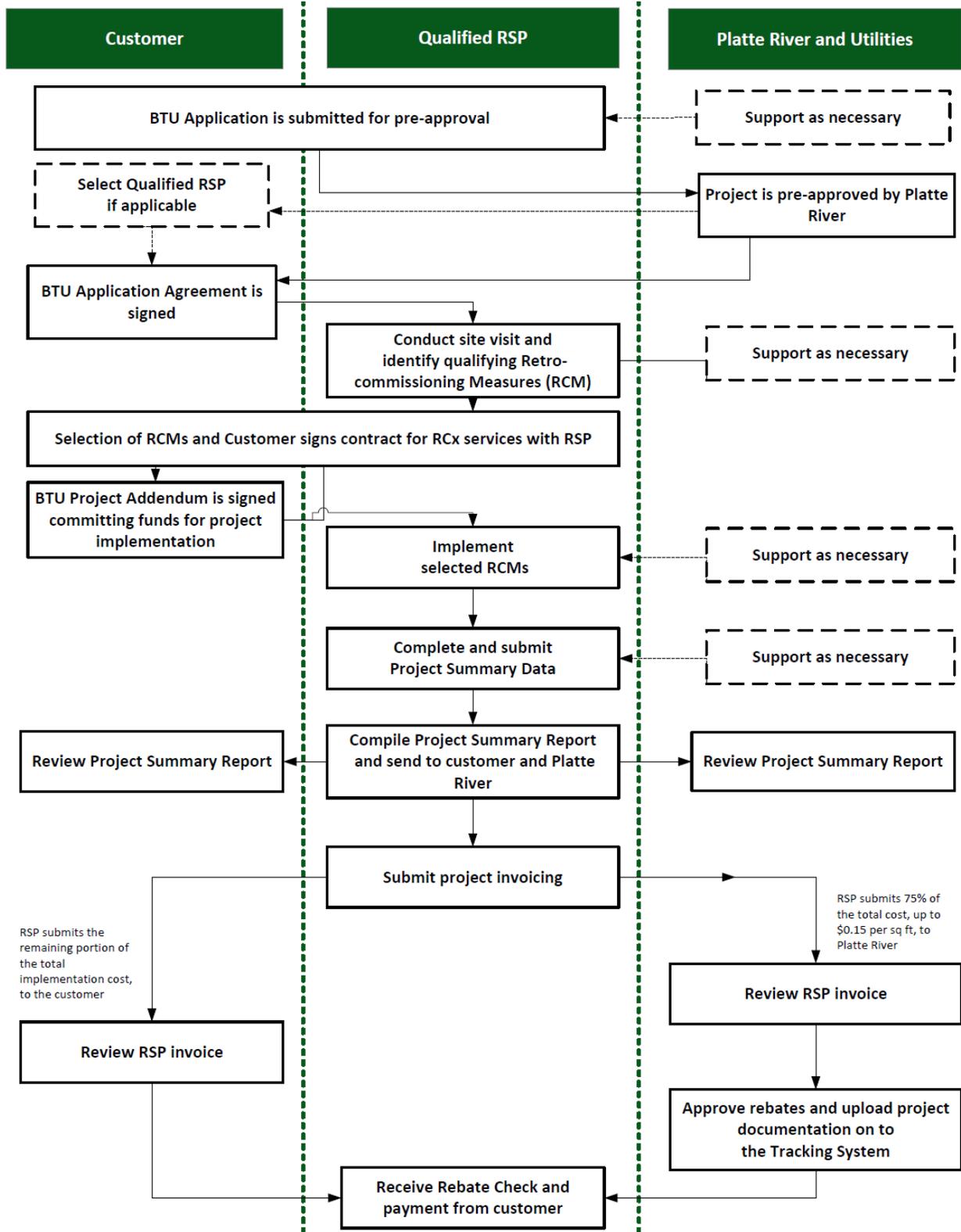


Figure 3-1 Building Tune-up Program Participation Procedures for Tier 1 Buildings

3.4 APPLICATION PHASE

Contact a qualified Retro-commissioning Service Provider (RSP) or Utility or Platte River Representative for help with application to get started. Pre-approval is required for all projects to be considered for funding in the Building Tune-up Program (BTU) program. To receive pre-approval, submit completed BTU application (Appendix A) and agreement prior to work being performed; including the following required pages: Page 1 - Customer Info, Page 2 - Project Pre-screening , and Page 3 - signed Building Tune-up Program Agreement. Electronic submittals are allowed by emailing the application and signature pages to tuneup@prpa.org. Note that Alternative Payment Recipient and second signature on the Agreement page are to be completed after the selection of the RSP if customer prefers the rebate to be paid directly to the qualified RSP. If RSP is already selected for the project, then this may be signed at the time submitting the application for pre-approval.

- Customer completes application with assistance from Platte River, Utility, or qualified RSP.

Once the application is received Platte River will verify customer account number, installation address for submitted account number, valid equipment installation date, equipment eligibility and capacity, and potential incentive amount. Applications which are incomplete or are not eligible to participate will receive an email, letter, or phone call describing to the customer the changes necessary to qualify for the program. Once the project is pre-approved, the customer or party submitting the application will receive an approval code to authorize the initial preliminary site assessment to begin (or Planning Phase).

Key RSP Application Phase Deliverables

- 1) Completed BTU Application and signed Agreement are submitted to Platte River.

3.5 PLANNING PHASE

The customer will select an RSP, if one has not already been selected, to conduct a preliminary site assessment and verify the operation of HVAC equipment and preventive maintenance status (see Section 3.6.I. Preliminary Maintenance Check for details) are used to generate an initial list of measures to assess overall project feasibility. The RSPs are trained to look for the prescriptive Retro-Commissioning Measures (RCM) to provide a list of potential RCMs to the customer. This initial work establishes the general framework – or plan – for the balance of the tune-up activities. The RSP then thoroughly discusses the potential RCMs in detail with the customer. Customer will select the RCMs that are to be implemented by the RSP based on general simple payback criteria of less than 2 years.

Key RSP Planning Phase Deliverables

- 1) Complete site assessment walk-through *and* the project "BTU Work Order" tab (located in the BTU Application).
- 2) Attendance at Project Planning Meeting and proposal of potential RCMs.
- 3) Complete Customer Selection Form in BTU Plan Approval Form.
- 4) Customer signs BTU Plan Approval Form to authorize the implementation of the selected RCMs and committed funds prior to the Implementation Phase.
- 5) Customer and selected RSP enter into an agreement and/or contract for scope of RCx services

3.6 IMPLEMENTATION PHASE

The Investigation and Implementation work is considered one Phase because the activities are linked for cost-effectiveness. For Tier I, as noted above, the Retrocommissioning Service Provider (RSP) will proceed with the Implementation Phase right after the Planning Phase.

Key RSP Implementation Phase Deliverables

- 1) Revised and completed BTU Application and Addendum #1 (if changes were made from the original pre-approved application), including customer report and measure tabs.
- 2) Provide Proof of Work Performed – invoices, etc.
- 3) Final Report to Customer – See Appendix C and BTU Application.

3.6.1 POTENTIAL MEASURES

The prescriptive measures described below are inexpensive ways to achieve significant energy savings. A detailed description of each measure is given below. These measures are all listed in the BTU Application and require the following protocols to meet program specifications; RSP is required to complete each tab in the workbook as it applies to the selected RCMs in the Planning Phase.

Preliminary Maintenance Check

Checking coil cleanliness on rooftop units helps ensure that the participant is performing preventative maintenance that is a pre-requisite for participation. If the coils are not clean, then the date of the last cleaning should be obtained from the participant. If it has been more than six months since the last cleaning and no cleaning is scheduled, then the unit should not be re-commissioned.

Other preventative maintenance tasks that should be checked before recommissioning is performed are:

- Confirming there is proper airflow and appropriate motor speed
- Checking fan belt tensions
- Investigating filter condition and most recent replacement

Scheduling Existing Controls Equipment

This measure involves evaluating and adjusting the temperature schedules in the existing programmable thermostat or control system. The conditioning schedule is adjusted so that heating and cooling equipment is fully operational only while the building is occupied. This means utilizing temperature setbacks during unoccupied times. For buildings with centralized Air Handling Units (AHUs), this means shutting down the air handler and associated systems during unoccupied times.

For buildings with programmable thermostats in use, the occupied temperature setpoint is called for one to two hours before occupants start arriving. If the programmable thermostat has “adaptive intelligent recovery” capability, then the occupied schedule starts when the first occupants arrive. Unoccupied time periods begin immediately when the majority of occupants start leaving for the day. This approach is used because the thermal mass of the building is assumed to keep the internal building temperature close to the occupied temperature setpoint until most occupants have left for the day.

Occupied temperature setpoints are not typically adjusted unless they are way outside of the “normal” temperature range. The most aggressive, energy-saving setpoints are utilized during the unoccupied periods. Typically, the unoccupied setpoints are set to be eight degrees away from the occupied setpoint. For heating setpoints, this means eight degrees lower; for cooling, this means eight degrees higher. Studies have shown that this temperature difference is optimum for saving energy in the long run. Using a larger temperature difference will make the system “work harder” when bringing the space temperature to the occupied setpoint and reduces the energy savings associated with the setbacks.

Table 3-I Recommended Setpoints for A Typical Office Space

Setpoints (°F)		
Mode	Cooling	Heating
Occupied	72	68
Unoccupied	80	60

After schedules are updated, the contractor should discuss with the participant changes made to the schedule and answer any questions they may have. Familiarizing the participant with the changes made to schedules will hopefully facilitate the persistence of the energy savings.

Installing and Scheduling Programmable Thermostats

This measure involves installing programmable thermostats, then programming them with the appropriate temperature schedules using the approach outlined above. If an existing thermostat does not have scheduling capabilities, then it should be replaced. If any existing programmable thermostats do not have ‘auto change-over,’ they will be evaluated on a case by case basis for replacement with a programmable thermostat that has ‘auto change-over’ functionality.

If the HVAC systems are controlled by independent thermostats, then thermostats should be consolidated and replaced. This will minimize the two systems working against one another and wasting energy.

If a new thermostat has been installed, the contractor should take some time to educate the participant on the temperature schedule, how to operate the new thermostat, and answer any questions they may have. The instructions for the thermostat should also be left with the participant.

Adjusting or Adding Economizers

This measure ensures that airside economizers are functioning in a way that will minimize the energy consumption of the refrigerant compressor. This involves evaluating the minimum and maximum damper settings, making sure that these settings are being achieved when called for, and adjusting the actuators as needed. The methodology for this is listed below:

- Call for cooling at the unit
- Confirm it modulates
- Repair/adjust if not working properly

Calibrating or Replacing Economizer Sensors

The outside air temperature sensors for airside economizers should be checked to see if they are out of calibration. If so, they should be calibrated if possible. If they can’t be calibrated, then they should be replaced. This task should help ensure that the economizer is operating optimally. This measure also replaces the Honeywell C7400 (Enthalpy) and C7650 (Dry Bulb) OA sensor with new OEM replacement (C7660) to correct a logic error and convert it to dry. This measure also replaces the Honeywell W7450 (Dry Bulb) and W7460 (Enthalpy) OA sensor with new OEM replacement to correct a logic error and convert it to dry bulb.

Repairing /Replacing Economizer Damper Actuators

Actuators and linkage should be adjusted, if possible. If an airside economizer damper actuator cannot be adjusted to function as desired, it should be replaced. Linkages should be replaced if necessary, as well. This will ensure that the outside air dampers on economizers are going to the minimum positions when in heating or cooling mode and are fully economizing in the appropriate temperature range.

Demand Control Ventilation (DCV) Controls

This measure ensures utilizes existing economizer controls and new CO₂ sensors placed in the return air of the RTU or AHU to calculate the amount of occupants are in the space and allow the proper amount of ventilation to match the occupant number. Typically the DCV is installed on existing airside economizers and are most cost effective if the space served by the RTU has a variable occupant load, such as: conference rooms, theaters and auditoriums, gymnasiums, waiting areas/lobbies, etc. The energy savings are a result of not having to re-condition ventilation or outside air unnecessarily if the space is mostly unoccupied.

Installing or Adjusting Direct Expansion (DX) Outside Air Lockout Controls

This measure is applicable to package Roof Top Units (RTU) or Air handling units (AHU) with two stage (or more) DX Cooling and economizer controls. The RTU could be prematurely engaging the mechanical cooling when the outside air temperatures are cool enough to satisfy the cooling needs of the space with outside air. The recommended outside air lockout temperature is below 50 degrees F. This measure will prevent the compressor from running below this temperature and allows the outside air damper to mix with the return air temperature to satisfy the cooling need in the space. Note that you may have to consider the addition of crank case heaters to prevent the compressor from freezing since the operation of the compressor at low ambient temperatures is likely (this is evaluated on a case by case basis) and also note that comfort issues may occur if the RTU or AHU currently has difficulty maintaining the cooling load in the space.

Adjusting Minimum Outside Air Fraction

The goal of this measure is to minimize the conditioning energy necessary for air handling equipment, while still meeting code-required fresh air requirements. The minimum outside air levels will be adjusted using the flow plates, or other approved tool, to measure CFM of outside air per unit. Table 3-2 shows recommended outside air for ventilation in a given space type and is based on ASHRAE 62.1

Table 3-2 ASHRAE 62.1 Ventilation Rates

Use Type	CFM/Person	Plus CFM/SF
Retail	7.5	0.12
Grocery	7.5	0.06
Office	5.0	0.06
School	10.0	0.12
Warehouse	10.0	0.06
Assembly	5.0	0.06
Common Areas	0.0	0.06
Restaurant (dining)	7.5	0.18

Measuring Total Airflow of RTU or Split Systems

The goal of this measure is to verify that the unit is moving the proper amount of airflow (CFM) for the cooling capacity. The recommended airflow rate should range from 350 to 550 CFM/Ton. This measure is recommended for RTUs and split

systems in order to maximize the full efficiency of the system. See Appendix E for RTU Airflow Protocol and related tab in the BTU Application.

Split System Cooling and Heating Efficiency

The goal of this measure is to verify that the unit is operating at its highest efficiency. The protocol for verifying this efficiency and operation of the unit is found in Appendix F: Split System Heating and Cooling Protocol, Installing Direct Expansion (DX) and Outside Air Lockout Controls (OALC).

This measure is applicable to buildings where the heating and cooling systems are controlled independently of one another. There is potential for unnecessary, simultaneous heating and cooling for systems of this type if they are not controlled properly. By installing lockout controls, annual operating hours of cooling systems can be reduced, but the primary goal is to ensure that the HVAC systems are not unnecessarily working against each other.

This measure is not typically applicable to packaged rooftop units, since these units can be in heating or cooling mode, but not both modes at the same time.

There are many options for lockout controllers on the market today, and no specific brand or type of controller is recommended for this program. Compatibility with existing equipment, reliability, product features, and cost should all be considered when choosing the appropriate controller.

Electronically Commutated Motors (ECMs): Some split systems may be good candidates for replacing their original shaded pole motor with an ECM. The ECM uses a fraction of the wattage of a shaded pole or PSC motor commonly found in furnaces. This measure should be evaluated on a case by case basis and will depend on the applicability of an ECM to the split system. Proper airflow and system warranties need to be considered before implementing this measure.

Installing low flow water faucet aerators and per-rinse spray valves

This measure is intended to replace water faucet aerators and kitchen pre-rinse spray valves with lower flow models. Aerators in hand sinks (lavatories) will be replaced with 0.5 gallons per minute Gallons Per Minute (GPM) aerators. The 0.5 GPM aerators should not be installed in sinks where grit type soap like mechanics often use and may not be a good fit where domestic hot water is regulated by the health department. Owners should be aware that low flow aerators will increase the time it takes for hot water to reach the faucet if it is not a recirculation system.

Low-flow pre-rinse spray valves that meet or exceed EPA Act 2005 federal minimum efficiency standard of 1.6 GPM can be installed to replace older higher flow models. These low-flow models reduce water use in the building and are designed to clean as or more effectively than the higher flow models. Information on models that have been tested to meet flow and cleanability performance standards can be found at www.fishnick.com/equipment/sprayvalves.

Installing or adjusting occupancy sensors or other lighting controls

Interior Lighting: This measure adjusts existing occupancy sensors or timers to operate effectively. Also, new installations of occupancy sensors or timers are allowed in the Building Tune-up Program (BTU) program. Occupancy sensors are most applicable in spaces with intermittent occupancy that control more than 4-6 fixtures, and where the lights often get left on.

Exterior Lighting: This measure adjusts existing exterior photocells or timers to operate effectively. Also, program allows the replacement of a malfunctioning photocell. Typically photocells can malfunction due to poor placement or age.

De-lamping of light fixtures

Many times a building will have fluorescent fixtures that have 3 or 4 lamps whereas the related space may have enough light levels with only one or two fluorescent lamps. It is important to check the ballast specifications to see if the ballast operation is compatible with the removal of a specific number of lamps from one fixture. If the removal of the lamps is not a viable option, Platte River's efficiency programs will provide cash rebates for the permanent removal of lamps and installation of new lamps, ballasts, and reflector kits. This measure removes lamps from a fixture to save energy and not sacrifice light levels. See Appendix M: De-lamping Guide for information on how to de-lamp a fixture.

Installing controls for plug load devices

There are new products entering the market that can allow you to turnoff (wireless and/or web based) plug loads in the building when the building is unoccupied and reduce energy use and phantom loads. Plug load devices may include: copiers, printers, task lights, PC monitors, electric space heaters, fans, radios, and etc. (Contact Platte River for information on these control options.)

PC Power Management

This measure is intended to activate sleep/standby settings on the Personal Computers (PCs) in the building and reduce energy use during periods of inactivity and unoccupied times. The implementation of the measure may require the companies' IT department involvement and/or approval. The following settings for computers and monitors/displays are based on ENERGY STAR recommendations. See *Appendix O - Computer Power Management Protocol* for more details on how to implement this measure on your personal computers.

- Set display to turn off (sleep) after 3 minutes of no use. (2 - 10 minutes is acceptable)
- Set computer to go to sleep (standby) after 20 minutes of no use. (10 - 30 minutes is acceptable)

Domestic Hot Water Temperature Adjustments

This measure lowers the temperature setting on the DHW tanks to 120 degrees F.

Domestic Hot Water Pump Timer Adjustments or New Installation

This measure adjusts the setting of the Domestic Hot Water (DHW) recirculation pump timers to only run during periods of highest use and NOT run during unoccupied times of the building use. Also, allows for the addition of pump timers when applicable. An addition of a pump timer may also be available if an Electronically Commuted Motor (ECM) is purchased to replace the old shaded pole pump motor. ECMs will save additional energy to the timer control.

Heating Adjustments for furnaces and boilers

This measure is a tune-up of the natural gas furnace(s) or boiler(s). For natural gas furnace tune-up protocols, see the heating mode section Appendix F: Split System Heating and Cooling Protocol

Advanced Controls

Typically advanced controls refer mostly to Building Automation System (BAS) systems which have a more cost effective way to add additional controls to equipment or BAS controls. The following are examples of advanced controls in the program:

- Install averaging sensors
- Relocate thermostat
- Install override timer
- Integrate economizer and DX controls
- Add morning warm up/cool down controls
- Calibrate BAS sensors
- Program BAS control systems

Custom Measures

Custom measures are allowed in the BTU program and are encouraged to be implemented if there is a potential for significant energy or water savings. (Contact Platte River for pre-approval of custom measures.)

The customer will work with a qualified RSP to implement tune-up measures to implement the measures described above as applicable. Final implementation costs may vary from the estimated market costs; however, the market costs will be used to document customer implementation obligations. A brief report will be submitted summarizing the initial observed conditions, the implemented measures, the estimated energy savings, the implementation costs, and the rebate provided by Platte River.

3.7 VERIFICATION PHASE

For Tier I, verification will be done on a sampling basis (i.e., a percentage of all the small buildings that participate in the program), and will need to be carefully planned to allow for pre- and post-monitoring after the measures have been implemented. The results of the data collected and analyzed will be compared to the deemed savings for the measures proposed for Tier I, and the savings will be adjusted accordingly. To streamline costs, a "good" candidate will be identified during a site walk-thru and observations made of the building systems. Before the trade ally proceeds with implementation, data loggers will be placed on the building systems for at least a week before the implementation, left on during implementation, and will remain for a week after implementation is complete. These collected data will be used to verify the deemed savings used in the Tier I projects.

The following section describes the targeted buildings, rebate structure and phases associated with the Tier 2 Buildings.

4.1 TARGETED BUILDINGS

The following typical characteristics are associated with the Tier 2 buildings:

- Typical building size: 50,000 to 100,000 sq ft
- The facility shall be at least 2 years old
- The facility must have an existing and fully functional Energy Management System or Building Automation System (BAS), direct digital control. Fully functional means:
 - Ability to trend multiple data points and store them for a minimum of 2-weeks.
 - Ability to monitor real-time operation on a Graphical User Interface (GUI).
 - EMS/BAS controls most of the facility's high energy consuming equipment.
- In some cases, data logging and trending of equipment not on a BAS system will be accepted, this option must be approved by Platte River
- Facility may have packaged roof top units or air handle units with variable air volume terminal units; possibly re-heat. And may have central plant – typically one boiler and chiller or DX cooling/furnace in air handling units; or combination of both.
- **Example of unique circumstances that may target a building for this tier:**
 - Building is 30,000 sq ft and is conditioned by variable volume, built up; air handling units with DX cooling, economizers and VAV boxes with reheat. Building may have single zone temperature sensors controlling each VAV and a BAS system with trending capability.

4.2 REBATES

Platte River pays 100% of the cost for the RSP to assemble the retro-commissioning plan, implementation support, and a brief updated RCx Planning Report, but not direct implementation of selected RCMs. The RSP costs depend on scope and size of facility. The customer is required to hire and pay for a contractor or use in house staff to implement measures and provide support to the RSP throughout the project. Customer Financial Commitment is based on \$0.05 per sq ft up to \$12,000 towards implementation, once the planning phase report is accepted. If the customer still does not make the improvements within a mutually agreed upon timeline, they shall reimburse the utility for the costs incurred to date for their project.

No additional rebates will be available to Customer through this program (i.e., no energy rebates). However, if energy or water efficiency measures are identified that are beyond the scope of Building Tune-up Program, the Customer may seek to qualify those measures through Platte River's standard and custom electric efficiency rebate programs or provided by their local Utility if not offered by Platte River. Customers may be subject to a rebate threshold per Customer per calendar year. Any rebates received through Xcel Energy or other party as part of any Platte River program will not count towards the Customer's annual rebate threshold.

4.3 PARTICIPATION PROCESS

The participation process for Tier 2 is listed below:

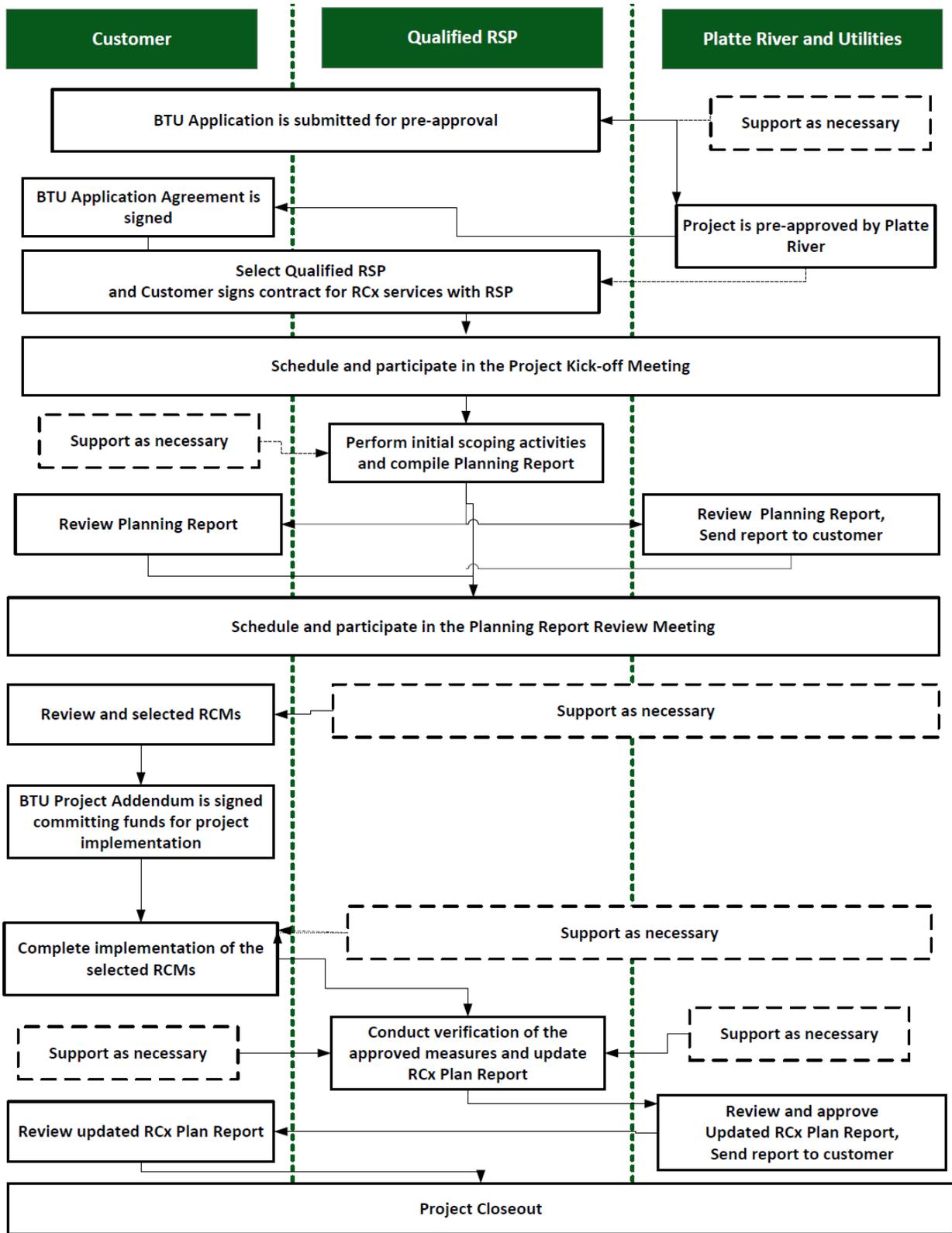


Figure 4-I Building Tune-up Program Participation Procedures for Tier 2 Buildings

4.4 APPLICATION PHASE

Contact a qualified Retro-commissioning Service Provider (RSP) or Utility or Platte River Representative for help with application to get started. Pre-approval is required for all projects to be considered for funding in the BTU program. To receive pre-approval, submit completed Building Tune-up Program (BTU) application (Appendix A) and agreement prior to work being performed; including the following required pages: Page 1 - Customer Info, Page 2 - Project Pre-screening, and Page 3 - signed Building Tune-up Program Agreement. Note that Alternative Payment Recipient and second signature on the Agreement page are to be completed after the selection of the RSP if customer prefers the rebate to be paid directly to the qualified RSP. If RSP is already selected for the project, then this may be signed at the time submitting the application for pre-approval.

Electronic submittals are allowed by emailing the application and signature pages to tuneup@prpa.org.

Pre-approving applications is an important part of the process. When screening program applications, Platte River will consider buildings with the following conditions to be placed in the Tier 2 Option of the BTU program:

- Buildings with more than 50,000 sq ft, but less than 100,000 sq ft of conditioned square feet, the customer must permit and/or authorize changes to the HVAC system's operations by a program-qualified RSP.
- The building shall have systems that are free of major problems requiring costly repairs or replacements, with no planned major system renovations or retrofits.
- The HVAC system receives periodic preventative maintenance (e.g., filter replacement, coil cleaning, refrigerant charge, and belt tension checks) and demonstrates general functionality. Also, the facility should have accessible and up-to-date building documentation and records.

Also, to qualify for the Tier 2 Option specifically, participants must express a commitment to be actively involved in the tune-up process. Active involvement will include:

- Providing facility access and time for facility personnel and/or their HVAC/controls contractor(s) to interface with the selected RSP.
- Providing and assisting with the reporting and collection of information pertaining to the building's tune-up.
- Spending \$0.05 per sq ft up to \$12,000 to implement identified RCMs with an estimated total project simple payback of two years or less, based upon electric and natural gas savings.

Once the application is received Platte River will verify customer account number, installation address for submitted account number, valid equipment installation date, equipment eligibility and capacity, and potential incentive amount. Applications which are incomplete or are not eligible to participate will receive an email, letter, or phone call describing to the customer the changes necessary to qualify for the program. Once the project is pre-approved, the customer or party submitting the application will receive an approval code to authorize the initial preliminary site assessment to begin (i.e. Planning Phase).

When the application is approved by Platte River, the retrocommissioning process begins with the Planning Phase, which consists of identification of project objectives, targeting of systems for improvements, defining tasks and responsibilities, and a Retrocommissioning Plan is developed as a result. The Implementation Phase follows, in which the building owner or representative is responsible for implementing the mutually agreed upon measures (between Platte River and the Owner) noted in this report. Once the improvements are made in the Implementation Phase, their success is validated in the Verification Phase.

The retrocommissioning procedures focus on electric and natural gas energy savings opportunities with low cost implications. Capital measures that are identified through Building Tune-up Program may be directed to Platte River's standard or custom program offerings.

Building Tune-up Program does not address fire and life safety or basic equipment safety controls. Additionally, the program does not provide services for new construction or to meet commissioning requirements of other rebate programs offered by Platte River.

Key RSP Application Phase Deliverables

- 1) Completed BTU Application and Agreement are submitted to Platte River
- 2) Customer and selected RSP enter into an agreement and/or contract for scope of RCx services

4.5 PLANNING PHASE

Following the acceptance of a project into the program and selection of an RSP, work begins by establishing the scope and timeline for the balance of the project. Customer is required to have an agreement with the selected RSP before work is performed and Planning Phase begins. This Planning Phase typically takes about four to six weeks. Key activities include a project kick-off meeting with the owner representative, engineering or facility staff, RSP, and Platte River and Utility representatives. A preliminary site assessment is completed by the RSP during this phase, where findings are used to generate the RCx Plan for the project and assess overall project feasibility. The RCx Plan establishes the general framework for the balance of the RCx activities. Upon its completion, a Planning Review meeting is held with the owner representative, engineering or facility staff, RSP, and Platte River and Utility representatives to review the scope of the plan. At the completion of the Planning Phase, the customer enters into the formal agreement with Platte River if the project appears viable to commit to implementing the selected RCMs.

4.5.1 PROJECT KICK-OFF MEETING

The initial project kick-off meeting is held soon after acceptance of the project application and the RSP is selected thereafter (if applicable). Key attendees include the owner's representative, facility and engineering staff, contractors, the selected RSP, Platte River, and/or the Utility representatives. The meeting is used to introduce key performers for the RCx project team and explain the timing and key steps of the project.

4.5.2 SITE ASSESSMENT ACTIVITIES

Site assessment activities often follow directly after the kick-off meeting with the RSP conducting a preliminary site visit to understand key facility systems and their operation. Site assessment activities conducted by the RSP also involve:

- Consulting with the facility's personnel to understand their concerns and identify areas where additional focus may be warranted
- Reviewing the facility system documentation and utility bills

Facility operations, maintenance schedules, equipment control sequences, set points, control parameters, schedules, occupant activities, and component operation are also documented at this point in the project.

4.5.3 IDENTIFICATION OF RCMS

Utilizing the information gathered during the kick-off meeting, utility usage data, and from the site assessment, the RSP is responsible for identifying potential RCMs. For each RCM, the RSP will evaluate and document the following parameters:

- Annual electric and natural gas energy savings potential
- Average electric demand savings potential in Summer and Winter months
- Estimated implementation cost
- Savings persistence
- Impacts on building occupant comfort and process operations
- Installation of water measures – low flow aerators and pre-rinse spray valves (if applicable)

Savings calculations must be supported by field observations, actual equipment specifications, and operating conditions. Calculations based solely on rules of thumb or unsupported assumptions are not acceptable.

4.5.4 RETROCOMMISSIONING PLAN

Using the information gathered and identified RCMs, the RSP develops the RCx Plan. The RCx Plan describes the building energy systems, identifies specific RCMs, estimates electric energy and demand savings, natural gas savings, and demonstrates project feasibility. The plan serves as the guiding document for the balance of the project. A viable RCx Plan is required before a Customer signs the BTU Plan Approval Form and for the project to continue under the program. A sample of the required RCx Plan template is included in Appendix G of this manual. The RCx Plan template will be updated, if necessary, to align with Xcel Energy's reporting requirement for an RCx study. Deviations from this template must be pre-approved in writing by Platte River.

If identified savings opportunities fail to meet or exceed the project savings target, Platte River may renegotiate a reduced scope of work and fee for the Implementation and Verification Phase with the RSP. If a project cannot demonstrate reasonable feasibility, the owner may be redirected towards another energy efficiency program offering from Platte River. If this is the case, the RSP will be paid for Planning Phase services only. No additional work will be performed or payments made.

4.5.5 PLANNING REVIEW MEETING

For approval of the RCx Plan, the Planning Review meeting is held with the owner representative, engineering or facility staff, RSP, and Platte River and Utility representatives to review the scope of the plan, the impacts and economics of the identified potential measures. To help facilitate this meeting, RSPs are required to prepare the Customer Selection Form (Table A of the BTU Plan Approval Form of the application). This document will be utilized throughout the balance of the RCx process to communicate RCM opportunities and seek Customer approval to proceed with implementation. A sample of this form is provided in Appendix A of this manual.

At the completion of the Planning Review meeting, the customer reviews the potential RCMs, completes and signs the BTU Plan Approval Form; and provides initial indication to approve of the measures to be refined and/or implemented in the Implementation Phase. By signing the BTU Approval Form, the customer commits to spend a minimum of \$0.05 per square foot of building size up to \$12,000 for the selected RCMs identified in Table A: Customer Selection Form. Note: selected RCMs are to be placed in Table A: Customer Selection Form located in Addendum #I: BTU Plan Approval Form of the BTU Application Agreement.

Key RSP Planning Phase Deliverables

- 1) Attendance at Project Kick-off Meeting
- 2) RCx Plan Report (including the Building Site Assessment Form if applicable)
- 3) Complete Customer Selection Form in BTU Plan Approval Form
- 4) Attendance at Project Planning Meeting and proposal of potential RCMs
- 5) Customer signs BTU Plan Approval Form to authorize the implementation of the selected RCMs and committed funds prior to the Implementation Phase

4.6 IMPLEMENTATION PHASE OVERVIEW

The Implementation Phase consists of installing the recommended RCMs. This phase may require eight to twenty weeks and is conducted during times when affected building systems are operational.

The Customer is responsible for implementing the RCMs identified and agreed to during the Planning Phase. Upon completion, the Customer will notify Platte River that the measures have been installed.

During the Implementation Phase, the RSP, with assistance from the facility and engineering staff, will expand upon the site assessment activities completed during the Planning Phase to develop and implement the RCx measures. The principal RSP Implementation Phase activity includes working with facility staff to guide the RCx activities and identify additional RCMs.

The facility owner implements RCMs after the Planning Phase Report has been completed and accepted. A key requirement to the success of this approach is that sufficient information be collected by the RSP to document the baseline and estimate the RCMs' electric and natural gas energy savings potential before implementation begins.

The implementation costs used to calculate project economics under the program are based upon reasonable market costs as determined by the RSP and approved solely by Platte River. Resources to obtain market costs include, but are not limited to industry accepted project estimation resources, vendor quotes, or professional judgment. The Customer is afforded the flexibility to utilize in-house staff or an outside contractor to implement RCx measures implementation. Final implementation costs may vary from the estimated market costs; however, the market costs will be utilized to support the \$0.05 per sq ft up to \$12,000 contractual obligations.

4.6.1 IMPLEMENTATION SUPPORT

During the Implementation Phase, the RSP works provides oversight with the Customer's implementation team to identify the recommended measures and provide recommendations to "fix" the problems. The implementation team includes the facility engineers, operational staff, and the mechanical, electrical, and controls contractors. The goal of this phase is to fully implement all agreed-upon RCx measures and stand ready for final verification.

Implementation of the RCMs is the sole responsibility of the Customer. However, the RSP is required to provide technical support during this phase for the Customer to implement the RCMs. A description of the Customer's role and the RSP's role in implementation is provided below.

- **Customer Implementation** funding commitment is a minimum of \$0.05 per sq ft, up to \$12,000, for the implementation of the selected RCMs. Examples may include: mechanical/electrical contracting, professional engineering design, controls modifications, and installation of equipment that is required for the RCM. The Customer may choose to solicit these services from the RSP, in which case the RSP would be working under direct contract with the Customer and not Platte River.
- **RSP Implementation** assistance is provided to Customers to guide them from a through the scope of work of the contractor required to implement each RCM. The main activity for the RSP will be answering technical questions. These costs are included as part of the RSP's price for the implementation phase of the project.

Key RSP Implementation Phase Deliverables

- 1) Ongoing RCM implementation support for Customer
- 2) Inspection Report / Punch List for installed measures
- 3) Presentation of Implemented RCMs to customer

4.7 VERIFICATION PHASE OVERVIEW

During the Verification Phase, the RSP revisits the site to verify that measures have been properly completed (e.g. new control strategies are functioning properly, repairs have been made, etc). The RSP updates the RCx Plan Report that summarizes the final findings and impacts from the project. The target timeline for completion of the Verification Phase is approximately three to ten weeks for a typical project.

4.7.1 VERIFY RCM IMPLEMENTATION

Initial RSP verification activities will include a site visit to confirm the installation of the RCMs approved in the Planning Phase Report. The RSP will report these preliminary findings to Platte River. If discrepancies are found between the

implemented RCMs and those agreed to with the building owner during the Implementation Phase of the project, Platte River may require that all verification activities be halted until they are implemented by the Customer.

To confirm that the recommended RCMs were properly implemented and savings estimates are accurate, the RSP is required to complete the verification activities identified in the Planning Phase Report. The verification will be limited to spot measurements, visual checks, and/or interviews with the party responsible for implementation. Generally, the verification procedures follow Option A of the International Performance Measurement & Verification Protocol. Re-trending of the points on the BAS collected during the Planning Phase will only be conducted if directed and approved by Platte River. As a general rule, trending will not be required for the Tier 2I verification phase.

Any discrepancies noted between the actual and recommended RCMs must be documented and presented in the Updated RCx Planning Report. It is essential that documented data be included in the report to support the final savings calculations and account for such implementation discrepancies. If discrepancies exist, the associated savings are recalculated, and the revised savings for each measure are presented in the report.

4.7.2 UPDATED RETROCOMMISSIONING PLAN

The Updated RCx Plan Report serves as final documentation for each of the project's implemented RCMs. The purpose of this report is to document that the RCMs were properly implemented and document verified electrical demand, energy, and natural gas savings for each RCM. The results of the verification activities for each implemented RCM will be used by the RSP in preparation of this report. This report includes a summary of completed RCMs, a summary of the verification activities, closed out master list of deficiencies, and the final estimated costs and energy savings.

The updated RCx Plan Report is submitted to Platte River for review and comment. Any requested changes are incorporated and a copy of the approved report is presented to the Customer.

Key RSP Verification Phase Deliverables

- 1) Updated Retrocommissioning Plan Report

Section 5

RCx Study and Support - Tier 3 Buildings

The following section describes the targeted buildings, rebate structure and phases associated with the Tier 3 Buildings.

5.1 TARGETED BUILDINGS

The following typical characteristics are associated with the Tier 2 buildings:

- Typical building size: greater than 100,000 sq ft
- The facility shall be at least 2-years old
- The facility must have an existing and fully functional Energy Management System or Building Automation System (BAS) (direct digital control). Fully functional means:
 - Ability to trend multiple data points and store them for a minimum of 2-weeks
 - Ability to monitor real-time operation on a Graphical User Interface (GUI)
 - EMS/BAS controls most of the facility's high energy consuming equipment
 - In some cases, data logging and trending of equipment not on a BAS system will be accepted, this option must be approved by Platte River
- Facility may air handle units or multi-zone units with and have central plant – typically more than one boiler and chiller and/or industrial processes.

5.2 REBATE STRUCTURE

Platte River pays 100% of the cost for the RSP to assemble the retro-commissioning plan, implementation support e, and a brief verification summary report, but not direct implementation of selected Retrocommissioning Measures (RCMs). The RSP costs depending on scope and size of facility. The customer is required to hire and pay for a contractor or use in house staff to implement measures. Platte River will not provide an energy rebate. Customer Financial Commitment is based on \$0.05 per sq ft up to \$12,000 towards implementation, once the planning phase report is accepted. If the customer still does not make the improvements within a mutually agreed upon timeline, they shall reimburse the utility for the costs incurred to date for their project.

Typically the rebate is paid in part upon the deliverables of each phase: Planning Phase (15% of total rebate), Implementation Phase (70% of total rebate) and Verification Phase (15% of total rebate); and can be issued directly to the RSP if the customer chooses to do so on the BTU Application.

No additional rebates will be available to Customer through this program (i.e., no energy rebates). However, if energy or water efficiency measures are identified that are beyond the scope of Building Tune-up Program, the Customer may seek to qualify those measures through Platte River's standard and custom electric efficiency rebate programs or provided by their local Utility if not offered by Platte River. Customers may be subject to a rebate threshold per Customer per calendar year. Any rebates received through Xcel Energy or other party as part of any Platte River program will not count towards the Customer's annual rebate threshold.

Table 5-I lists some typical RCMs for Tier 3 buildings.

Table 5-I Example Eligible and Ineligible RCMs for Tier 3 Buildings

Eligible RCMs	Ineligible RCMs
Reduce minimum outside air flow Correct economizer operation Eliminate simultaneous heating and cooling Reduce/reset supply air static pressure set points Eliminate chilled water short-circuiting Improve chiller or other equipment sequencing Reduce/reset condenser water setpoints Correct refrigerant charge Improve equipment scheduling Reduce air flow in Control Volume (CV) air handling systems Improve refrigeration system controls Improve process controls	Fuel switching Measures that negatively affect occupant comfort Major equipment replacement (capital expenditure) Measures necessary for basic facility operation Measures that produce electricity Terminate or relocate existing processes/operations Measures that compromise safety and/or code requirements

5.3 PARTICIPATION PROCESS

The program administrative process for each approved project follows four basic program phases:

- 1) Application Phase
- 2) Planning Phase
- 3) Implementation Phase
- 4) Verification Phase

This process is illustrated in Figure 5-I is an overview about each phase of a Tier 3 building with a focus on Customer responsibilities. The total estimated time period to complete a retrocommissioning project is four to nine months.

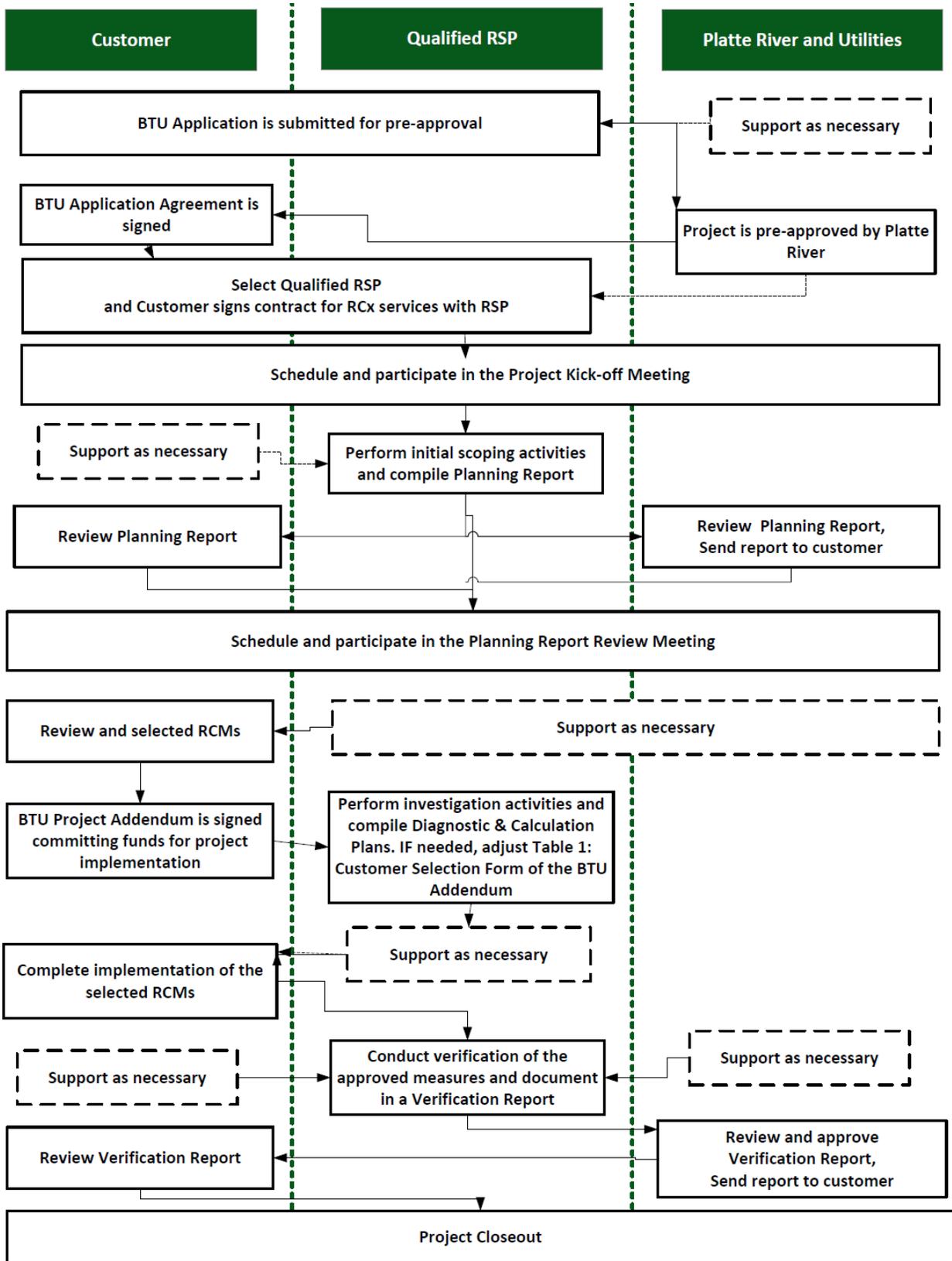


Figure 5-1 Building Tune-up Program Participation Procedures for Tier 3 Buildings

5.4 APPLICATION PHASE

Contact a qualified Retro-commissioning Service Provider (RSP) or Utility or Platte River Representative for help with application to get started. Pre-approval is required for all projects to be considered for funding in the BTU program. To receive pre-approval, submit completed BTU application (Appendix A) and agreement prior to work being performed; including the following required pages: Page 1 - Customer Info, Page 2 - Project Pre-screening , and Page 3 - signed Building Tune-up Program Agreement. Note that Alternative Payment Recipient and second signature on the Agreement page are to be completed after the selection of the RSP if customer prefers the rebate to be paid directly to the qualified RSP. If RSP is already selected for the project, then this may be signed at the time submitting the application for pre-approval.

Electronic submittals are allowed by emailing the application and signature pages to tuneup@prpa.org.

Pre-approving applications is an important part of the process. When screening program applications, Platte River will consider buildings with the following considerations to be placed in the Tier 3 Option of the BTU program:

- Buildings with more than greater than 100,000 sq ft of conditioned square feet. The customer must permit and/or authorize changes to the system operations by a program-qualified RSP.
- Facility must be greater than 2 years old.
- The building shall be free of major problems requiring costly repairs or replacements, with no planned major system renovations or retrofits.
- The systems receive periodic preventative maintenance (e.g., filter replacement, coil cleaning, refrigerant charge, and belt tension checks) and demonstrate general functionality. Also, the facility should have accessible and up-to-date building documentation and records.

Also, to qualify for the Tier 3 Option specifically, participants must express a commitment to be actively involved in the tune-up process. Active involvement will include:

- Providing facility access and time for facility personnel to interface with the selected RSP.
- Providing and assisting with the reporting and collection of information pertaining to the building's tune-up.
- Spending \$0.05 per sq ft up to \$12,000 to implement identified RCMs with an estimated total project simple payback of two years or less, based upon electric and natural gas savings.

Once the application is received Platte River will verify customer account number, installation address for submitted account number, valid equipment installation date, equipment eligibility and capacity, and potential incentive amount. Applications which are incomplete or are not eligible to participate will receive an email, letter, or phone call describing to the customer the changes necessary to qualify for the program. Once the project is pre-approved, the customer or party submitting the application will receive an approval code to authorize the initial preliminary site assessment to begin (i.e. Planning Phase).

When the application is approved by Platte River, the retrocommissioning process begins with the Planning Phase, which consists of identification of project objectives, targeting of systems for improvements, defining tasks and responsibilities, and a retrocommissioning plan is developed as a result. The Implementation Phase follows, in which the building owner or representative is responsible for implementing the mutually agreed upon measures (between Platte River and the Owner) noted in this report. Once the improvements are made in the Implementation Phase, their success is validated in the Verification Phase.

The retrocommissioning procedures focus on electric and natural gas energy savings opportunities with low cost implications. Capital measures that are identified through Building Tune-up Program may be directed to Platte River's standard or custom program offerings.

Building Tune-up Program does not address fire and life safety or basic equipment safety controls. Additionally, the program does not provide services for new construction or to meet commissioning requirements of other rebate programs offered by Platte River.

Key RSP Application Phase Deliverables

- 1) Completed BTU Application and Agreement are submitted to Platte River
- 2) Customer and selected RSP enter into an agreement and/or contract for scope of RCx services

5.4.1 PROJECT KICK-OFF MEETING

The initial project kick-off meeting is held soon after acceptance of the project application and the RSP is selected thereafter (if applicable). Key attendees include the owner's representative, facility and engineering staff, contractors, the selected RSP, Platte River, and/or the Utility representatives. The meeting is used to introduce key performers for the RCx project team and explain the timing and key steps of the project.

5.4.2 SITE ASSESSMENT ACTIVITIES

Site assessment activities often follow directly after the kick-off meeting with the RSP conducting a preliminary site visit to understand key facility systems and their operation. Site assessment activities conducted by the RSP also involve:

- Consulting with the facility's personnel to understand their concerns and identify areas where additional focus may be warranted
- Reviewing the facility system documentation and utility bills
- Performing non-invasive measurements and functional tests as necessary to provide a thorough understanding of the facility's systems
- Completing a Building Site Assessment Form

Facility operations, maintenance schedules, equipment control sequences, set points, control parameters, schedules, occupant activities, and component operation are also documented at this point in the project.

Appendix F of this manual includes a sample copy of the Building Site Assessment Form. Deviations from this template must be pre-approved in writing by Platte River. Similar documentation is required for compressed air, refrigeration, and industrial process systems if applicable.

5.4.3 IDENTIFICATION OF RCMS

Utilizing the information gathered during the kick-off meeting, utility usage data, and from the site assessment, the RSP is responsible for identifying potential RCMS. For each RCM, the RSP will evaluate and document the following parameters:

- Annual electric and natural energy savings potential
- Average electric demand savings potential in Summer and Winter months
- Estimated implementation cost
- Savings persistence
- Impacts on building occupant comfort and process operations
- Installation of water measures – low flow aerators and pre-rinse spray valves (if applicable).

Savings calculations must be supported by field observations, actual equipment specifications, and operating conditions. Calculations based solely on rules of thumb or unsupported assumptions are not acceptable.

5.4.4 RETROCOMMISSIONING PLAN

Using the information gathered and identified RCMs, the RSP develops the RCx Plan. The RCx Plan describes the building energy systems, identifies specific RCMs, estimates electric energy and demand savings, natural gas savings, and demonstrates project feasibility. The plan serves as the guiding document for the balance of the project. A viable RCx Plan is required before a Customer signs the BTU Plan Approval Form and for the project to continue under the program. A sample of the required RCx Plan template is included in Appendix G of this manual. The RCx Plan template will be updated, if necessary, to align with Xcel Energy's reporting requirement for an RCx study. Deviations from this template must be pre-approved in writing by Platte River.

If identified savings opportunities fail to meet or exceed the project savings target, Platte River may renegotiate a reduced scope of work and fee for the Implementation and Verification Phase with the RSP. If a project cannot demonstrate reasonable feasibility, the owner may be redirected towards another energy efficiency program offering from Platte River. If this is the case, the RSP will be paid for Planning Phase services only. No additional work will be performed or payments made.

5.4.5 PLANNING REVIEW MEETING

For approval of the RCx Plan, the Planning Review meeting is held with the owner representative, engineering or facility staff, RSP, and Platte River and Utility representatives to review the scope of the plan, the impacts and economics of the identified potential measures. To help facilitate this meeting, RSPs are required to prepare a the Customer Selection Form (located in the BTU Plan Approval Form of the application). This document will be utilized throughout the balance of the RCx process to communicate RCM opportunities and seek Customer approval to proceed with implementation. A sample of this form is provided in Appendix A of this manual.

At the completion of the Planning Review meeting, the customer reviews the potential RCMs, completes and signs a the BTU Plan Approval Form; and provides initial indication to approve of the measures to be refined and/or implemented in the Implementation Phase. By signing the BTU Approval Form, the customer commits to spend a minimum of \$0.05 per square foot of building size up to \$12,000 for the selected RCMs identified in Table A: Customer Selection Form. Note: selected RCMs are to be placed in Table A: Customer Selection Form located in Addendum #I: BTU Plan Approval Form of the BTU Application Agreement.

Key RSP Planning Phase Deliverables

- 1) Attendance at Project Kick-off Meeting
- 2) RCx Plan, including the Building Site Assessment Form
- 3) Complete Customer Selection Form in BTU Plan Approval Form
- 4) Attendance at Project Planning Meeting and proposal of potential RCMs
- 5) Customer signs BTU Plan Approval Form to authorize the implementation of the selected RCMs and committed funds prior to the Implementation Phase

5.5 IMPLEMENTATION PHASE OVERVIEW

The Implementation Phase consists of a detailed analysis followed by implementation of the recommended measures. It involves the detailed investigation of the RCMs identified in the RCx Plan, and further investigation to identify additional RCMs. The investigation component of this phase includes activities such as conducting detailed site assessments, diagnostic testing, and trending analyses to evaluate current facility operating procedures, equipment functionality, and to verify planning phase assumptions. Throughout the Implementation Phase, the RCx measures and associated costs, savings, and economic impacts will be updated and summarized in the Customer Selection Form. This phase may require eight to twenty weeks and is conducted during times when affected building systems are operational.

As RCx opportunities are finalized, the Customer will be asked to fund the implementation of such measures. The Customer is responsible for implementing the RCMs identified and agreed to during the Implementation Phase. Upon completion, the Customer will notify Platte River that the measures have been installed.

During the Implementation Phase, the RSP, with assistance from the facility engineering staff, will expand upon the site assessment activities completed during the Planning Phase to develop and implement the RCx measures. The principal RSP Implementation Phase activities include the following:

- Working with facility staff to guide the RCx activities and identify additional RCMs
- Gathering additional information to assess equipment operation
- Updating the Customer Selection Form
- Developing Diagnostic testing and Calculation plans for each RCM
- Estimating the potential electric and natural gas energy savings for identified RCMs
- Assessing the cost to implement RCMs
- Assisting the Customer's implementation team to implement the RCM
- Educating the implementation team on the ramifications of RCM and how and why to maintain the changes implemented
- Closing out/updating items either in a punch list or master list of deficiencies as they are mitigated

The facility owner typically implements RCMs after all RCM Diagnostic and Calculation Plans have been finalized. However, the facility owner is encouraged to implement selected RCMs as individual measures are finalized. A key requirement to the success of this approach is that sufficient information be collected by the RSP to document the baseline and estimate the RCMs' electric and natural gas energy savings potential before implementation begins.

The implementation costs used to calculate project economics under the program are based upon reasonable market costs as determined by the RSP and approved solely by Platte River. Resources to obtain market costs include, but are not limited to industry accepted project estimation resources, vendor quotes, or professional judgment. The Customer is afforded the flexibility to utilize in-house staff or an outside contractor to implement RCx measures implementation. Final implementation costs may vary from the estimated market costs; however, the market costs will be utilized to support \$0.05 per sq ft up to \$12,000 contractual obligations.

5.5.1 FOCUSED ASSESSMENT

A focused assessment of the energy using systems and equipment is necessary to build on the general site assessment done in the Planning Phase. The assessment focuses on problem areas identified by facility staff, identified RCMs, and potential new RCMs. At the facility level, the following information is typically collected and documented:

- Facility location, use, and operating/occupancy schedule
- Systems with highest electric/natural gas energy use and demand
- Significant control, operational, and maintenance problems
- Comfort problems
- Operations and maintenance (O&M) practices
- Major equipment sequences of operation

At the system and equipment level, the assessment involves collecting nameplate information and conducting a minimum standard set of diagnostic tests and parameter measurements. Standardized RCx forms for common equipment types are provided in Appendix F. The system and equipment assessments generally include the following information:

- Nameplate data
- Design and operational intent
- Actual operation (e.g. set points, schedule, sequence of operation)
- Actual operating parameters (e.g. temperature, pressure, flow)

Results from the assessment will be used to develop the Diagnostic and Calculation Plans, the Customer Selection Form, and a punch list or master list of deficiencies. The tasks outlined Table 5-2 provide a summary of the typical investigation activities expected to be executed for major system components. This scope of work is provided as an example, and may change for different facility types.

Table 5-2 RCx Survey Elements Summary (Example)

System or equipment	Survey minimum requirements
Chiller	<ul style="list-style-type: none"> • Document sequence of operations Sequence of Operation (SeqOp) • Verify/justify SeqOp • Document actual schematic • Spot measure actual performance (kW/ton) • Document setpoints • Verify temperature and pressure sensor calibration • Verify thermostat calibration • Document operations and maintenance (O&M) procedures • Collect trend data to identify operational problems and establish baseline operation
Air Handling Unit	<ul style="list-style-type: none"> • Document SeqOp • Verify/justify SeqOp • Document system type • Document nameplate ratings • Document actual schematic • Document temperature, pressure at control points • Verify economizer operation (if present) • Verify damper operation and sealing • Verify temperature and pressure sensor calibration • Verify proper chilled water, hot water, and/or steam valve operation • Measure motor/fan load, flow, pressure • Identify operating point on fan curve • Verify inlet guide vane /discharge damper / Variable Frequency Drive (VFD) operation (if present) • Document O&M procedures • Collect trend data to identify operational problems and establish baseline operation

System or equipment	Survey minimum requirements
Cooling Tower	<ul style="list-style-type: none"> • Document SeqOp • Verify/justify SeqOp • Document system type • Document nameplate ratings • Document temperature, flow at control points • Document O&M procedures • Collect trend data to identify operational problems and establish baseline operation
Control System	<ul style="list-style-type: none"> • Document SeqOp for the HVAC system, integrating the equipment SeqOps • Verify/justify SeqOp • Verify and sketch system schematic

5.5.2 PRESENTATION OF RCMS

Following approval of the RCM Diagnostic and Calculation Plans by Platte River, the RSP will update the Customer Selection Form. This form includes measure descriptions, energy savings, implementation costs, simple payback periods, and estimated completion dates. The Customer Selection Form also identifies three separate RCM bundles recommended by the RSP with an option for customization.

Together with the RSP and Platte River, the facility representatives review the project recommendations. The bundle of RCMs to be implemented is agreed upon by all parties, taking into consideration factors such as comfort, safety, or liability as input by the participants in the meeting. Also to be considered is the Customer's commitment to spending at least the minimum amount for the facility \$0.05 per sq ft up to \$12,000 for implementation of agreed upon RCx measures that result in a bundled estimated simple payback of 2 years or less. Although this meeting provides a singular formal communication of results, the RSP is also encouraged to review RCM status with the building ownership on an ongoing basis to facilitate a quick implementation timeframe.

5.5.3 IMPLEMENTATION SUPPORT

During the Implementation Phase, the RSP works hand-in-hand with the Customer's implementation team to identify the recommended measures and provide recommendations to "fix" the problems. The implementation team includes the facility engineers, operational staff, and the mechanical, electrical, and controls contractors. As the Customer approves RCx measures, the implementation team will be asked to "fix" the items associated with the relevant measures. The goal of this phase is to fully implement all agreed-upon RCx measures and stand ready for final verification.

Implementation of the RCMs is the sole responsibility of the Customer. However, the RSP is required to provide technical support during this phase for the Customer to implement the RCMs. A description of the Customer's role and the RSP's role in implementation is provided below.

- **Customer Implementation** activities are specific to funding implementation of the recommended RCMs (\$0.05 per sq ft up to \$12,000). Examples may include: mechanical/electrical contracting, professional engineering design, controls modifications, and installation of equipment that is required for the RCM. The Customer may choose to solicit these services from the RSP, in which case the RSP would be working under direct contract with the Customer and not Platte River.
- **RSP Implementation** assistance is provided to Customers to guide them from a recommended solution to the physical installation of the RCM. These activities may take the form of troubleshooting recommended control sequences, suggesting alternative RCM strategies during implementation, commenting on alternative design solutions, and answering technical questions. These costs are included as part of the RSP's price for the implementation phase of the project.

Key RSP Implementation Phase Deliverables

- 1) Diagnostic and Calculation Plans for all RCMs
- 2) Updated Customer Selection Form
- 3) Presentation of Implemented RCMs to customer
- 4) Ongoing RCM implementation support for Customer

5.6 VERIFICATION PHASE OVERVIEW

During the Verification Phase, the RSP evaluates facility trending data (from the building EMS, facility sub-meters, or utility meter) and revisits the site to verify that measures have been properly completed (e.g. new control strategies are functioning properly, repairs have been made, etc). The RSP prepares and submits the Verification Report that summarizes the final findings and impacts from the project. The target timeline for completion of the Verification Phase is approximately three to ten weeks for a typical project.

5.6.1 VERIFY RCM IMPLEMENTATION

Initial RSP verification activities will include a site visit to confirm the installation of the RCMs approved in the Customer Selection Form. Activities will consist of visual inspections and functional testing/retesting as appropriate to ensure RCMs were completed as anticipated. The RSP will report these preliminary findings to Platte River. If discrepancies are found between the implemented RCMs and those agreed to with the building owner during the Implementation Phase of the project, Platte River may require that all verification activities be halted until they are implemented by the Customer.

To confirm that the recommended RCMs were properly implemented and savings estimates are accurate, the RSP is required to complete the verification activities identified in the completed RCMs' Diagnostic and Calculation Plans. The verification may consist of data trending, spot measurements, visual checks, and/or interviews with the party responsible for implementation. Generally, the verification procedures follow Option A or Option B of the International Performance Measurement & Verification Protocol.

Any discrepancies noted between the actual and recommended RCMs must be documented and presented in the Verification Report. It is essential that documented data be included in the report to support the final savings calculations and account for such implementation discrepancies. If discrepancies exist, the associated savings are recalculated, and the revised savings for each measure are presented in the report.

5.6.2 VERIFICATION REPORT

The Verification Report serves as final documentation for each of the project's implemented RCMs. The purpose of this report is to verify that the RCMs were properly implemented and document verified electrical demand, energy, and natural gas savings for each RCM. Planning and results of the verification activities for each implemented RCM will be used by the RSP to prepare the Verification Report. This report includes a summary of completed RCMs, a summary of trending and functional testing, and the final estimated costs and energy savings.

The Verification Report is submitted to Platte River for review and comment. Any requested changes are incorporated and a copy of the approved report is presented to the Customer. A copy of the required Verification Report template is included in Appendix H of this manual. Deviations from this template must be pre-approved in writing by Platte River.

Key RSP Verification Phase Deliverables

- 1) Verification Report
- 2) Participation in presentation of Verification Report to Customer, if necessary

Appendix A

Sample BTU Project Application

A sample copy of the *Building Tune-up Program* Project Application (front page) is provided here in this appendix. A Microsoft Excel version of this application is available by contacting Platte River or at www.prpa.org/business/tuneup

Building Tune-up Program Application (v2.0)

Page 1: General Customer and Project Information

Approval Code:



Estes Park • Fort Collins • Longmont • Loveland

Complete this application to apply for funding for Building Tune-up projects in existing commercial buildings.

Project Eligibility

Project is eligible to participate in Building Tune-up Program if:

1. Project is an existing commercial building served by one of the four following electric utilities: Estes Park Light & Power (970-577-3583), Fort Collins Utilities (970-221-6700), Longmont Power & Communications (303-651-8386), Loveland Water & Power (970-962-3000).
2. Unless otherwise approved by Platte River Energy Services, Customer must work with a qualified Retro-commissioning Service Provider (RSP) to perform retro-commissioning (RCx) work and submit RCx plan prior to start of project for pre-approval.
3. Projects will be qualified on a case by case basis and are at the discretion of Platte River. Please contact Platte River Energy Services for more information on incentives available and/or qualifying your specific project.

Steps to Participate

Important: Refer to the BTU Manual to see how your specific project process may differ based on your facility size and/or system types.

1. Contact a qualified Retro-commissioning Service Provider (RSP) or Utility or Platte River Representative for help with application.
2. Submit completed project application for preliminary approval prior to selection of qualified RSP and work being performed; including the following required pages: Page 1 - Customer Info and Page 2 - Project Pre-screening.
3. Determine if your project and building will require a detailed RCx study or Direct Implementation to be performed by the applicable qualified RSP.
4. Select qualified RSP and sign and submit Page 3 - Building Tune-up Program Agreement before the start of the Planning Phase of the BTU project.
5. Complete either the project "BTU Work Order" tab (located in this workbook) or RCx Plan (as defined in the BTU Manual) and submit a signed and completed Building Tune-up Plan Approval Form (Addendum #1) listing selected measures to be implemented prior to work being performed.
6. Once selected measures are implemented, send the final measurement and verification results, proof of work performed, and an IRS W-9 form to Platte River Energy Services (include notes of any changes to the original pre-approved project).
7. Receive incentive check typically in four to six weeks.*

*Platte River Energy Services may request a site visit at any time to confirm the accuracy of the application and reserves the right to determine the final eligibility and incentives for all projects.

Eligible Utility Customer		Party Completing Form (if different from company at left)	
Company:		Company:	
Site Address:		Address:	
City, state, zip:		City, state, zip:	
Contact person:		Contact person:	
Mailing address: <i>(if different)</i>		Mailing address: <i>(if different)</i>	
City, state, zip:		City, state, zip:	
Telephone:	Fax:	Telephone:	Fax:
Email:		Email:	
How did you hear about program?			
Project Site			
Serving electric utility:	Select your local utility	Facility type:	
Total Project Area (sq ft):	Enter Building Square Feet	If Other, describe:	
Annual Hours of Operation:	Age of Building	Renovation Date:	
Estimated Project Schedule			
Start date:		Completion date:	
Incentive funds are subject to change without notice. Contact Platte River Energy Services to ensure that funds are available.			
Contact Information			

For questions or to submit an application for approval or payment, please contact Platte River Energy Services:

Platte River Power Authority
2000 E Horsetooth Rd
Fort Collins, CO 80525-5721

Phone: 970-226-4000
Fax: 970-229-5244
Email: tuneup@prpa.org

Please be sure to direct all correspondence to Energy Services.

Building Tune-up Program Application (v2.0)

Page 2 - Project Pre-screening and Assessment Checklist



Information about this page

This page is required to be completed for project pre-approval prior to work being performed. The data provided on this page will help us determine the best building tune-up approach for your project. Please leave cells blank if you do not know the answer to the question(s) or specific equipment type(s). Contact Platte River Energy Services for assistance with this page if needed.

General Information Fill in green cells only

Program Expectations			
Building Schedule	Occupied description	Unoccupied Description	
Describe hours and days of week			
Number of Daily Occupants			
Primary complaints of occupants? <i>(e.g. comfort, energy use, etc)</i>			
Planned/ expected equipment replacements			
Age and availability of as-built drawings and/or sequence of operations?			
Previous energy assessments performed?			
List any Energy Efficiency Projects you have done or plan on doing in the future			
Will you be able to provide natural gas data?		Gas provider?	

Building Description NOTES

Building's energy use - rank your building's energy use from 1 to 5. <i>(1 is poor, 3 is average, 5 is good)</i>				
Building Size (sq ft)				
Building Age				
Do you own or lease your building/space? <i>(if lease, then owner permission is required)</i>				
HVAC Preventative Maintenance?				

BTU Equipment Description # of units NOTES

Thermostats (single zone, local control)	Select from dropdown list below			
	Non-programmable			
Thermostats (single zone, local control)	Programmable			
Thermostats/sensors (central control)	BMS system			
Heating & Cooling Type 1				
Heating Source				
Cooling Source				
Equipment Age				
Outside Air Economizer(s)				
Fixed Minimum Outside Air				
Heating & Cooling Type 2				
Heating Source				
Cooling Source				
Equipment Age				
Outside Air Economizer(s)				
Fixed Minimum Outside Air				
Heating & Cooling Type 3				
Heating Source				

Cooling Source				
Equipment Age				
Outside Air Economizer(s)				
Fixed Minimum Outside Air				
Other HVAC System Types to consider (e.g. cooling towers, process equipment, pumps, compressed air, etc)	write description here			
BAS/EMS System Type?				
BAS trending capability?				
Water fixtures - Faucet Aerators or showerheads				
Water fixtures - Pre-rinse Spray Valves				
Lighting Controls (Interior)				
Lighting Controls (exterior)				
Lighting de-lamping opportunity?				
PC Power Management				
Plug Loads: office loads, (monitors, task lights, speakers, etc), Copiers, Printers, vending machines, drinking fountains, coffe makers, etc.				
Domestic Hot Water				
Domestic Hot Water Pump Timer				

BTU Score ###

Building Tune-up Program Application (v2.0)

Page 3: Building Tune-up Program Agreement



Approval Code:

Information about this page

This Agreement is to be read, signed, and submitted after the qualified RSP is selected and prior to the Planning Phase being performed. The "Potential Rebate" is calculated based on one of the following: A) If project building is less than 50,000 square feet rebate is equal to \$0.15 per square foot of the project building; or B) If project square feet is greater than 50,000 square feet, rebate is based on the selected RSP's cost of performing RCx services. Contact Platte River Energy Services for questions you may have regarding this agreement.

Estimated Economics and Timeline

	Start Date	Completion Date		
Planning Phase/Walk-Through:	1/30/1900	2/29/1900	Potential Rebate	
Implementation Phase	3/1/1900	5/30/1900	Customer Commitment	Actual costs and rebate may vary depending on results of the RCx proposals, RCx plan or walk-through assessment is performed. Customer commitment is \$0.05 per sq ft
Verification Phase	5/31/1900	6/30/1900	Total	\$ -
Completion	6/30/1900		Est. Payback	< 2 years* *Typical energy cost savings sufficient to repay the customer cost in two years or less

Terms and Conditions

Platte River is implementing *Building Tune-up (BTU) Program* to provide customers with technical services to improve energy-efficiency in qualifying Platte River served facilities. The following terms and conditions apply to the program:

1. To qualify for the *Building Tune-up Program* the proposed facility must:
 - a. Facility is an existing commercial building served by one of the four following electric utilities: Estes Park Light & Power (970-577-3583), Fort Collins Utilities (970-221-6700), Longmont Power & Communications (303-651-8386), Loveland Water & Power (970-962-3000).
 - b. Abide by the program rules and eligibility requirements in effect on the date of the submitted Project Application.
 - c. Obtain project pre-approval from Platte River prior to work being performed.
2. Failure to provide any of the required information, including signatures, forms, or other requested documentation, will result in the return of the Project Application.
3. Unless otherwise approved by Platte River Energy Services, Customer shall work with an approved Retrocommissioning Service Provider (RSP) to perform retrocommissioning (RCx) work. Customer shall adhere to the steps and requirements of Platte River's *Building Tune-up Program*.
4. Projects will be pre-approved or qualified on a case by case basis and are at the discretion of Platte River.
5. Platte River rebate for the partial cost of the retrocommissioning services described in the *Building Tune-up Program Manual* will be paid directly to the Customer, unless an approved alternative payment recipient is identified.
6. If the Customer chooses to not continue the project at the completion of the planning phase, Platte River will reimburse the RSP for their cost of service to complete the planning phase.
7. If the Customer chooses to not continue the BTU project during the implementation phase, upon execution of the *Building Tune-up Plan Approval Form*, the Customer will not be eligible to receive a rebate from Platte River. The Customer will reimburse the RSP for the services provided pro rata to the project termination date, or as otherwise set forth in Customer's contract with the RSP.
8. Customer rebates may be subject to a cumulative rebate cap per calendar year. Reaching this cap will not necessarily limit future rebates received from Platte River in a subsequent calendar year. Any rebates received through Xcel Energy as part of any Platte River program will not count towards the Customer's annual rebate threshold.
9. For the purposes of Platte River's energy efficiency programs, a Customer is defined as a company or organization that receives electric service from one of Platte River's municipal owners under an approved municipal rate schedule. A Customer is a holder of a single account, multiple accounts in aggregate or corporate accounts. Multiple accounts or corporate accounts with a single municipal customer identification number will be considered a single Customer. An organization of this type can participate in multiple efficiency programs, but will be subject to any applicable customer rebate caps. Platte River retains the right to make final determination of customer eligibility.
10. Platte River will submit to Customer the name(s) and address(es) of the RSP that Platte River identifies through a bidding process to provide the technical support services if the Project Application is approved. The final decision to proceed under the program and use of such persons will be subject to the approval of Customer.
11. Customer shall enter into a contractual legal agreement with the selected RSP for retrocommissioning services described in the *Building Tune-up Program Manual* and other services to be performed at the request of the Customer.
12. Customer agrees to require its employees, design team, and contractors to cooperate with Platte River and the approved RSP to provide Facility operating data and energy use evaluation assistance needed by Platte River for participation in the program, including cooperation in gathering electricity (and natural gas) bills and releasing information to necessary parties in the *Building Tune-up Program*.
13. Platte River reserves the right to inspect the facility for compliance with the program requirements. Inspection may include a telephone survey, site visit, and/or the installation of temporary monitoring equipment at any time up to two years after installation. Customers will allow Platte River and their subcontractors' reasonable access to and egress from site during normal business hours for inspection purposes. If selected for inspection, the rebate will be withheld pending outcome of the inspection. If the equipment is found to be in compliance with the program requirements, the rebate will be paid otherwise the Customer will be notified.
14. Platte River and program RSPs shall have no responsibility for the discovery, presence, handling, removal or disposal of, or exposure of persons to hazardous materials of any kind in connection with the Facility including, but not limited to, asbestos, asbestos products, PCBs, or other toxic substances. Customer is required to notify Platte River, RSP, and other sub-contractors if hazardous materials exist prior to work being performed.
15. Customer acknowledges that prior to performing any work, a Building Tune-up Plan Approval Form including, but not limited to, the terms of the Customer's financial obligations is required. If approved by Platte River Energy Services, Customer may perform implementation services with a third party or with their own facility staff. In which case, Customer agrees to adhere to the requirements of the Building Tune-up Program.

16. If Customer does not work with the selected RSP, Customer, or third party contractor, must demonstrate to Platte River and to the selected RSP that the RCMs recommended by the RSP were implemented and are operating as intended. For example, demonstrate in person or provide trend data, etc.

17. Program procedures, requirements, and rebate levels are subject to change or cancellation without notice.

18. Platte River makes no representations and provides no warranty or guaranty with respect to the accuracy or completeness of the provided technical support services.

19. Participation as a RSP does not constitute an endorsement by Platte River, nor does it certify or guarantee the quality of work performed. Platte River is not responsible if the RSP or other contractor, retailer, vendor or other party provides the Customer with inaccurate information about the amount of any rebate or conditions of the program.

20. The terms and conditions set forth herein constitute a the complete Agreement applicable to this promotion and may be supplemented only by the execution of the Building Tune-up Plan Approval Form (Addendum #1), and supersede all prior representations or understandings, whether written or oral. Platte River shall not be bound by or be liable for any statement, representation, promise, inducement or understanding of any kind that is not set forth herein. Platte River reserves the right to change or cancel this promotion or its terms and conditions at any time.

21. In consideration of receiving the incentives stated herein, Customer and Building Owner shall indemnify, protect, defend and hold harmless, Platte River, its board members, directors, officers, employees, partners, principals, contractors, agents, and representatives, from and against any and all claims, costs, damages, demands, expenses, fines, judgments, liabilities, losses, penalties, and remedial actions of any kind, including but not limited to, reasonable attorneys' fees and the costs of defense arising, directly or indirectly, in whole or in part, out of participation in the Building Tune-Up Program, the performance of the Measures, or the provision of assistance and incentives by Platte River related to the Building Tune-Up Program.

22. Customer and Building Owner shall require that all parties, contractors, or subcontractors implementing the proposals and/or installing the Measures that are the subject of this Agreement maintain comprehensive general liability insurance in amounts not less than \$500,000 each person \$1,000,000 each occurrence for bodily injury, and \$500,000 each occurrence \$1,000,000 in aggregate for property damage. If the Customer is implementing the proposals and/or installing the Measures, the Customer shall maintain insurance in the amounts specified herein.

By signing below, Customer and the Building Owner acknowledge and agree that they have read, understand and agree to be bound by the terms and conditions set forth in this Agreement, and to the customer eligibility, measure eligibility and participation procedures for the Building Tune-up Program in the BTU Program Manual as amended from time to time. Customer and Building Owner further certify that all of the information contained within this application is true and factual. Building Owner specifically agrees to be equally bound by all of the requirements and obligations of the "Customer" as set forth in this Agreement.

I have read, understood, and agree to be bound by the terms and conditions of this Agreement as set forth herein.

CUSTOMER:

BUILDING OWNER (IF DIFFERENT FROM APPLICANT):

Signature:		Signature:	
Name:		Name:	
Title:		Title:	
Business:		Business:	
Address:		Address:	
Date:		Date:	
Phone:		Phone:	

Alternate incentive payment recipient:

Complete this section only if you want the incentive payment to go to someone other than the utility's customer of record at the project site.

Alternate incentive payment recipient:			
An IRS Form W-9: Request for Taxpayer Identification Number and Certification for the company named below must be submitted before payment can be made.			
Company:		Contact:	
Address:		Phone:	
		Email:	

I authorize Platte River Power Authority to make the incentive payment to the identified party.

Signature: _____	Date: _____
Name: _____	Phone: _____
Title: _____	

Return application materials to:
 Platte River Power Authority
 2000 E. Horsetooth Rd.
 Fort Collins, Colorado 80525-5721

Contact information:
 Telephone: (970) 226-4000
 Email: tuneup@prpa.org
 Fax: (970) 229-5244

Building Tune-up Program Application (v2.0)
Page 4: Addendum #1 - Building Tune-up Plan Approval Form



Customer Name:
 RSP or RC:
 Program Representative:
 Date:

Approval code:
Platte River Use Only

Information about this page

This Addendum to the BTU Agreement is to be completed, signed, and submitted prior to work being performed. Table A: Customer Selection Form (below) is to be completed after either the project "BTU Work Order" tab (located in this workbook) or the RCx Plan (as defined in the BTU Manual). Customer shall select the measures to be implemented by selecting an "X" next to the measures.

Table A: Customer Selection Form

RCM Description	Measure Selected by Owner ¹ (select "X")	RCM No.	Annual Electric Energy Savings (kWh/yr)	Annual Gas Energy Savings (Therms/yr)	Total Cost Savings	Measure Incremental Cost (\$)	Simple Payback (yrs)	Project Approval	
								Estimated Completion Date	Owner Initials
		1							
		2							
		3							
		4							
		5							
		6							
		7							
		8							
		9							
		10							
		11							
		12							
		13							
		14							
		15							
		16							
		17							
		18							
Totals (For all Selected (X) values only)					\$	\$	#DIV/0!		
Project Funding Summary					Est Customer payback after rebate		#VALUE!	years	
Potential Platte River Rebate	\$0	Customer Committed Funds	#VALUE!						
Est. Project Timeline:	Start date	1/0/1900	Completion Date:	1/0/1900					

Notes
 1. Customer selects / de-selects measures by editing the column labeled "Measure Selected By Customer. Use the X key to select / de-select measures.

By signing this addendum to the BTU Program Agreement, Customer and Building Owner represent, warrant, acknowledge and agree that:

I/we have read, understand, and agree to all Terms and Conditions of the Project Application and the customer eligibility, measure eligibility, and participation procedures for Building Tune-up Program in the Participant Program Manual. I/we understand that these requirements may be amended from time to time and agree to be bound by any such amendments.

I/we certify that all the information contained within this application is true and factual.

I/we agree to the timeline and payment amounts committed by ourselves and Platte River Power Authority listed above for the measures selected in above Table A: Customer Selection Form for project.

In consideration of receiving the incentives stated herein, Customer and Building Owner shall indemnify, protect, defend and hold harmless, Platte River, its board members, directors, officers, employees, partners, principals, contractors, agents, and representatives, from and against any and all claims, costs, damages, demands, expenses, fines, judgments, liabilities, losses, penalties, and remedial actions of any kind, including but not limited to, reasonable attorneys' fees and the costs of defense arising, directly or indirectly, in whole or in part, out of participation in the Building Tune-Up Program, the performance of the recommended measures, as described in Table A of this agreement the provision of assistance and incentives by Platte River related to the Building Tune-Up Program.

As the signatory, I/we have the authority to authorize the project to begin and have contracted with the selected RSP.

CUSTOMER:

Signature:
 Name:
 Title:

BUILDING OWNER (IF DIFFERENT FROM CUSTOMER):

Signature:
 Name:
 Title:

Business:

Address:

Date:

Phone:

Business:

Address:

Date:

Phone:

Alternate incentive payment recipient:

Complete this section only if you want the incentive payment to go to someone other than the utility's customer of record at the project site.

Alternate incentive payment recipient:

An IRS Form W-9: Request for Taxpayer Identification Number and Certification for the company named below must be submitted before payment can be made.

Company:

Address:

Contact:

Phone:

Email:

I authorize Platte River Power Authority to make the incentive payment to the identified party.

Signature: _____

Name: _____

Title: _____

Date: _____

Phone: _____

Return application materials to:
 Platte River Power Authority
 2000 E. Horsetooth Rd.
 Fort Collins, Colorado 80525-5721

Contact information:
 Telephone: (970) 226-4000
 Email: tuneup@prpa.org
 Fax: (970) 229-5244

Appendix B

Sample BTU Work Order for Tier 1

A sample copy of the Work Order of the *Building Tune-up Work Order Sheet* is provided in the Microsoft Excel Version BTU Application for use in Tier I projects only. All RCMs listed in the BTU Work Order have individual worksheets to be completed in the BTU Application.

Building Tune-up Work Order - Tier 1													Reapproval		
Yellow highlighted cells are from inputs on pre-screening worksheet and may be overridden or other measures may be selected															
RCx Measures	Qty	Total Area (ft ²)	Priority	Notes	Unit Deemed Cost (\$)	Total Measure Cost (\$)	Pay-back (yrs)	Electric Savings (kWh/yr)	Gas Savings (th/yr)	Water Savings (kgal/yr)	Annual Cost Savings	CO2e (MT)	Incentive Eligible Costs (\$)	Non-Rebate Cost (\$)	Re-approval Cost (\$)
1a	Initial Walk-through Assessment	0	0		\$195	50							50		
1b	PM check - basic functional testing/Cx, filters, coil condition, belt tension, etc.	0		PM needs to be done before tune-up work can start		50								50	
2	Thermostat Controls														
2a	Reprogram existing tstats to match occupancy	0	0		\$55	50		0	0	0	0	0	50		
2b	Install programmable tstat(s)	0	0		\$215	50		0	0	0	0	0	50		
2c	BMS or Advanced Controls - see 9 for more	0	0		\$1,000	50		0	0	0	0	0	50		
3	Economizer/Ventilation & Cooling														
3a	Adjust existing economizer - temp setting, etc.	0	0		\$55	50		0	0	0	0	0	50		
3b	Replace enthalpy OA sensor w/ dry bulb	0	0		\$200	50		0	0	0	0	0	50		
3c	Adjust/repair damper seal, linkage, actuator	0	0		\$105	50		0	0	0	0	0	50		
3d	Replace damper actuator or linkage	0	0		\$645	50		0	0	0	0	0	50		
3e	Add new economizer (no existing economizer only)	0	0		\$1,000	50		0	0	0	0	0	50		
3f	Add demand control ventilation to economizer	0	0		\$500	50		0	0	0	0	0	50		
3g	Adjust minimum OA setting	0	0		\$100	50		0	0	0	0	0	50		
3h	Split system airflow measurement/adj.	0	0		\$105	50		0	0	0	0	0	50		
3i	Install DX OAT lockout controls	0	0		\$280	50		0	0	0	0	0	50		
3j	Calibrate BMS economizer OAT sensor	0	0		\$135	50		0	0	0	0	0	50		
4	Water Efficiency														
4a	Install .5 gpm ultra low-flow aerators	0			\$30	50		0	0	0	0	0	50		
4b	Install low-flow pre-rinse spray nozzle(s)	0			\$215	50		0	0	0	0	0	50		
5	Lighting Controls														
5a	Adjust exterior lighting timer or photocell	0			\$105	50		0	0	0	0	0	50		
5b	Adjust or install occupancy sensor/timer	0			\$105	50		0	0	0	0	0	50		
5c	De-lamping of fluorescent fixtures	0			\$5	50		0	0	0	0	0	50		
6	PC and Office Power Management														
6a	Set-up power management for personal computers	0			\$15	50		0	0	0	0	0	50		
6b	Controls on office loads, (monitors, task lights, speakers, etc), Copiers, Printers, vending machines, drinking fountains, coffee makers, etc.	0			\$150	50		0	0	0	0	0	50		
7	Domestic Hot Water														
7a	Adjust DHW temperature - decrease to 120°F	0			\$55	50		0	0	0	0	0	50		
7b	Adjust DHW recirc pump timer schedule	0			\$55	50		0	0	0	0	0	50		
7c	Install & program a DHW recirc pump timer	0			\$430	50		0	0	0	0	0	50		
8	Heating Adjustments														
8a	Furnace combustion efficiency (RTU/SS)	0	0		\$190	50		0	0	0	0	0	50		
8b	Boiler tune-up	0	0		\$325	50		0	0	0	0	0	50		
9	BMS or Advanced Controls	# of units	Sq ft												
9a	Averaging sensors	0			\$590	50		0	0	0	0	0	50		
9b	Thermostat relocation	0			\$240	50		0	0	0	0	0	50		
9c	Install override timer	0			\$430	50		0	0	0	0	0	50		
9d	Integrated economizer and DX controls	0	0		\$430	50		0	0	0	0	0	50		
9e	Add morning warm up / cool down controls	0	0			50		0	0	0	0	0	50		
9f	BMS sensor calibration	0	0			50		0	0	0	0	0	50		
9g	BMS damper calibration	0	0			50		0	0	0	0	0	50		
9h	BMS control system programming	0				50		0	0	0	0	0	50		
9i	BMS control system trending	0				50		0	0	0	0	0	50		
9j	OAT Sensor Lockout for electric reheat	0				50		0	0	0	0	0	50		
10	Custom														
10a	Custom measures	0				50		0	0	0	0	0	50		
11	Final Reporting				\$290	\$290							50		

The *Building Tune-up Tier I Report* to the customer is provided in the Microsoft Excel Version BTU Application for use in Tier I projects only



Building Name

Building Tune-Up Report

Building Address

Building Address

[Insert Picture Here]

LIST OF TUNE-UP MEASURES PERFORMED

- Adjusted heating/cooling equipment operation schedule to better match building's typical occupancy
- Installed programmable thermostat(s) to schedule heating/cooling equipment according to typical occupancy
- Adjusted or repaired RTU economizer components (sensors, damper actuators, etc.) for proper function
- Measured and adjusted amount of outside air coming into RTU
- Measured and adjusted split system air conditioning airflow
- Installed cooling temperature lockout controls
- Calibrated BMS economizer outdoor temperature sensor
- Installed ultra low-flow faucet aerator(s)
- Installed low-flow pre-rinse spray valve nozzle(s)
- Adjusted exterior lighting timer or photocell
- Calibrated existing lighting occupancy sensors
- Set-up power management for personal computers
- Lowered domestic hot water (DHW) temperature
- Adjusted DHW circulation pump timer schedule
- Installed DHW circulation pump timer
- Tuned gas combustion equipment of heating system
- Checked building automation system to review calibration of control points, adjust setpoints, and optimize programming of controls
- Other Opportunities: See below

RESULTING ANNUAL SAVINGS	
0	Electricity (kWh)
0	Natural Gas (Th)
0	Water (kgal)
0	CO2 (metric tons)
\$0	Cost Savings

COST OF TUNE-UP SERVICES	
\$0	Total
#DIV/0!	Payback, yrs



Measuring the % of outside air and total flow in RTU's using TrueFlow Flow Plates

In this protocol we will determine the % of Outside Air to Total System Volumetric Airflow in RTU's. There are several setup conditions you will encounter depending on the size of the RTU's and the number of TrueFlow plates that you have available for the test. This protocol focuses on two setup scenarios:

- The RTU is larger than 5 ton and there only 2 TrueFlow (TF) plate kits available, requiring the Total system airflow and outside air flow to be measured separately.
- The RTU is 5 ton or less and 2 TrueFlow plate kits enable you to determine Total System airflow and outside airflow at the same time in one test.

We would ideally always like to be able to do simultaneous system and outside air flows to determine the % of outside air, but this can only be done if we have smaller units of 5 ton or less in size and we only need two plate kits, or in larger than 5 ton units you have enough plates to fill the return air filter lot and the economizer filter slot at the same time.

Once the total system airflow and OA flow is determined, you will need to assess if the OA airflow is within the % specified for the building occupancy type.

Larger than 5 Ton RTU's

Here is the protocol if you only have two sets of plates and a larger than 5 ton unit. First we determine the total system volumetric airflow, and then separately determine the OA flow through the economizer to determine the % of OA:

First determine the total system volumetric airflow in return air filter slot (TrueFlow plates must cover > 50% of the opening):

- Replace dirty return air filters and clean the economizer filter.
- Measure Normal System Operating Pressure (NSOP) with a pressure tap on the supply side of the blower. Connect tube to pressure input tap of the manometer set to Pressure (use any digital manometer).
- Record NSOP on form in 'Supply Plenum Pressure, With Filters in.
- Remove filters from return air rack and install TF plates with fillers added (the filler area cannot exceed 50% of total opening area). Be sure not to pinch TF tubes when closing the filter access.
- With blower on, measure pressure drop across each TF plate, and record in the pressure box for each plate in the 'As Found System Flow' (A) for the plate size.
- Look up indicated airflow for each plate in the TF Meter Flow Conversion Table A (use either the Table for Pa or in wc, and make sure to read the flow for the plate size used). Record in the Raw Flow box in the As Found System Flow (A) for each plate.
- Add up the Raw Flows from all plates and record as the Total Raw Indicated Airflow.
- Measure supply plenum pressure True Flow System Operating Pressure (TFSOP) with the flow plates still in the return filter slot. Record on top of form in System Supply plenum pressure, TFSOP with Plates in.
- Determine Flow Resistance Correction Factor (CF) for system airflow using TF Appendix B, or calculate it using the sq root of NSOP/TFSOP. Record it on the form.
- Multiply Total Raw Indicated Airflow by the CF to obtain Corrected System Airflow.
- Measure return air temperature with a probe inserted into the return air plenum where there is a good mix of outside and return air.
- Obtain Total Correction factor by multiplying the Correction Factor (CF) by the Air Density Factor (found in TF Appendix Table C.I.c). The Flow Conversion Tables in Appendix A converts the pressure drop to air flow at sea

level. The Air Density Factor converts that flow for the air density at the air temp that is going through the plate at our altitude.

- Convert to 'Total Corrected Flow' by multiplying the Total Raw Flow' by the Total Correction Factor.
- Calculate 'As Found' CFM per ton and record on form.
- If lower then 325 CFM/Ton adjust blower belt pulleys and other measures to increase airflow to at least that rate.
- If airflow is adjusted repeat steps above and record in 'Adjusted System Airflow (C).

Then determine volumetric Outside Air (OA) airflow in the economizer:

- Remove TF plates from RA filter slot and replace with clean RA air filters.
- Remove economizer filter and install TF plate/s and fillers in the economizer filter slot.
- With blower on measure pressure drop across each plate.
- Record pressure of each plate in 'As Found Econo Flow' (B).
- Look up indicated airflow for each plate in the TF Meter Flow Conversion Table A (use plate pressure drop measurement in Pa or in wc, and Plate #14 or 20 columns to find 'Indicated' air flow) and record in the raw flow line in section (A) for each plate.
- Add up the indicated airflow for all the plates to get Total Raw Indicated Airflow for the total OA.
- Measure supply plenum pressure (TFSOP) on the manometer channel A with the flow plates still in the economizer slot. Record on top of form in Econo Supply plenum pressure, TFSOP with Plates.
- Determine Flow Resistance Correction Factor (CF) for economizer airflow using TF Appendix B, or calculate it using the sq root of NSOP / TFSOP. Record on form.
- Calculate OA volumetric airflow (corrected OA flow x I.I) and record on form.
- Calculate As found OA % (volumetric OA flow/volumetric system flow).
- Is % of OA correct for the building occupancy type?

Appendix E Split System Heating and Cooling Protocol

Cooling Mode:

1. Measure and record total system airflow using TrueFlow flow plate
 - a. Target airflow is 350-550 cfm/ton
 2. If airflow meets target then leave it as is and note to customer that refrigerant charge should be checked as part of regular PM
 3. If less than 325 cfm/ton then identify cause and increase to at least 350 cfm/ton
 - a. If run into issues requiring large capital investment then reevaluate and make recommendation to customer
 4. Charge system to airflow per manufacturer specifications
 - a. If run into issues requiring large capital investment then reevaluate and make recommendation to customer
 - b. Record
 - i. Target and actual superheat, should be $\pm 5^{\circ}\text{F}$ of target OR
 - ii. For Thermal Expansion Valve (TXV), target and actual subcooling, should be $\pm 3^{\circ}\text{F}$ of target, use 10°F subcooling if OEM spec is not available
- Possible airflow issues: filters, closed registers, dirty fan, dirty coil, restricted duct, and other

Heating Mode:

1. Measure and record gas pressure for high and low fan speed. Adjust to within OEM spec if necessary.
 2. Measure and record temperature rise at high and low fan speed. If not within mid-range of OEM specs adjust airflow accordingly.
 3. Measure and record Total External Static Pressure (TESP) at high fan speed and evaluate if above OEM spec (or ~ 0.7 in wc).
 4. Measure and record exhaust flue vent CO level at steady state.
- Inform owner of any concerns and recommend solutions
 - Temperature rise on low or high end
 - Low/high TESP, airflow adjustment needed
 - CO levels
 - 0-25 ppm – ok
 - 25-100 ppm – medium
 - 100-400 ppm – high
 - >400 ppm – very high
 - Use TrueFlow flow plate as diagnostic tool if needed

Appendix F Building Site Assessment Form –Tier 2 & 3

A sample copy of the front page of the Building Tune-up Program Building Site Assessment Form is provided in this appendix. A Microsoft Word version of this form is available by contacting Platte River.

General Information

RSP: _____
 Project name: _____
 Project number: _____
 Facility address: _____
 Facility city, state, zip: _____

Building Characteristics

Characteristic	Description	
Year of construction		
Gross area (gross square footage)		
Percent of gross area designated as prime office space		
Percent of gross area designated as computer data center space		
Percentage and type of other secondary space uses (e.g. parking, clarify below if necessary)		
Building configuration (e.g. campus, towers, low-rise)		
Building use (e.g. office, school, hospital)		
Number of floors (levels)		
Number of occupants		
Annual occupancy rate of primary space by year	Year	Occupancy Rate (%)
	2007	
	2008	
	2009	
Number of personal computers in operation (approx.)		
Type of lighting equipment installed (e.g. T12, T8, HID)		
Describe the lighting current systems and control		
Weekly hours of operation by major space type	Space type	Hours/week
Building occupied for 11 or more of last 12 months?		
Brief renovation history		
Brief description of building improvements planned		

Building Equipment

Equipment	Description
Type of cooling system (e.g. central plant, district cooling, packaged A/C)	
Type of condenser (e.g. air or water, number of cells)	
HVAC distribution system (e.g. constant volume, variable volume, dual duct, multi-zone)	
Age of primary cooling system	
Heating system type	
HVAC control system type (e.g. pneumatic, DDC)	
Brief equipment replacement / renovation history	
Other (specify)	
Other (specify)	
Other (specify)	

Outline the current control strategies of the facility's HVAC and lighting systems.

Strategy	Description
Cooling Equipment	
What is the operating schedule of major cooling equipment?	
What is the chilled water supply temperature set point?	
What is the condenser water set point? Is it reset?	
Are there VFDs on the cooling tower fans?	
Describe the cooling equipment staging strategy	
Describe the use of any air-side or water-side economizers	
Air Handling Equipment	
Does the HVAC system have an automatic shutdown?	
Is an optimum start/stop strategy used?	
Is the air distribution system VAV or CV?	
Are the VAV boxes fan powered?	
For VAV systems, what is the supply static pressure set point?	
For VAV systems, is a supply static pressure reset strategy used? If yes, please indicate the strategy(ies) used.	

Strategy	Description
Are VAV terminal units DDC controlled through a global controller?	
Do the VAV terminal units' DDC controllers have capability to be scheduled?	
Does the facility use a zone temperature setback/setup strategy?	
What is the supply air temperature set point during the summer?	
Is a supply air temperature reset strategy used? If yes, please indicate the strategy(ies) used.	
What type of reheat does the air distribution system have, if any?	
What is the heating energy source (e.g. gas, electric, district)?	
How is outdoor air intake controlled?	
What is the minimum outside air fraction setting?	
Is the system equipped with zone isolation devices for minimizing energy use in off-peak hours?	
Is there exhaust air heat recovery?	

Building Control Systems

Strategy	Description
Does facility use a zone temperature setup/setback strategy?	
Is the central supply air temperature fixed or is a reset strategy used?	
Does central air system have pre-heat?	
Is free cooling used, i.e. with an air or water-side economizer?	
How is the outdoor air controlled? What is the design minimum outdoor air fraction?	
For VAV systems, is a supply static pressure reset strategy used?	
Does system have automatic shutdown?	
Is an optimum start strategy used?	
Is system equipped with zone isolation devices for minimizing energy use in off-hour operation?	
Is there exhaust air heat recovery?	
Other (specify)	
Other (specify)	
Other (specify)	

General O&M Issues

Has the heating system always met load? [Yes/No](#)

If no, under what conditions has the heating system not met load?

What was the approach to solve this problem?

Has the cooling system always met load? [Yes/No](#)

If no, under what conditions has the cooling system not met load?

What was the approach to solve this problem?

Is any free cooling used? [Yes/No](#)

If yes, please describe.

Is there any HVAC equipment that is considered to be undersized? [Yes/No](#)

If yes, explain:

What compensation is made for the undersizing?

Is there any HVAC equipment that is considered to be oversized? [Yes/No](#)

If yes, explain:

What compensation is made for the oversizing?

Is the facility mechanical equipment (fans, pumps, etc.) scheduled to start up simultaneously, or is the startup staged?

What HVAC adjustments are made to unoccupied areas or spaces (e.g., turn off HVAC, adjust thermostat to minimum heating and cooling, close off diffuser)?

Is the facility HVAC system airflow correctly balanced? [Yes/No](#)

If yes, when was it completed?

If no, explain:

Are there any problems with the humidification method (explain)? [Yes/No](#)

If yes, explain:

Describe the method of humidification for the building:

Are there any problems with the dehumidification method (explain)? [Yes/No](#)

If yes, explain:

Describe the method of dehumidification for the building:

From what areas in the facility are the most complaints received (explain nature of complaints)?

What is the worst facility problem and how is it managed?

Do you have a procedure for systematically identifying areas of excessive energy usage? [Yes/No](#)

If yes, describe:

Does the building facilities team have specific goals established for improving the building mechanical systems? [Yes/No](#)

If yes, describe:

In the past year, have modifications been made to improve the facility's energy efficiency? [Yes/No](#)

If yes, describe:

Additional notes, comments, and observations from RSP

Notes, Comments, and Observations from Facilities Manager

5.6.3 THE NEXT SECTION IS DIRECTED TOWARDS INDUSTRIAL FACILITIES AND SHOULD ONLY BE FILLED OUT AS NECESSARY.

5.6.4 FACILITY COMPRESSED AIR, PROCESSING AND REFRIGERATION SYSTEM

Complete this section only if your facility has compressed air systems, process equipment and/or refrigeration systems. Examples of these systems include, but are not limited to:

- Compressed Air Systems – Air compressor(s) and refrigerated air dryers that serve a manufacturing or process related activity.
- Process Equipment – Equipment such as conveyor lines, manufacturing equipment or equipment that runs continuously or for significant periods of time, have motors, and/or have specific heating/cooling requirements.
- Refrigeration Systems – Refrigeration equipment that is used to satisfy supply cooling requirements for food storage, manufacturing, or process equipment.

What are your primary objectives in managing your systems (check all that apply)?

Compressed Air	Process	Refrigeration	Objective
			Maintain continuous operation
			Improved or increased production
			Control and/or reduce energy use and costs
			Reduce capital costs
			Meet process quality standards
			Improve safety
			Reduce equipment maintenance
			Other:

What management approaches and tools do you currently employ (check all that apply)?

Compressed Air	Process	Refrigeration	Resources
			Preventative diagnostic testing
			Short term monitoring
			Long term monitoring
			Leak detection and repair
			Tracking energy use/costs
			Improving control strategies
			Using life-cycle costing to select opportunities
			Other:

What are the top two barriers to more effectively operate your facility's systems?

Compressed Air	Process	Refrigeration	Barriers
			Not enough staff time
			Lack of budget for efficiency improvements
			Capital expenses are too high
			Paybacks are too long
			Primary focus is on production
			Lack of accountability for system energy costs
			Lack of information about opportunities
			Lack of in-house technical expertise
			Lack of training
			Management approval
			Other:

What influences you the most in terms of adopting new management tools or approaches (rank on a 1 to 10 scale, where 10 is high)?

Compressed Air	Process	Refrigeration	Influences
			Books
			Industry articles and professional publications
			Peers/Professional organizations
			Classes/continuing education
			Demonstrated success of others in the market
			Internal pilot program success
			Outside consultants
			Equipment vendors and manufacturer reps
			Other:

5.6.5 FACILITY COMPRESSED AIR, PROCESSING AND REFRIGERATION SYSTEM INFORMATION

Complete this section only if applicable for the facility being submitted for consideration in the retrocommissioning program

Please list all air compressors that are currently located at your facility (add more rows as necessary).

Air Compressors					
Equipment ID/Manufacturer	HP	Compressor Type (E.g. Scroll, Screw, Reciprocating, Centrifugal)	Capacity Control Mode (E.g. Load/Unload, VFD, Inlet Modulation, Blow- off)	Age (years)	Annual Operating Hours
CNP 75588-750 (example)	150	Screw	Load/Unload	15	4,000
Dryers					
Equipment ID/Manufacturer	Type	Status (Op/standby)	Age (years)		
Dryer #1 (example)	Refrigerated	Operational	15 years		
Storage					
Equipment ID/Manufacturer	Size (Gallons)	Status (Op/standby)	Age (years)		
Receiver A (example)	600	Operational	15 years		

Describe the compressed air system operating schedule at the facility.

What is the system pressure? Do you have trouble maintaining this pressure?

Describe the staging of the air compressors (e.g. manual, automatic, always on. etc.)

Is there a management system or manual procedure in place to shut compressors OFF sometimes? If so, do you think the system is properly tuned?

Are you willing to change your control strategy or usage of compressed air if recommended in the retrocommissioning study?

5.6.6 PROCESSING EQUIPMENT

Complete this section only if applicable for the facility being submitted for consideration in the retrocommissioning program:

Please list all major processing equipment currently located at your facility (add more rows as necessary).

Equipment Description/ID	HP or kW	Average loading (% full capacity)	Status (Op/standby)	Age
300 ton Servo Press – SPI (example)	180 HP	50%	Operational	6 years

Describe the process equipment schedule at your facility.

What percentage of the facility's electric use is attributable to operation of processing equipment?

What percentage of the facility's natural gas use is attributable to operation of processing equipment?

Are there any current operational issues with your equipment?

5.6.7 REFRIGERATION EQUIPMENT

Complete this section only if applicable for the facility being submitted for consideration in the retrocommissioning program

Please list all major refrigeration equipment that is currently located at your facility (add more rows as necessary).

Unit description/ID	Absorption unit	Tons	Average loading (% full capacity)	Status (Op/standby)	Age
Walk in cooler – RS60A	No	60	60-80%	Operational	8 years

Describe the loads served by equipment identified above.

Describe the temperature and pressure set points for the identified refrigeration equipment.

Outline the sequencing of refrigeration equipment at the facility.

Is floating head pressure control utilized?

Describe defrost schedules/controls for refrigeration equipment at the facility.

What type of capacity control does the refrigeration equipment have (e.g. hot gas bypasses, VFDs, etc.)?

What percentage of the facility's electric use is attributable to operation of the refrigeration equipment?

Is there an energy recovery system in place to capture waste heat?

A sample copy of the front page of the BTU Retrocommissioning Plan Report Template is provided in this appendix. A Microsoft Word version of this form is available by contacting Platte River.



**PLATTE RIVER
POWER AUTHORITY**

Estes Park • Fort Collins • Longmont • Loveland

Building Tune-up Program Retrocommissioning Plan

[Click here to type project name](#)

Located at:

[Click here to type address](#)
[Click here to type City, State, ZIP](#)

Presented to:

[Click here to type customer's name](#)

Project # **[Click here to type project # \(Provided by Prog. Admin\)](#)**

[Click here to type date \(For e.g. January XX, 20XX\)](#)

Disclaimer

The intent of this Retrocommissioning Plan is to provide a preliminary estimate of the potential energy and demand savings available at the project site and identify a tentative plan for completing the detailed retrocommissioning investigative activities. While the preliminary findings in this report have been reviewed for technical accuracy and are believed to be reasonably accurate, the actual results may vary. As a result, Platte River Power Authority (Platte River) and/or [Click here to type RSP's name](#) are not liable if estimated savings or economics are not realized. All savings and cost estimates in the report are for informational purposes, and are not to be construed as a design document or as guarantees.

[Click here to type customer's name](#) shall independently evaluate any advice or suggestions provided in this report. In no event will Platte River and/or [Click here to type RSP's name](#) be liable for the failure of the customer to achieve a specified amount of energy or demand savings, the operation of the customer's facilities, or any incidental or consequential damages of any kind in connection with this report or the installation of evaluated measures.

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Executive Summary

Provide a summary of the Retrocommissioning Plan objectives and preliminary findings. Present an overview of identified measures and the total preliminary savings estimate. Compare the project savings target with the savings estimate. Recommend if the project should proceed or be terminated based upon the results of the planning activities. Also provide total facility floor space (sq ft), total conditioned floor space (sq ft), rate schedule and municipal electric utility account number(s) associated with the facility.

Table ES-I Preliminary RCM Estimates

RCM No.	RCM Description	Annual Energy Savings (kWh/yr)	Summer Avg. Demand Savings (kW)	Winter Avg. Demand Savings (kW)	Annual Electric Energy Cost Savings (\$/yr)	Annual Natural Gas Savings (therms/yr)	Annual Natural Gas Savings (\$/yr)	Implementation Cost (\$)	Simple Payback (years)
Total									

OWNER / OWNER REPRESENTATIVE

[Click here to type Name](#)
[Click here to type title](#)
[Click here to type company](#)
[Click here to type street](#)
[Click here to type City, State, and Zip](#)
P: [Click here to type phone #](#)
F: [Click here to type fax #](#)
E: [Click here to type email](#)

PLATTE RIVER REPRESENTATIVE (OTHER THAN PROGRAM ADMINISTER LISTED BELOW)

[Click here to type account manager](#)
Local Utility 2000 E. Horsetooth Rd.
Fort Collins, CO 80525
P: [Click here to type phone #](#)
F: 970-229-5244
E: [Click here to type email](#)

LOCAL UTILITY REPRESENTATIVE

[Click here to type account manager](#)
Key Account Manager
Address
City, ST Zip
P: [Click here to type phone #](#)
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BUILDING TUNE-UP PROGRAM ADMINISTRATOR:

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RSP

[Click here to type Name](#)
[Click here to type title](#)
[Click here to type company](#)
[Click here to type street](#)
[Click here to type City, State, and Zip](#)
P: [Click here to type phone #](#)
F: [Click here to type fax #](#)
E: [Click here to type email](#)

Introduction

Platte River's *Building Tune-up Program* targets savings opportunities through the systematic evaluation of electric energy-using systems and the subsequent implementation of no-cost and low-cost measures. Rebates are available to reduce the implementation costs of identified Retrocommissioning Measures (RCM) if the estimated simple payback is greater than two years. The program also provides an opportunity for facility staff to work hand-in-hand with expert engineers to increase their knowledge of the efficient and effective operation of building systems.

The program administrative process for each project follows four basic program phases:

- 1) Application Phase
- 2) Planning Phase
- 3) Implementation Phase
- 4) Verification Phase

6.1 PROJECT OBJECTIVES

Most buildings have never gone through a formal, systematic commissioning or quality assurance process, and are likely performing below their potential. This program is designed to assist in improving building performance, and in the process, capture energy and demand savings opportunities. Retrocommissioning not only identifies problems due to design flaws or events that occurred during construction, just as traditional commissioning of a new building does, but it also identifies and recommends solutions to problems that have developed during the building's existence.

Efficient operation of existing major building systems presents a significant potential for energy and demand savings, usually with little or no capital investment. A key goal of the retrocommissioning process involves achieving this efficient operation. Retrocommissioning seeks to assist with equipment and system functionality, and optimizing their integrated operation to reduce energy waste and improve building performance and occupant comfort.

The goals of the retrocommissioning effort are as follows:

- Reduction in electrical demand and related costs;
- Reduction in annual electrical consumption and annual costs; and
- Improved building system control and occupant comfort.

6.2 PROJECT SCOPE

When the application is approved by Platte River, the retrocommissioning process begins with the Planning Phase, which consists of identification of project objectives, targeting of systems for improvements, and defining tasks and responsibilities. A plan for conducting more detailed investigations is developed as a result. An Implementation Phase follows, in which on-site equipment assessment and testing are conducted. This phase identifies additional system deficiencies and opportunities for improvement, estimates their economic potential, and defines an implementation scope of work for you to follow in order to implement the measures. Once the improvements are made in the Implementation Phase, and their success is validated through a final evaluation, revised calculations performed in the Verification Phase.

The retrocommissioning procedures focus on electric energy savings opportunities with low cost implications. Capital measures that are identified through *Building Tune-up Program* may be directed to Platte River's standard or custom program offerings.

Building Tune-up Program does not address fire and life safety or basic equipment safety controls. Additionally, the program does not provide services for new construction or to meet commissioning requirements of other rebate programs offered by Platte River.

7.1 GENERAL

Provide a general building description – location, size, use, construction and configuration. Discuss the building space uses in a narrative format. Please reference a copy of the Building Site Assessment Form which is included in Appendix A.

7.2 ENERGY USE ANALYSIS

Present building performance data here including the ENERGY STAR Portfolio Manager Rating and energy intensity. Graphs of utility usage should include: peak-electric demand-day building load profile and various benchmarks (W/ft², kWh/ft², \$/ft², ft²/Ton, cfm/ft², etc.).

7.3 BUILDING EQUIPMENT

Present a description of building systems and equipment. Describe the types of equipment installed, the system configuration (e.g. chillers in parallel on primary Chilled Water (CHW) loop, with secondary loop serving AHU coils, HW pumps etc.) and any pertinent details regarding sequence of operation. Include a tabular equipment list as shown below. Briefly discuss important sequences of operation and operating schedules.

Table 7 - I Building Equipment List

Equipment Item	Description	Capacity/Size	Area Served

8.1 RETROCOMMISSIONING MEASURES

RCM No.	Measure Description	Energy Savings (kWh/yr)	Average Demand Savings Summer/Winter (kW)	Implementation Cost (\$)
1.	<p>EXAMPLE: Reduce operating schedules for AHUs, as allowable. This will involve modest adjustment of central schedules via Direct Digital Control (DDC), and may include significant adjust of kitchen system operating schedules that are not currently controlled via DDC. This will also include review of occ & Unocc setpoints to reduce observed unocc cycling.</p> <p><u>Current Conditions:</u> Review of schedules for the DDC system showed that the majority of the airs handling units are starting at 5:00am.</p> <p><u>Proposed Changes:</u> Discuss the proposed changes that shall be implemented per this RCM.</p> <p><u>Technical & Physical Feasibility:</u> Measure will require review of schedules and discussions with the facility staff to verify when the units are needed. Changes to schedules will require intermediate skill level to interact with the DDC system.</p> <p><u>Measure Persistence:</u> Estimated life for this measure is long. Some minor changes to the schedules may be needed on a yearly basis.</p> <p><u>Verification Method:</u> Describe methodology for verifying energy and demand savings.</p> <p><u>Owner Buy-in:</u> Measure should be acceptable to the District due to the limited amount of work and cost involved.</p> <p><u>Measure Cost:</u> Cost is estimated on labor needed to adjust the schedules.</p>	50,000	0/0	\$250
2.	<p><u>Current Conditions:</u></p> <p><u>Proposed Changes:</u></p> <p><u>Technical & Physical Feasibility:</u></p> <p><u>Measure Persistence:</u></p> <p><u>Verification Method:</u></p> <p><u>Owner Buy-in:</u></p> <p><u>Measure Cost:</u></p>			

Describe each preliminary identified RCM in tabular form (example shown above). Provide an overview of the current condition and a description of the proposed change. Document the following aspects of implementation feasibility for each measure:

- Annual Electric Energy Savings – the annual electric energy savings as seen at the customer meter.
- Summer/Winter Average Electric Demand Savings Estimate – the electric demand savings as seen at the customer meter/monthly bill which is the average demand reduction in the summer months and in the winter months. The average Peak Electric Demand Savings (kW/month) should be the average of the peak monthly demand savings for each season October to April and May to September.

- Measure Persistence – Measures under the Retrocommissioning Program should continue to deliver persistent savings for 7 years or longer. RSPs should dedicate efforts to measures that have longer persistence and document in this section the estimated measure life. For example, logic control changes will have longer persistence than behavioral changes.
- Verification Method – RSPs should describe their methodology for verifying energy and demand savings for this measure. RSPs should reference descriptions on verifying RCx measures under the Retrocommissioning Program in Section 9 and Appendix G of BTU program manual.
- Owner Buy-in – This section explores the viability of the measure from the perspective of the customer. The RSP should provide a statement to the facility Owner/representative/engineer regarding the measure's impact on building systems, comfort, health or other concerns. This section should be discussed with the customer to verify whether the measure should be pursued in future phases of the project.
- Technical & Physical Feasibility – Indicate the level of difficulty in implementing this measure. For example, is it straightforward? Does it require the assistance of an external controls contractor? etc.
- Trending Requirements – This section explains any trending requirements that may be necessary to obtain accurate information for calculating savings. Necessary equipment, trending methodology, related costs, and timeframe should be explained with direction towards the owner.
- Measure Cost – Briefly explain on what basis the implementation cost was calculated?

8.2 ADDITIONAL MEASURES

Using the same tabular format for section 4.1 briefly list and discuss additional measures that were identified but which have uncertain electric energy savings potential or are capital in nature. Capital measures are defined as measures that require installation of new equipment that increases the functionality of the system above a least cost baseline.

Also list the measures that require further study that could be performed during the Investigation Phase.

8.3 RECOMMENDATIONS

Based on the preliminary RCM identification, savings estimates, and project savings target, provide a recommendation whether this project is suitable to proceed to the implementation phase.

9.1 ROLES AND RESPONSIBILITIES

Program Administrator/Utility Account Manager?

- Serve as project manager, if applicable.
- Facilitate the gathering of project information as needed by the RSP.
- Work with the RSP to determine the Retrocommissioning Plan and how to best leverage existing resources to streamline the project and reduce costs.
- Support the RSP's efforts to accomplish the work.
- Define the lines of communication between the team members. Support the RSP by facilitating communication between the RSP and other project team members as needed.

Owner/Owner Representative

- Serve as project manager, if applicable.
- Provide contact person for facilitating communications.
- Gather building documentation.
- Assist and provide detailed input into the initial assessment and investigation process, to also include such items as:
 - O&M methods and procedures
 - Service contract information
 - Equipment condition and operational constraints
- Keep the building occupants informed of the intended retrocommissioning work, as needed.
- Provide technician to assist RSP for retrocommissioning activities in the building.
- Provide an Energy Management System (EMS) programmer to investigate program changes.
- Gather trending information from the EMS, as recommended by RSP.
- Assist with the performance of functional testing, as needed.
- Perform appropriate preventive maintenance and complete any pre-requisite tasks requested by the RSP prior to any diagnostic or functional testing.
- Identify and coordinate building work protocol for retrocommissioning team members, such as:
 - Security and access
 - Restrictions on special areas in the building (sensitive tenants, etc.)
 - Restrictions on photos or videos (building-wide or in certain areas)
 - Necessary identification
 - Parking permits
 - Safety and emergency requirements and contacts

- Need for escort while in the building or in special areas of the building.
- Special protocols when entering tenant spaces (e.g., the most acceptable times for performing work in tenant spaces).
- Attend training sessions and retrocommissioning meetings.
- Update and maintain Customer Selection Form.

Retrocommissioning Service Provider (RSP)

- Identify documentation, drawings, data, and other information required from facility staff.
- Develop a building-specific retrocommissioning report.
- Update and maintain Customer Selection Form.
- Propose a schedule for review and acceptance by the team members.
- Perform a detailed on-site assessment of the present maintenance practices and operating strategies, noting all possible improvements.
- Review the service contracts in effect and make recommendations how they may be improved to ensure that the equipment operates efficiently.
- Develop monitoring and testing plans.
- Perform short-term diagnostic monitoring, using EMS trend-logging where appropriate.
- Develop, oversee, and document the functional test procedures as needed.
- Maintain a master list of deficiencies that will be closed out by the end of the project.
- Install and remove short-term diagnostic monitoring equipment.
- Recommend system or energy-efficient capital improvements on electricity-using systems for further investigation.
- Prioritize for implementation the most cost-effective improvements of existing systems.
- Perform post-installation verification, monitoring and testing activities.
- Calculate the estimated electrical energy savings.
- Develop methods for the owner and building staff to continue to track the performance of the improvements.
- Submit a final report and all specified deliverables, such as:
 - Project schedule;
 - Retrocommissioning Plan specific to the building;
 - Meeting minutes;
 - Completed assessment forms;
 - Diagnostic monitoring, trending, and functional test plans;
 - Completed functional performance tests;
 - Master list of deficiencies;

- List of recommended improvements for immediate implementation (based on cost-effectiveness);
 - List of recommendations for capital improvements for further investigation;
 - Final energy saving estimates and calculations;
 - Retrocommissioning schedule;
 - Updated/revised building documentation;
- Provide follow-up service and troubleshooting as needed.

9.2 PROJECT SCHEDULE

Outline the anticipated schedule for each phase of the project. The schedule is to be presented in a table, as shown below. Include the estimated duration and completion dates of each phase based on normal program phase duration and a reasonable time allocation for deliverable review and revision. It is recommended that the project schedule match the dates in the Work Authorization Form.

Table 9-I Retro-commissioning Project Schedule

Project Phase	Tasks	Deliverable	Due Date
Planning	<ul style="list-style-type: none"> • Visit building to meet with owner to discuss project goals • Collect building documentation • Develop project Retrocommissioning Plan 	Retrocommissioning Plan	mm-dd-yyyy
Implementation	<ul style="list-style-type: none"> • Perform detailed site assessment • Compile list of deficiencies • Develop diagnostic and calculation plan • Conduct testing and monitoring • Select measures for recommendation • Estimate average seasonal demand and energy savings for recommended measures • Develop implementation verification procedures for recommended measures • Present updated Customer Selection Form • Building owner implements measures as investigation is completed 	Updated Customer Selection Form	mm-dd-yyyy
Verification	<ul style="list-style-type: none"> • Conduct on-site verification of measure implementation • Review Verification Report 	Verification Report	mm-dd-yyyy

The Building Site Assessment Form should be included here as a reference. General conclusions drawn from responses to questions on the form are presented in the Retrocommissioning Plan.

Summarize the analysis of the historical utility data (30-minute interval data, if available or monthly billing data) and the ENERGY STAR rating. Illustrate with graphs any anomalies identified, typical daily profile (kW & kWh), and annual profile (kW & kWh). Include text to explain what may have caused the anomalies, and how that may relate the identified savings measures.

A sample copy of the front page of the Standardized Retrocommissioning Form for the program is provided in this appendix. A Microsoft Word version of this form is available by contacting Platte River.

General Instructions for Retrocommissioning Procedures

The retrocommissioning procedures do not address fire and life safety or basic equipment safety controls. To ensure that the retrocommissioning procedures will not damage any equipment or affect any equipment warranties, obtain clearance for all test procedures from the building engineer or maintenance supervisor prior to execution.

The retrocommissioning procedure forms are intended to serve two purposes; they assure that a minimum level of investigation is completed, and provide retrocommissioning information to Platte River in a standard format. The retrocommissioning procedures are designed to be “generic” for the equipment class. If the complexity, configuration, or other aspects of a specific project require additional tests or information, explain in the comments area of the appropriate section, and attach the additional test procedures and field data.

In all sections, circle or otherwise identify any responses that indicate deficiencies. All deficiencies must be included on the Master List. The forms generally consist of the following sections (some forms do not include all sections):

- **Operator Interview.** Determine from a discussion with the building operator whether the system or equipment is operating properly to the best of their knowledge. Use the table to note any reported problems, and the building representative’s proposed solutions.
- **System Schematic.** This should be a clear but simple hand sketch, not a detailed CAD-generated drawing. The sketch should show the major control points sufficiently that someone unfamiliar with the site could understand the sequence of operations of the system or equipment covered in the procedure.
- **Nameplate (and Operating) Data.** Record only field-verified data from actual equipment, not from equipment schedules, drawings, etc. Exceptions to this include items such as cooling coil capacity. If additional information is available but not included on the form, record it in the comment space below the form. If an item does not apply, write “NA” for not applicable. Operating data must be field-measured and documented with date and time of measurement, at a minimum.
- **Controls Calibration.** The tests outlined in this section determine whether the installed sensors are reporting correct information to the Energy Management and Control System (EMS). It is critical that the field measurement and the EMS reading are taken simultaneously to avoid mistaking time variation of values for sensor miscalibration.
- **Functional Performance Testing.** The field tests in this section provide a “snapshot” of system operation, and verify that the equipment, as installed, operates as intended by the manufacturer and designer. If the field observation does not correspond to the intended design operation, does not follow the intended sequence of operations, or appears inappropriate, write a comment number that refers to an explanatory comment in the comments section or on attached comments sheets/Master List. If a test does not apply, write "NA" for not applicable. Write “ND” for tests not done, and explain in a comment. For items that refer to an activity, such as documenting the sequence of operations, indicate completion with a check mark, and attach supporting information on separate sheets as necessary.

9.2.1 UNITS

Values should be reported using the inch-pound (I-P) system of units, e.g. psi, F, gpm, etc.

9.2.2 VARIABLE FREQUENCY DRIVES

For motors with VFDs, special precautions should be taken. Running the motor at less than about 25 to 30% of the full load speed rating may cause motor overheating due to inadequate motor ventilation. Also, if the motor is driven at less than 50% of the full load speed rating, the thermal over-load protection may not properly protect the motor. The motor should not be driven below 50% of its full load speed rating without consulting the building engineer or the motor manufacturer's representative.

9.2.3 VOLTAGE UNBALANCE

Per NEMA MG-1 motors ratings allow a maximum unbalance of 1% at rated conditions. Voltage unbalance between 1% and 5% requires that the motor be derated. A motor should never be operated with a voltage unbalance of 5% or greater. Voltage unbalance is defined as the greatest difference between the measurement for any of the 3 phases and the average of the 3 phases, that quantity divided by the average of the 3 phases. As an example, if the voltage measurements are 451, 461, and 463, then the average is 458.3 volts. The greatest difference between any measurement and the average is 451-458.3, or 7.3 volts. Then, the voltage unbalance is 7.3 volts /458.3 volts, or 0.016. As a percentage, this is 1.6% which would result in a slight derating of the motor (0.97).

9.2.4 DATA LOGGING

Use of data logging instrumentation (either by EMS or by stand alone loggers) is recommended to implement and document some tests. Annotate any data and graphs so that it is clear what the data are proving. Attach annotated data and graphs to the test sheet. Trend logs of EMS outputs, program printouts, or schedule and setpoint printouts are not acceptable as proof of operation.

9.2.5 EXAMPLE TEST PROCEDURES

In all cases where a functional test procedure is followed, describe the procedure in the comment area below the table. Identify the comment using the item number from the table. Where possible, it is highly recommended that the device to be tested is not actuated directly from the EMS but rather via an independent variable – in this way, a portion of the Standard Operation Procedure (SOP) can be verified. The following is an example procedure for stroking a cooling coil valve:

Set cooling setpoint 20°F above room temperature. Observe the valve close. Remove control air or power from the valve and verify that the valve stem and actuator position do not change. Restore to normal. Set cooling setpoint to 20°F below room temperature. Observe valve open. For pneumatics, by override in the Energy Management Control System (EMS), increase pressure to valve by 3 psi (do not exceed actuator pressure rating) and verify valve stem and actuator position does not change. Restore to normal.

The following is an example procedure for checking leakage through a coil valve:

Method 1—Water Pressure with 2-Way Valve. If there are pete's plugs before and after coil, not including the valve, measure the pressure drop across the coil with the valve fully open. Then close the valve and take the measurement again. If the pressure drop across the coil is greater than 0.1 psi, leakage is probably occurring. (Note deficiencies on Master List.)

Method 2—Air Temperature with 2 or 3-Way Valve. Calibrate air temperature sensors on each side of coil to be within 0.5°F of each other. Change mixed or discharge air setpoint, override values, or bleed or squeeze bulb pneumatic controller to cause the valve to close. Air handler fans should be on. After 5 minutes observe air delta T across coil. If it is greater than 1°F, leakage is probably occurring. Note deficiencies on Master List.

Chiller Procedure Instructions

Before using this retrocommissioning procedure, read the **General Instructions for Retrocommissioning Procedures**. Following are equipment and system specific instructions.

- **Operator Interview.** See General Instructions for Retrocommissioning Procedures.
- **System Schematic.** The sketch should include the chilled water plant showing chillers, condensers or cooling towers, pumps, and major control points (temperature, pressure, flow) sufficiently that someone unfamiliar with the site could understand the sequence of operations. If there are several chillers in the plant, provide the system schematic on one of the chiller forms only.
- **Nameplate and Operating Data.** See General Instructions for Retrocommissioning Procedures.
- **Controls Calibration.** Chiller “actual” values taken from the chiller local control panel are an acceptable alternative to manual measurement. Indicate “Panel” or “Measured” beside numbers recorded in the form.
- **Functional Performance Testing.** See General Instructions for Procedures.

Project Information

RSP: _____

Project name: _____

Project number: _____

RCM end use category: Chiller _____

RCM equipment ID: _____

Date(s) of testing: _____

Operator Interview

Problem description and effect	Proposed solution

System Schematic Sketch

Name Plate and Operating Data

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. Manufacturer	
2. Chiller type (centrifugal, screw, recip, scroll)	
3. Chiller rated capacity (Tons)	
4. Condenser type (water or air cooled)	
5. Refrigerant type	
6. Chilled water (CHW) set point (panel readout)	
NOTE: Items 7, 11, and 12 must be measured concurrently (as possible) and under steady-state conditions to allow calculation of chiller efficiency (kW/Ton).	
7. Chiller kW(indicated measured or from chiller panel)	Record both design kW and actual
8. Leaving CHW temp, design	
9. Entering CHW temp, design	
10. CHW flow rate, design	
11. Leaving CHW temp, measured	
12. Entering CHW temp, measured	
13. CHW flow rate, measured (indicate method used)	
14. Leaving CW temp, design	
15. Entering CW temp, design	
16. CW flow rate, design	
17. Leaving CW temp, measured	
18. Entering CW temp, measured	
19. CW flow rate, measured	

Notes/Comments on chiller nameplate and operational data

Enter Project Name

Date Here

Controls Calibration

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Sensor	Recommended Tolerance (+/-)
Cooling coil, chilled and condenser water temps	1.0 °F
Air Handling Unit (AHU) wet bulb or dew point	2.0 °F
Hot water coil and boiler water temp	2.0 °F
Outside air temps	1.5 °F
Relative humidity	4%
Space and coil air temps	2.0 °F

Sensor	Recommended Tolerance (+/-)
Watt-hour, voltage & amperage	4% of scale
Flow rates, water	4% of scale
Oxygen or CO ₂ monitor	1% of scale
Flow rates, air	10% of design
Building differential pressure	0.02 in. of water
Pressures, air, water and gas	2% of scale

Description	Sensor Location	Sensor Location Acceptable?	Measured Value	EMS Value	EMS Value Acceptable?
1. Outdoor air temp (EMS)					
2. Evap. water temp. in (°F)					
3. Evap. water temp. out (°F)					
4. Evap. water flow (gpm)					
5. Cond. water temp. in (°F)					
6. Cond. water temp. out (°F)					
7. Cond. water flow (gpm)					

Notes/Comments on control equipment

Functional Performance Testing

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. Document existing chiller sequence of operations (SeqOp), including unit staging and operating schedule, on an attached sheet	
2. Does chiller system operate according to the existing SeqOp?	
3. Is the existing SeqOp appropriate for the application?	
4. If chiller system does not operate according to the existing SeqOp, describe problem and note on Master List.	
5. Chiller appears to meet load (no complaints)	
6. Shut-down and start-up sequences stage multiple chillers & accessories properly	
7. Record & explain any diagnostic codes in control panel memory. Include explanation as necessary below. Note deficiencies on Master List.	
8. Compare schematic sketch in Section 2 with design documents. Note any differences below and any deficiencies on the Master List.	

Notes/Comments on functional equipment testing

Condenser & Cooling Tower Procedure Instructions

Before using this retrocommissioning procedure, read the **General Instructions for Retrocommissioning Procedures**. Following are equipment and system specific instructions.

- **Operator Interview.** See General Instructions for Retrocommissioning Procedures.
- **System Schematic.** The condensers or cooling towers should be included on the lead chiller form.
- **Nameplate and Operating Data.** See General Instructions for Retrocommissioning Procedures.
- **Functional Performance Testing.** See General Instructions for Retrocommissioning Procedures.

Project Information

RSP: _____

Project name: _____

Project number: _____

RCM end use category: Condenser/Cooling Tower _____

RCM equipment ID: _____

Date(s) of testing: _____

Operator Interview

Problem description and effect	Proposed solution

Nameplate and Operating Data

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. Manufacturer	
2. Rated capacity (tons)	
3. Condenser type (water or air cooled)	
4. Cooling tower type (e.g. open/closed circuit)	
5. Number of cells	
6. Number of fans	
7. Fan motor power (HP, each)	
8. Fan speed control (e.g. constant, multiple, VFD)	
NOTE: The following items should be measured concurrently (if possible) and under peak conditions if possible	
9. Ambient dry bulb air temperature (°F)	
10. Ambient wet bulb temperature (°F)	
11. Entering CW temp, measured (°F)	
12. Leaving CW temp, measured (°F)	
13. Leaving CW temp, set point (°F)	
14. Tower water flow rate, measured (gpm)	
15. Number of fans running	

Notes/Comments on condenser/cooling tower nameplate and operational data

Functional and Performance Testing

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. Document existing condenser/cooling tower sequence of operations (SeqOp), including unit staging and water-side economizer if applicable, on an attached sheet	
2. Does condenser/cooling tower system operate according to the existing SeqOp?	
3. Is the existing SeqOp appropriate for the application?	

Notes/Comments on functional equipment testing

Air Handler Unit Procedure Instructions

Before using this retrocommissioning procedure, read the **General Instructions for Retrocommissioning Procedures**. Following are equipment and system specific instructions.

- **Operator Interview.** See General Instructions for Retrocommissioning Procedures.
- **System Schematic.** The sketch of the AHU should show filters, dampers, coils, fans, and the major control points (temperature, pressure, flow) sufficiently that someone unfamiliar with the site could understand the sequence of operations. Show representative terminal units, zone and space sensors, etc. as necessary to give a complete representation of the air distribution and control system.
- **Nameplate and Operating Data.** Items that are labeled with a “(P)” refer to packaged AHUs only. Items that are labeled with a “(B)” refer to built-up AHUs only.
- **Controls Calibration.** See General Instructions for Retrocommissioning Procedures.
- **Functional Performance Testing.** See General Instructions for Retrocommissioning Procedures.

Project Information

RSP: _____
Project name: _____
Project number: _____
RCM end use category: AHU _____
RCM equipment ID: _____
Date(s) of testing: _____

Enter Project Name

Date Here

Operator Interview

Problem description and effect	Proposed solution

Enter Project Name

Date Here

System Schematic Sketch

Enter Project Name

Date Here

Nameplate and Operating Data

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. System type (VAV, CAV; SZ, MZ, DD, etc.)	
2. Cooling coil type (chilled water or DX)	
3. Heating coil type (hot water, steam, or electric)	
4. Other coils: use & type	
5. Is AHU equipped with economizer? If yes, dry bulb or enthalpy	
6. Economizer set point (indicate changeover temperature or enthalpy) (°F)	
7. Supply air temperature, set point (°F)	
NOTE: Items 8-11 must be made concurrently (as possible), under steady-state operating conditions, and at peak load conditions.	
8. Supply air temperature, measured (°F)	
9. Return air temperature, measured (°F)	
10. Mixed air temperature, measured (°F)	
11. Outside air temperature, measured (°F)	
Supply Fan:	
12. Fan rated CFM @ design pressure	
13. Fan motor nameplate power	
14. Fan volume control (e.g. VFD, inlet vanes, variable pitch blades, etc.)	
15. Fan speed control parameter (e.g. supply duct pressure, return plenum pressure, etc.)	
16. Control parameter set point	
Return / Relief Fan	
17. Fan rated CFM @ design pressure	
18. Fan motor, HP	
19. Fan volume control (VFD, inlet vanes, variable pitch blades, etc.)	
20. Fan speed control parameter (e.g. supply duct pressure, return plenum pressure, etc.)	
21. Control parameter set point	
Other Fans (specify)	

Enter Project Name

Date Here

22. Fan rated CFM @ design pressure	
23. Fan motor, HP	
24. Fan volume control (VFD, inlet vanes, variable pitch blades, etc.)	
25. Fan speed control parameter (e.g. supply duct pressure, return plenum pressure, etc.)	
26. Control parameter set point	
9.2.5.1 Cooling Coil	
27. Design capacity	
28. Design air flow	
29. Design CHW delta T	
30. CHW delta T measured	
31. Design CHW flow	
32. Delivered capacity (determine at peak conditions, steady-state)	
Other Coil (specify)	
33. Design capacity	
34. Design air flow	
35. Design water delta T	
36. Water delta T measured	
37. Design water flow	
38. Delivered capacity (determine at peak conditions, steady-state)	

Notes/Comments on AHU nameplate and operational data

Controls Calibration

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Sensor	Recommended Tolerance (+/-)
Cooling coil, chilled and condenser water temps	1.0 °F
AHU wet bulb or dew point	2.0 °F
Hot water coil and boiler water temp	2.0 °F
Outside air temps	1.5 °F

Sensor	Recommended Tolerance (+/-)
Watt-hour, voltage & amperage	4% of scale
Flow rates, water	4% of scale
Oxygen or CO ₂ monitor	1% of scale
Flow rates, air	10% of design

Enter Project Name

Date Here

Relative humidity	4%
Space and coil air temps	2.0 °F

Building differential pressure	0.02 in. of water
Pressures, air, water and gas	2% of scale

Description	Sensor Location	Sensor Location Acceptable?	Measured Value	EMS Value	EMS Value Acceptable?
1. Outdoor air temp. (EMS)					
2. Outdoor air % RH, (EMS)					
3. Outdoor air temp. at AHU					
4. Discharge air temp.					
5. Mixed air temp.					
6. Return air temp.					
7. Static pressure					
8. Zone temp. (SZ systems only)					

Notes/Comments on control equipment

Functional Performance Testing

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. Document sequence of operations (SeqOp)/control sequence for AHU and its components.	
2. Justify the AHU SeqOp as reasonable for the application.	
3. Outside air fraction at minimum SA flow (measured or calculated).	
4. Outside air fraction at maximum SA flow (indicate measured or calculated).	
5. Verify economizer switchover at control set point.	
6. Verify proper damper operation through full range.	
7. Verify proper valve actuator operation through full range.	
8. Access doors close tightly?	
9. Significant duct leakage?	
10. Supply pressure reset strategy functional? (i.e. supply static pressure decreases with lower building loads)	

Enter Project Name

Date Here

Notes/Comments on functional equipment testing

Enter Project Name

Date Here

EMS Procedure Instructions

Before using this retrocommissioning procedure, read the **General Instructions for Retrocommissioning Procedures**. Following are equipment and system specific instructions.

- **Operator Interview.** See General Instructions for Retrocommissioning Procedures.
- **System Schematic.** The sketch should show all major components controlled by the Energy Management Control System (EMS), including but not limited to the chilled water plant (including chillers, condensers or cooling towers, and pumps), and air handling units (a representative sample of similar AHUs is sufficient). The goal of this sketch is to pull together the component parts of the HVAC system sufficiently that someone unfamiliar with the site could understand the overall sequence of operations.
- **Controls Calibration.** Given that the bulk of the controls calibrations have been checked in the course of investigating the individual system components, no explicit controls calibration is required for the EMS. If the retrocommissioning provider deems it necessary to verify calibration of system-level controls not covered in one of the equipment retro-commissioning procedures, this section should be included.
- **Functional Performance Testing.** Some of the information presented here is a compilation of the results of equipment-level functional testing. However, most items verify operation at the system level and require additional functional tests. Since there are many possible control sequences for energy management systems, it is impossible to write generic tests that cover all such sequences. If the standard test procedures are not applicable or adequate, document the sequences, tests, and results on attached pages. First describe the control sequence. Next describe in detail what tests were conducted to verify each control sequence. Finally, describe the test results and conclusions. Include any deficiencies found on the Master List.

Project Information

RSP: _____
Project name: _____
Project number: _____
RCM end use category: EMS
RCM equipment ID: _____
Date(s) of testing: _____

Operator Interview

Problem description and effect	Proposed solution

System Schematic Sketch

Functional Performance Testing

Date:	
Time of day:	
Outside air temperature:	
Sky conditions:	

Description	Data (units)
1. Print out and attach a listing of the status of all points controlled by the EMS. Comment on any points that are overridden (i.e. not under automatic control.) If unable to print a listing, view point status on screen, attach notes, and comment.	
2. Points that should be under automatic control according to the approved controls submittal must not be overridden. Verify that there is a procedure in place to document parameter modifications or status change from automatic to manual.	
3. Document sequence of operations (SeqOp)/control sequence for the overall HVAC control system.	
4. Determine whether the existing SeqOp is reasonable for the application.	
5. HVAC optimal start/stop algorithms programmed & operational?	
6. Unoccupied temperature setback/up algorithms programmed & operational?	
7. Electrical demand limiting algorithms programmed & operational?	
8. Lighting sweep control algorithms programmed & operational?	
9. VAV terminal unit control algorithms programmed & operational?	
10. Ventilation and economizer control algorithms programmed & operational?	
11. Supply air temperature reset algorithms programmed & operational?	
12. Heating water lockout algorithms programmed & operational?	
13. Chilled water temperature reset algorithms programmed & operational?	
14. Chiller sequencing algorithms programmed & operational?	
15. Other equipment sequencing algorithms programmed & operational? (specify equipment)	

Notes/Comments on functional equipment testing

Appendix I RCx Diagnostic and Calculation Plan– Tier 3

A sample copy of the front page of the Retrocommissioning Diagnostic and Calculation Plan template is provided in this appendix. A Microsoft Word version of this form is available by contacting Platte River.

General Information

RSP: [Click here to type Name](#)

Project name: [Click here to type Name](#)

Project number: [Click here to type project number](#)

Date: _____

Completed by: [Click here to type Name](#)

Measure Summary

Measure Name	Click here to complete
RCM end use category	<input type="checkbox"/> Cooling <input type="checkbox"/> Lighting <input type="checkbox"/> Refrigeration
	<input type="checkbox"/> Heating <input type="checkbox"/> Cooking <input type="checkbox"/> Other
	<input checked="" type="checkbox"/> Ventilation <input type="checkbox"/> Plug Loads <input type="checkbox"/> Other
	<input type="checkbox"/> Pumping <input type="checkbox"/> Controls <input type="checkbox"/> Other
	<input type="checkbox"/> Water Heating <input type="checkbox"/> Compressed Air <input type="checkbox"/> Other
Affected sub-system(s)	Click here to complete
Detailed RCM description	Click here to complete

Data Acquisition Summary

Investigation approach	Click here to complete
Parameter(s) trended	Click here to complete
Parameters(s) functionally tested	Click here to complete
Dates of testing/trending	Click here to complete
Summarize Findings	Click here to complete
Insert applicable supporting graphs	
Other	

Savings Calculations Methodology

Avg. Summer demand savings (kW)	Click here to complete
Avg. Winter demand savings (kW)	Click here to complete
Annual energy savings (kWh)	Click here to complete
Annual electric cost savings (\$)	Click here to complete
Additional equations	Click here to complete

Calculation assumptions	Click here to complete
-------------------------	--

Implementation Details

Affected equipment ID(s)	Click here to complete
Scope of work for RCM	Click here to complete
Equipment required for implementation	Click here to complete
Personnel required for implementation	Click here to complete
Control sequences required for implementation	Click here to complete
Limitations to implementation	Click here to complete
Other	

Measure Costs & Impacts

Measure cost source	Click here to complete
Cost description	Click here to complete
Amount	Click here to complete
Other	Click here to complete
RCM Simple Payback (years)	Click here to complete

Verification Planning

Verification test or procedure	Click here to complete
Parameter(s) to be trended	Click here to complete
Trend interval	Click here to complete
Functional testing	Click here to complete
Expected test results	Click here to complete
Personnel required	Click here to complete
Other	

Verification Results

Summary of implementation completion	Click here to complete
Modifications to measure scope	Click here to complete
Modifications to savings calculations	Click here to complete
Modifications to costs	Click here to complete
Modification from verification plan	Click here to complete
Dates of testing/trending	Click here to complete
Summary of functional testing	Click here to complete

Summary of trending	Click here to complete
Insert applicable supporting graphs	
Other	

Final Results

Avg. Summer demand savings (kW)	
Avg. Winter demand savings (kW)	
Annual energy savings (kWh)	
Annual electric cost savings (\$)	
Simple Payback (years)	

A sample copy of the Verification report template is provided in this appendix. A Microsoft Word version of this form is available by contacting Platte River.



**PLATTE RIVER
POWER AUTHORITY**

Estes Park • Fort Collins • Longmont • Loveland

Building Tune-up Program Verification Report (v1.0)

[Click here to type project name](#)

Located at:

[Click here to type address](#)
[Click here to type City, State, ZIP](#)

Presented to:

[Click here to type customer's name](#)

Project # RCS[Click here to type project # \(Provided by Prog. Admin\)](#)

[Click here to type date \(For e.g. January XX, 20XX\)](#)

Disclaimer

The intent of this Verification Report is to summarize the final implemented RCMs and verified savings from the project. While the findings in this report have been reviewed for technical accuracy and are believed to be reasonably accurate, the actual results may vary. As a result, Platte River Power Authority (Platte River) and/or [Click here to type RSP name](#) are not liable if estimated savings or economics are not realized. All savings and cost estimates in the report are “ballpark” and for informational purposes, and are not to be construed as a design document or as guarantees.

[Click here to type customer name](#) shall independently evaluate any advice or suggestions provided in this report. In no event will Platte River and/or [Click here to type RSP name](#) be liable for the failure of the customer to achieve a specified amount of energy or demand savings, the operation of the customer’s facilities, or any incidental or consequential damages of any kind in connection with this report or the installation of evaluated measures.

Contents

EXECUTIVE SUMMARY

SECTION 1	PROJECT CONTACTS.....	9-1
SECTION 2	BUILDING DESCRIPTION.....	9-1
SECTION 3	PROJECT DESCRIPTION.....	10-1
SECTION 4	RECOMMENDED CAPITAL MEASURES	11-1
APPENDIX A	RCM DIAGNOSTIC AND CALCULATION PLANS.....	A-1
APPENDIX B	CUSTOMER SELECTION FORM.....	B-1

Executive Summary

This section presents a brief description of the types of measures recommended for the building, and some highlights regarding significant differences found between the recommended course of action and the actual implementation, and explanation of why things may have been done differently than recommended. (Include a summary table.)

Include a brief discussion about the recommended RCMs. Also, discuss whether some measures are planned for future implementation, when they are scheduled, and why they were delayed.

Provide a summary of the eligible project rebates in the Investigation Report and update any changes in the project rebates in the table corresponding to the Verification Report.

Table ES-I. Verification Report (Post-Implementation) RCM Summary

RCM No.	RCM Description	Annual Energy Savings (kWh/yr)	Average Summer Demand Savings (kW)	Average Winter Demand Savings (kW)	Annual Electric Energy Cost Savings (\$/yr)	Annual Natural Gas Savings (therms/yr)	Annual Natural Gas Savings (\$/yr)	Implementation Cost (\$)	Simple Payback (years)
	Total								

OWNER / OWNER REPRESENTATIVE

[Click here to type Name](#)
[Click here to type title](#)
[Click here to type company](#)
[Click here to type street](#)
[Click here to type City, State, and Zip](#)
P: [Click here to type phone #](#)
F: [Click here to type fax #](#)
E: [Click here to type email](#)

PLATTE RIVER REPRESENTATIVE (OTHER THAN PROGRAM ADMINISTER LISTED BELOW)

[Click here to type account manager](#)
Platte River Power Authority
2000 E. Horsetooth Rd.
Fort Collins, CO 80525
P: [Click here to type phone #](#)
F: 970-229-5244
E: [Click here to type email](#)

UTILITY REPRESENTATIVE

[Click here to type account manager](#)
Key Account Manager
Address
City, ST Zip
P: [Click here to type phone #](#)
F: [Click here to type fax #](#)
E: [Click here to type email](#)

BUILDING TUNE-UP PROGRAM ADMINISTRATOR:

Adam Perry
Platte River Power Authority
2000 E. Horsetooth Rd.
Fort Collins, CO 80525
P: (970) 226-4000
O: (970) 229-5356
F: (970) 229-5244
E: tuneup@prpa.org

RSP

[Click here to type Name](#)
[Click here to type title](#)
[Click here to type company](#)
[Click here to type street](#)
[Click here to type City, State, and Zip](#)
P: [Click here to type phone #](#)
F: [Click here to type fax #](#)
E: [Click here to type email](#)

Section 10**Building Description**

This section contains a description of the building. The description must include:

- Building Floor Space (sq ft)
- Building Total Conditioned Floor Space (sq ft)
- Building Type (Office, Hospital, Manufacturing facility etc.)
- Occupancy
- Standard Hours of Operation
- Rate Schedule
- Platte River Account Number(s)

Include information on the equipment relevant to recommended measures. This description must include:

- Equipment Type
- Equipment Size
- Equipment Location
- Quantity
- Operating hours

Include a tabular equipment list as shown below.

Table 0-I Building Equipment List

Equipment Item	Description	Capacity/Size	Area Served

Section 10

Project Description

This section summarizes the project scope and the recommended RCMs. Explain why certain measures were not selected for implementation.

Section 11

Recommended Capital Measures

Include any additional recommended measures that require capital expenditure and have a simple payback period greater than one year. For each measure, please include which program it qualifies under as well as estimated demand and energy savings, cost savings, implementation costs, rebate amounts, and simple payback period.

Include the RCM diagnostic and calculation plans for each implemented measure.

Include the final Customer's Selection Form

Appendix K Sample Electric Utility Bill Figures

Representative Fort Collins Utility Bill



Fort Collins Utilities
Customer Service
 330 S. College Ave.
 Hours: 8 a.m. to 5 p.m., Mon., Tue., Thur., & Fri.
 10 a.m. to 5 p.m. Wed.

Phone: (970) 212-2900
 E-mail: utilities@fcgov.com
 Web: www.fcgov.com/utilities

Account Number	Customer Name	Service Address	Bill Date	Date Due	Amount Due
123456-7890	Widgets Plus	1111 Widget Avenue	12-04-09	12-29-09	\$1,734.58

Account Number

See side for customer information and explanation of abbreviations.

Billing and Payment Summary

Billing period	\$	3,224.92
Payments received since last billing	\$	1,668.75
Previous balance; please pay now	\$	1,556.17
Charges for this billing period due 12-29-09	\$	1,734.58
Total amount due	\$	3,290.75

Rate Schedule

Service	Rate Code	Service Date From	To	Units Present	Multiplier	Usage	Charge		
Electric Energy	E300	11-01-09	12-01-09	30	4068	4299	120	27720 KWH	\$573.03
Facility Demand	E300	11-01-09	12-01-09	30		.69	120	82.8 KW	\$378.28
Coincident Peak	E300	11-01-09	12-01-09	30		.4	120	48 KW	\$667.55
Late Fee	P900								\$10.00
Sub-total									\$1,628.86
City Sales Tax									\$45.82
State/County Sales Tax									\$59.90
Total charges this billing period									\$1,734.58

Representative Longmont Utility Bill

CITY OF LONGMONT
 STATEMENT OF ACCOUNTS



CITY OF LONGMONT
 150 PARKWAY EAST
 LONGMONT, CO 80501

For billing inquiries, call 303-651-8664

Pay on-line: www.ci.longmont.co.us Power Outages: 303-776-0011

Customer Account No.	[Redacted]	
Bill Date	13-DEC-2009	
Service Addr.	Data Reads	
Prior Balance	\$.00	
Current	\$1,976.81	Due 06-JAN-2010
TOTAL DUE	\$1,976.81	

Account Number

	From	To		Edg	NetRdg	Mult	Usage	Rate	\$-Cost
Commercial Demand Rate	10/29/09	10/29/09	13482	13483	1	X 120	120		
Meter Out 03473340							23.4		
Demand KW					200	X 120	24000		
Meter In 98911407	10/29/09	11/30/09	0				24120	0.02620	\$631.94
							95.4		
Demand KW							95.40	10.70000	\$1,020.78
Monthly service charge									\$10.00
									Electric subtotal
									\$1,662.72
									Total electric services
									\$1,662.72

WATER & WASTEWATER SERVICES

Representative Estes Park Utility Bill

Page 1

TOWN OF ESTES PARK, UTILITY BILLING DEPARTMENT
 P.O. BOX 1747, 170 MACGREGOR AVENUE
 ESTES PARK, CO 80517-1747
 PHONE: 970-586-5331 OR 1-800-748-1717 www.estesnet.com

SERVICE ADDRESS			
ACCOUNT NUMBER	CYCLE	BILL DATE	DUE DATE
[Redacted]	02-27	12/29/09	1/15/10



Total Current 2,240.81 CHECK HERE FOR ADDRESS CHANGE
 Balance Forward 2,361.24 AND COMPLETE FORM ON BACK
 Total Amount Due 4,602.05

Accou
nt
Numbe

AMOUNT PAID



00001039700000874800000460205

4672 HOLD DETAILS WITH PAYMENT MADE TO: TOWN OF ESTES PARK
RETAIN BOTTOM PORTION FOR YOUR RECORDS

SERVICE ADDRESS

Rate
Schedule

ACCOUNT NUMBER	CYCLE	BILL DATE	DUE DATE
[Redacted]	02-27	12/29/09	1/15/10

Last Bill Amount 4,496.77
 Payments 2,135.53-
 Adjustments .00
 Balance Forward 2,361.24

Rate Class : COMMERCIAL LARGE
 Last payment amount/date: 2,135.53 12/02/09

Service Period	Days	Meter Number	Mult	Units	Current	Previous	Usage
EL 11/04/09 12/07/09	33	14109A	360.0	KWH	5749.24	5651.03	35355.60
EL 11/04/09 12/07/09	33	14109B	360.0	KW	.23	.24	82.80

Representative Loveland Utility Bill



City of Loveland Water and Power Department • Utility Billing Office
 500 East Third Street • Loveland, Colorado 80537 • 970-962-2111

SERVICE ADDRESS			
500 ANY STREET			
ACCOUNT NUMBER	CYCLE	BILL DATE	DUE DATE
11111-2222	04-05	12/04/09	12/22/09

Total Current Charge 131.16
 Balance Forward .00
 Total Amount Due 131.16

Account Number

City of Loveland Utility Customer
 500 ANY STREET
 LOVELAND CO 80537

City of Loveland
 PO BOX 3500
 LOVELAND CO 80539-3500

THANK YOU FOR YOUR PROMPT PAYMENT
 2560 00099

Rate Schedule

RETAIN BOTTOM PORTION FOR YOUR RECORDS. DETACH

MADE PAYABLE TO: CITY OF LOVELAND.

SERVICE ADDRESS			
500 ANY STREET			
ACCOUNT NUMBER	CYCLE	BILL DATE	DUE DATE
11111-2222	04-05	12/04/09	12/22/09

Rate Class : SMALL GEN SVC - 1/88

Last Bill Amount 97.14
 Payments 97.14
 Adjustments .00
 Balance Forward .00

Service	Period	Days	Meter Number	Mult	Units	Current	Previous	Usage
EL	11/03/09 - 12/02/09	29	44628	1	KWH	6830	4948	1882
Consumption						Charge		Total
EL	ELECTRIC					1,882.00	122.80	
EL	PIF					1,882.00	8.36	
TOTAL ELECTRIC								131.16
Total Current Charges								131.16
Balance Forward								.00
Total Amount Due								131.16

Electric Usage (KWH) Last Year 970 This Year 1882

Appendix L Platte River and Utility Efficiency Programs

Platte River and their Utilities of Fort Collins, Estes Park, Longmont and Loveland offer a range of energy efficiency opportunities to help non-residential Customers save energy and money. Reduced energy costs, technical assistance, and/or rebates are available for qualifying Customers. A summary of other available non-residential energy efficiency programs is provided below. Additional information regarding eligibility requirements, rebates, and participation processes is available at www.prrpa.org/energy/business or by contacting Platte River.

LIGHTENUP

The LIGHTENUP program provides a comprehensive platform for cost-effective non-residential lighting energy efficiency projects. LIGHTENUP helps maximize the value and minimize the electricity cost of Customers lighting by providing funding and technical assistance to upgrade old, inefficient lighting technology with modern, efficient technology. The rebates serve to buy down the cost of installing high efficiency lighting over standard efficiency lighting, thus making the high-efficiency option more attractive to Customers.

Electric Efficiency Program for New Construction and Renovations

The Electric Efficiency Program for New Construction and Renovations promotes the purchase of industry-proven, high-efficiency equipment during projects that are either new construction or for major renovations. Rebates serve to buy down the difference between the cost of high-efficiency and standard equipment, thereby making the high-efficiency equipment a more attractive option for Customers. Rebates are available for qualifying lighting, HVAC, envelope, food service equipment, grocery equipment, office equipment, premium efficiency motors, and even custom measures.

Electric Efficiency Program for Existing Buildings

The Electric Efficiency Program for Existing Buildings promotes the purchase of industry-proven, high-efficiency equipment to replace current, less efficient equipment. Rebates serve to buy down the difference between the cost of high-efficiency and standard equipment, thereby making the high-efficiency equipment a more attractive option for Customers. Rebates are available for qualifying lighting, HVAC, envelope, food service equipment, grocery equipment, office equipment, premium efficiency motors, and even custom measures.

Owner Municipality Efficiency Programs

Some of our Utilities offer rebates and/or technical assistance for energy and water efficiency support outside of Platte River's programs. Visit their websites for more information:

Town of Estes Park Light and Power: www.estesnet.com

Fort Collins Utilities: www.fcgov.com/utilities/consERVE

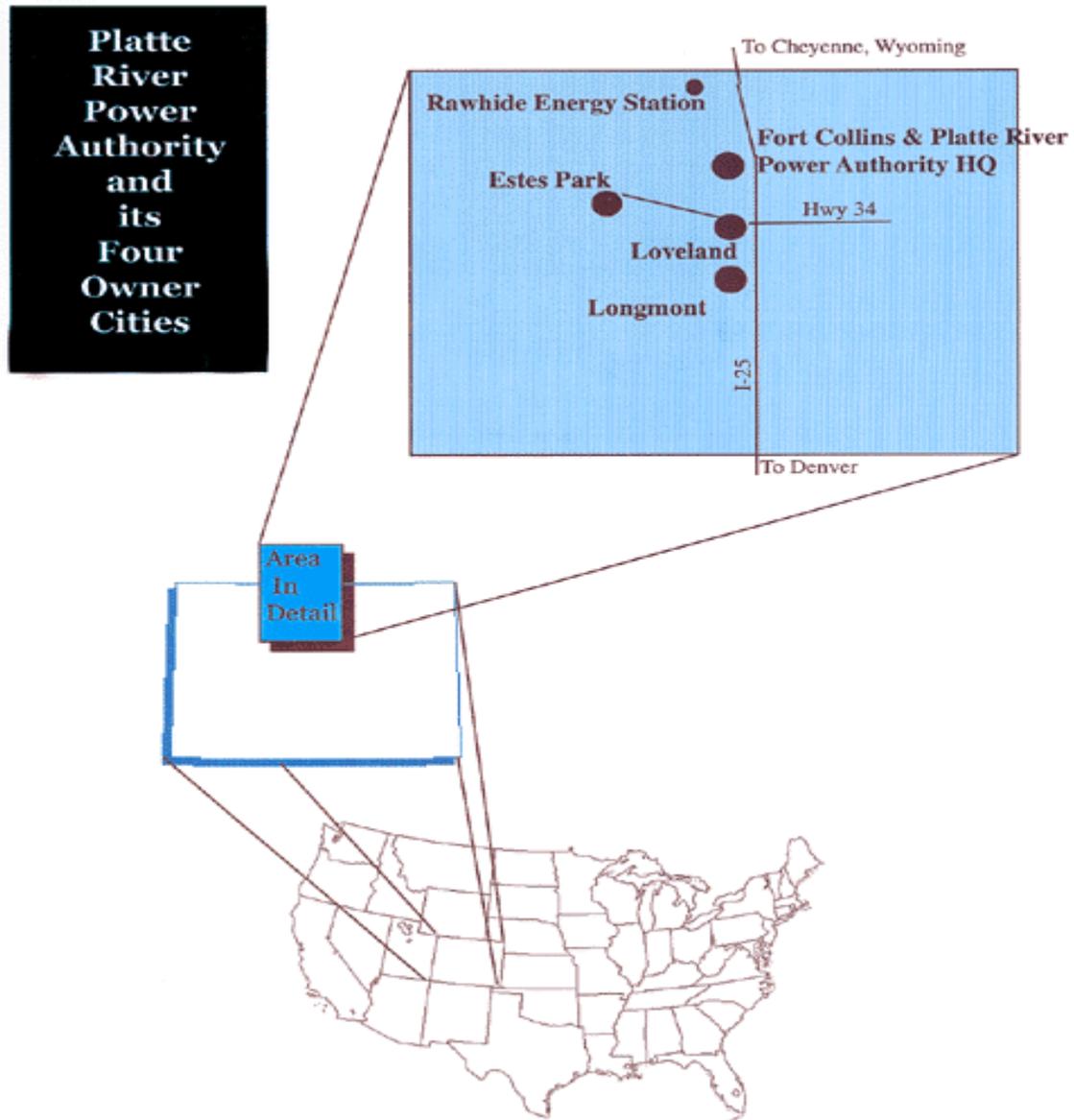
Longmont Power & Communication: www.ci.longmont.co.us/lpc

Loveland Water and Power: www.ci.loveland.co.us

Appendix M

Utility Service Territory

An illustration of Platte River's service area is provided below.



Appendix N

De-Lamping Guide

The following are typical T8 fluorescent fixtures that can be de-lamped in a building and the effect on light levels (% decrease).

Existing Fixture Type	Fixture After De-lamping	Estimate % Change in Light Levels
4 lamp T8 & Electric Ballast	2 lamp (800) T8 & HE NBF Elec Ballast	-25%
3 lamp T8 & Elec Ballast	2 lamp (800) T8 & HE NBF Elec Ballast	-20%
2 lamp T8 & Elec Ballast	1 lamp (28W) T8 & HE LBF Elec Ballast	-35%

Note: This table for reference only. Actual lumen output per fixture will vary by application and by as much as 15% more or less.

These values are based on estimated mean lumens and fixture efficiency per fixture type. See the **LIGHTENUP** Custom Lighting Application or Retrofit Specifications Guide for other fixture types and estimated lumen outputs.

Illuminance Guide Worksheet:

The following are typical spaces and applications where you may be retrofitting linear fluorescent fixtures. Reference this document for estimated Foot Candle (FC) or light level changes for common de-lamping retrofits and place in table below to calculate estimate effects of proposed retrofit.

Space Type (A)	Current Average FC level (B)	Target IESNA Average FC Level (C)	Est. % change light levels for Retrofit (D)	Est. FC Change (E)	Est. New FC Level
Example: Office	50 fc	30 to 50 fc	-15%	- 7 fc	43 fc

Directions to filling out the above worksheet:

- Reference Table 2.I below for space type to enter in cell. If not listed, please reference the current Illuminating Engineering Society of North America (IESNA) Lighting Handbook for values.
- Actual measured foot candle readings with illuminance (foot candle) meter placed at 0 or 2.5 ft above finished floor depending on task. Light meter is need to measure actual foot candles in space.
- Reference Table 2.I below for recommended foot candle levels for space type and enter in cell. If not listed, please reference the current IESNA Lighting Handbook for values.
- Reference above *Table 1.1: Retrofit Kits Increase Performance* for percent estimated change in light level for common retrofits. Also see the **LIGHTENUP** Custom Lighting Application for more fixture types and estimate light output changes for your retrofit.
- Actual calculated foot candle level change (value is foot candles). Calculated by multiplying cell B and cell D.

- (F) New estimated foot candle level post retrofit for space. Calculated by subtracting cell E from cell B. Compare this value to target foot candle level in cell C.

Note: Platte River does not guarantee the information is up to date or correct. This is merely a guide for quick reference of some general applications. Foot candle (fc) values listed below in are derived from the IESNA Lighting Ready Reference Guide (RR-03), A Compendium of Materials from the IESNA Lighting Handbook, 9th Edition. Reference your detailed applications in the current version of the Illuminating Engineering Society of North America (IESNA) Lighting Handbook.

Space Type	Recommended IESNA Illuminance Level (FC)	Space Type	Recommended IESNA Illuminance Level (FC)
Auditoriums	5 to 20	Lobby	5 to 10
Auto Repair	50 to 75	Retail – Sales Counters	30
Auto Body Shop	75 to 100	Retail – Circulation	5 to 10
Auto Showroom	50 to 75	Retail – General Display	30 to 50
Banks – General	10 to 20	Manufacturing	
Banks – Teller Stations	50	Assembly and inspection Easy	30
Barbershop/Salon	50	Medium	50
Church	20 to 25	Fine	75 to 100+
Office – Open and Private Intense to some computer use	30 to 50	Material Handling	30 to 50
Conference Rooms	30	Packaging, wrapping, labeling, shipping/receive	30
Classrooms and Reading	30 to 50	Reading on computers	10 to 30
Dining Areas	10 to 20	Restrooms	5 to 20
Engineering and Drafting	50 to 75	Stairwells and Hallways	5 to 10
Gymnasiums Recreational	30	Warehouse Inactive storage	5 to 10
Elementary/club	50	Big items/Loading docks	10
High school to competitive	80 to 100	Small items	10 to 30

Electricity savings can be achieved by enabling and adjusting computer power management settings to put the computer and monitor to sleep after a specified amount of time.

General Computer and Monitor Sleep Setting Recommendations

The following recommendations are for general purpose computing such as in a typical office environment. In parentheses is the recommended range to accommodate varying preferences and situations. The power management specifications for general purpose computing are as follows:

- Set display to turn off (sleep) after 3 minutes of no use. (2 – 10 minutes)
- Set computer to go to sleep (standby) after 20 minutes of no use. (10 – 30 minutes)

Exceptions: Do not turn computers off when updates, such as virus protection or software patches, will be pushed out.

Computer Power Management Instructions:

The instructions that follow outline steps for making the recommended power management changes on common computer operating systems.

1. Microsoft Windows 7
2. Microsoft Windows Vista
3. Microsoft Windows XP
4. Microsoft Windows 2000
5. Apple/Mac OS X

Operating systems can be identified as follows:

1. Microsoft Windows
 - a. Open or go to a Windows Explorer window that shows all the folders on the computer (not Internet Explorer)
 - b. Right-click on 'My Computer' or 'Computer' and select 'Properties'
 - c. OR go to the 'Start' menu and right-click on 'My Computer' or 'Computer' and select 'Properties'
2. Apple/Mac – look for apple logo

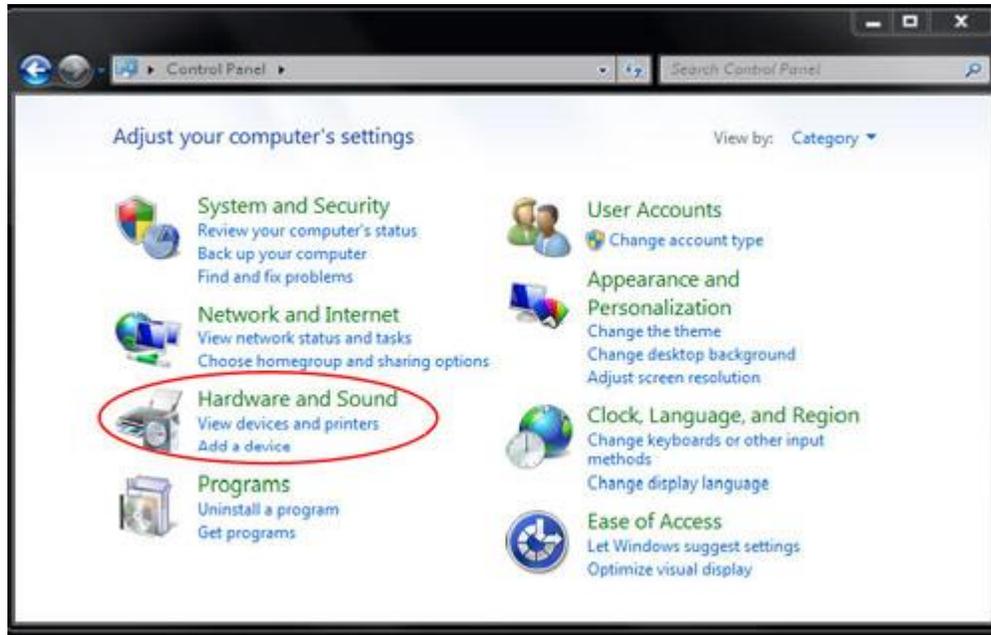
Additional Resources:

Energy Star resources for individual computers and enterprise network solutions:

- www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_low_carbon
- www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_users
- www.energystar.gov/index.cfm?c=power_mgt.pr_power_mgt_implementation_res

Windows 7

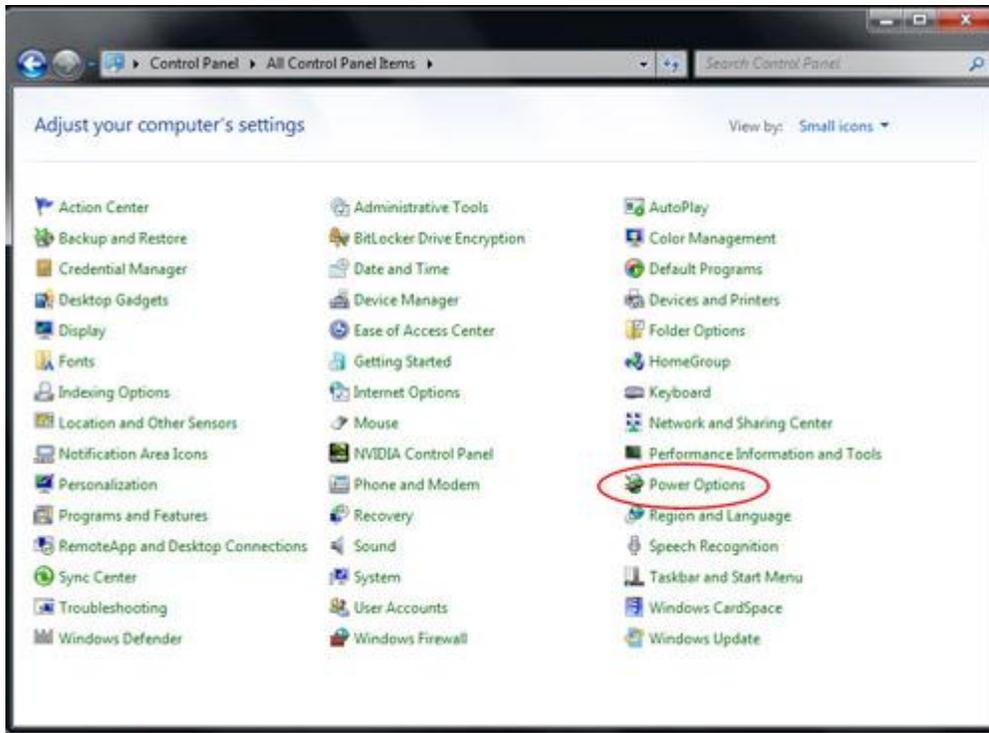
Click on Start, then on the right hand side of the menu select 'Control Panel.' Control Panel has two views. If you are in **Themed View**, double click on 'Hardware and Sound' and...



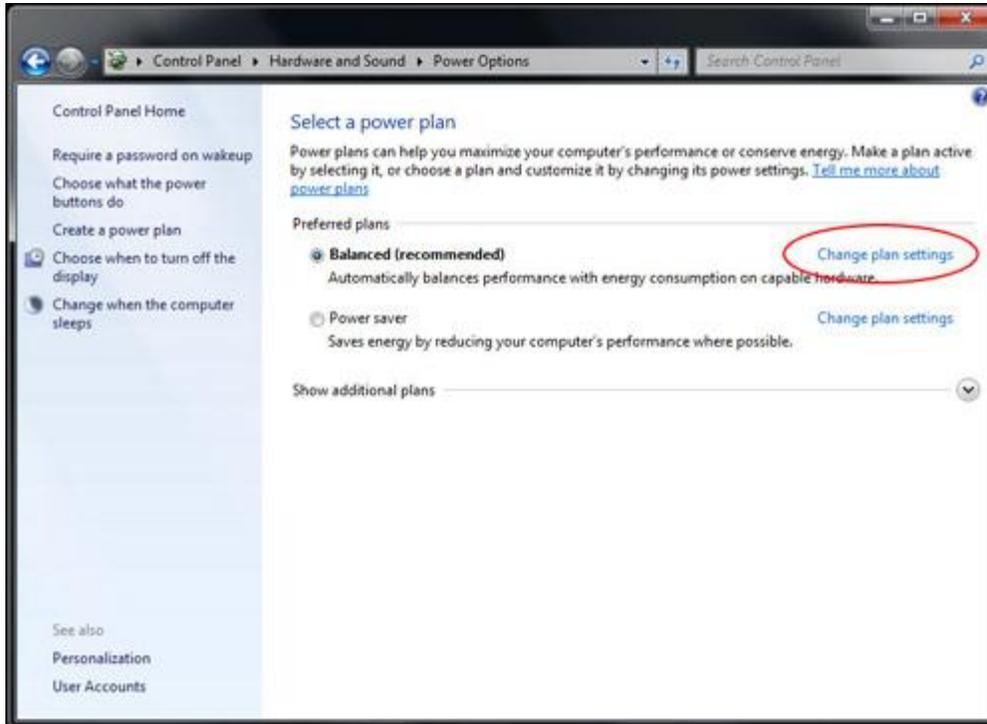
... Then select 'Power Options.'



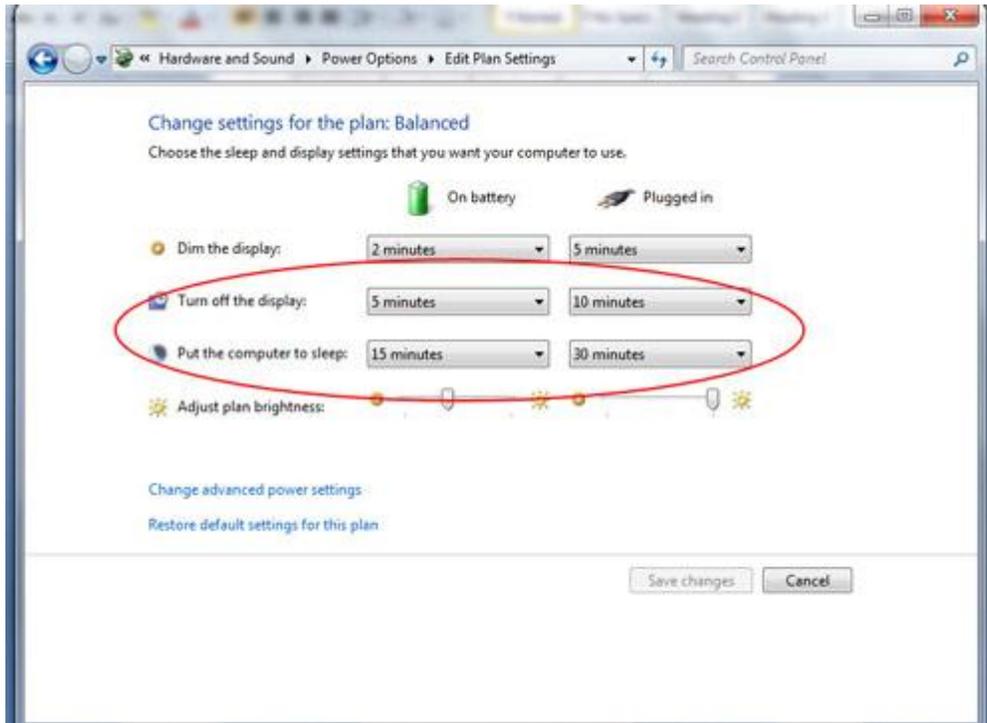
If using a **Standard View**, select 'Power Options.'



Once you are in Power Options, you can customize one of the pre-configured plans by selecting the change plan settings'option.



...and setting the amount of time before 'turn off display' and 'put the computer to sleep' actions are initiated. These can be set for when the computer is plugged in and when it is on battery (if you have a laptop).



Windows Vista

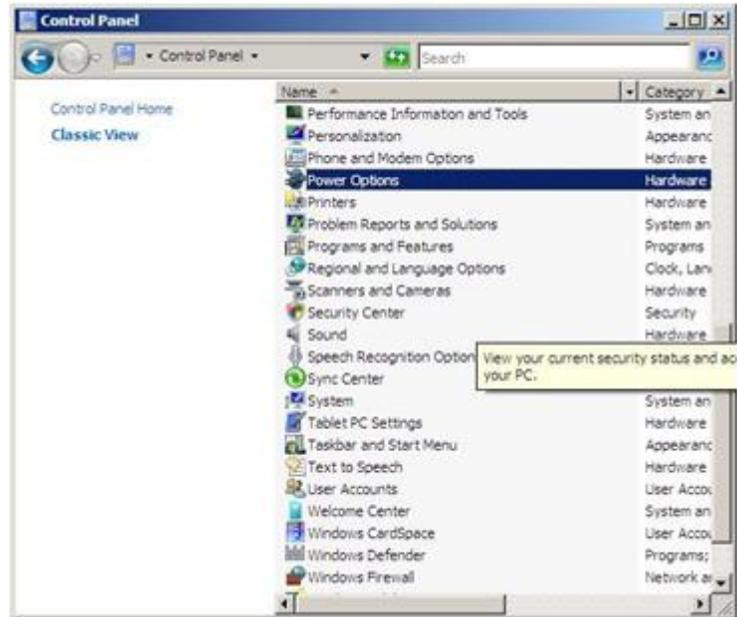
To configure power management on Windows Vista, click on 'Start', 'Run,' and then 'Control Panel'. Control Panel has two views. If you are in **Theme View** double click on 'System and Maintenance'...



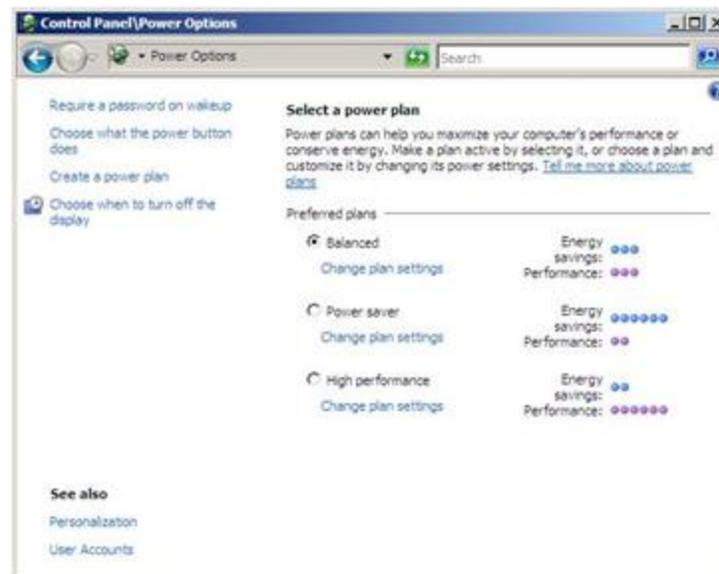
... and then on 'Power Options.'



If you are in **Classic View** simply double click on 'Power Options'.



Once you are in Power Options you can choose a pre-configured plan, customize one of the pre-configured plans, or create a new plan.

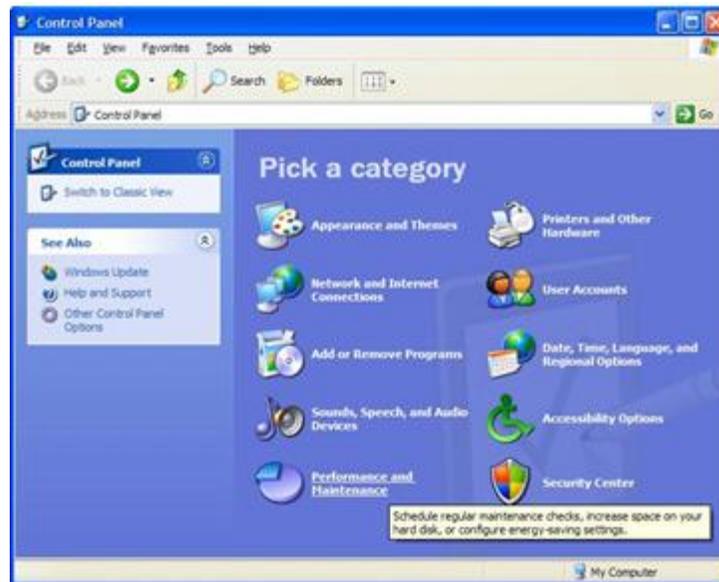


The initial screen for editing a plan allows you to change the monitor and sleep timeout settings.

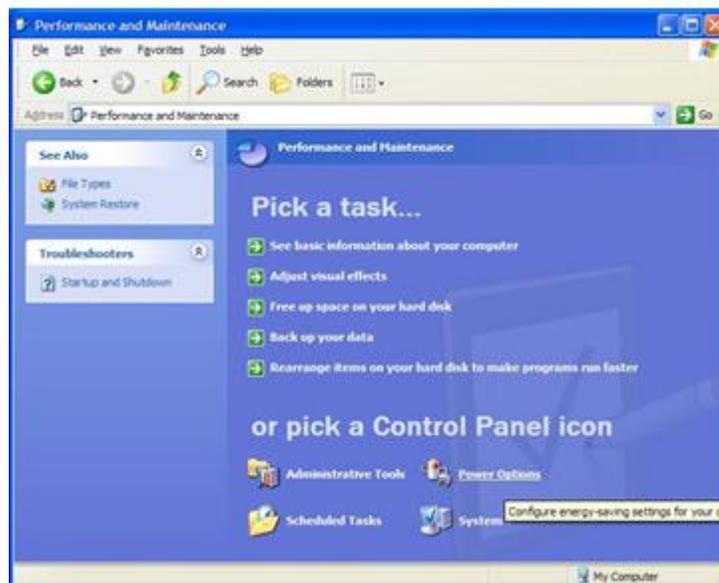


Windows XP

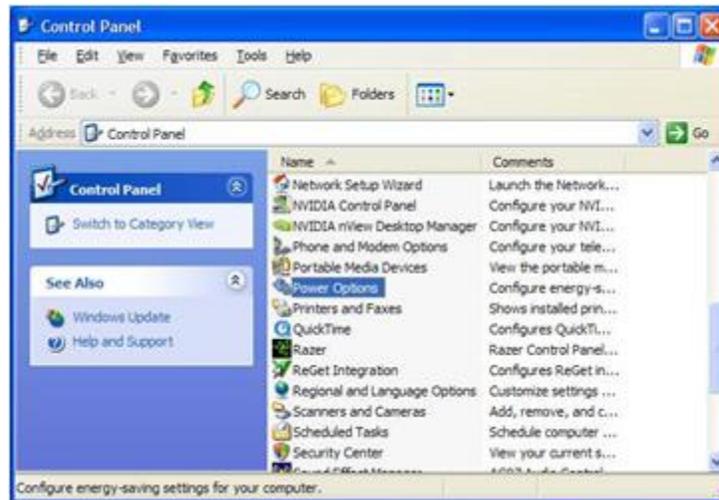
To configure power management on Windows XP, click on 'Start', 'Run,' and then 'Control Panel'. Control Panel has two views. If you are in **Theme View**, double click on 'Performance and Maintenance'...



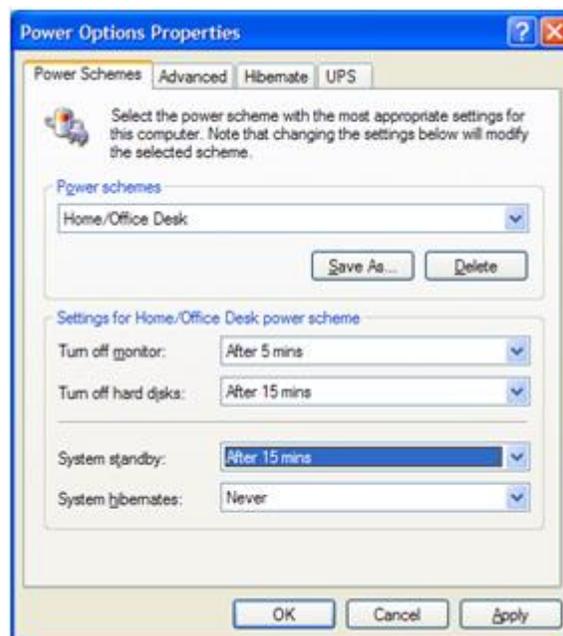
... and then on 'Power Options.'



If you are in **Classic View**, simply double click on 'Power Options.'



The Power Options Properties dialog box should be displayed with the Power Schemes tab selected. Here you can set timeouts for your monitor and system standby (sleep). Notebook computer users can specify an alternative power scheme that will take effect when the PC is running on battery power.

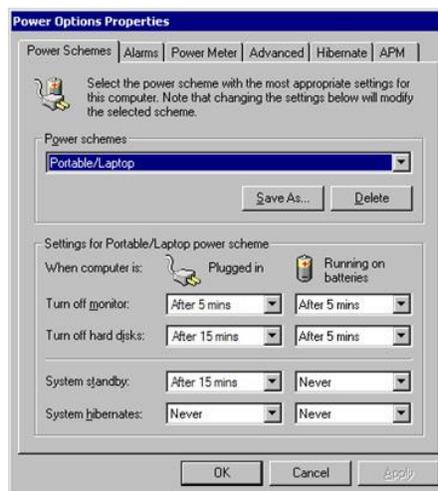


Situations That Cause Windows XP to Stay Awake

You may find that your PC doesn't go to sleep after the allotted time. Personal Computers (PCs) may not enter sleep mode when they have a file open over the network. Additionally, certain software applications may be preventing the computer from sleeping. (Software applications can tell Windows not to enter sleep modes.) Graphic-intensive screen savers can prevent PCs from entering sleep mode as well and should be disabled. Screen saver settings can be adjusted by right-clicking on the desktop and selecting 'Properties'. Then set screen saver to 'None' or 'Blank' on the Screen Saver tab.

Windows 2000

To view power management settings in Windows 2000, click on 'Start', 'Run,' and then 'Control Panel'. In Control Panel, double click 'Power Options'. Here you can set timeouts for your monitor, system standby, and hibernate. Notebook computer users can specify an alternative power scheme that will take effect when the PC is running on battery power.



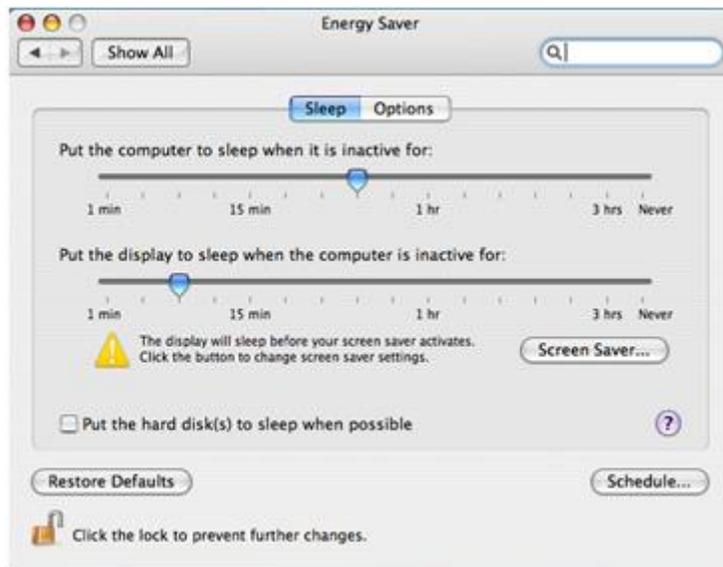
Situations That Cause Windows 2000 to Stay Awake

You may find that your PC does not go to sleep after the allotted time. PCs may not enter sleep mode when they have a file open over the network. Additionally, certain software applications may be preventing the computer from sleeping. (Software applications can tell Windows not to enter sleep modes.) Graphic-intensive screen savers can prevent PCs from entering sleep mode as well and should be disabled. Screen saver settings can be adjusted by right-clicking on the desktop and selecting 'Properties'. Then set screen saver to 'None' or 'Blank' on the Screen Saver tab.

Apple/Mac OS X

Follow the instructions below for Mac OS X Version 10.4 (Tiger). Steps for activating sleep settings in other versions of OS X will be very similar.

1. Click on the apple symbol (Apple Menu) in the upper left of your screen.
2. Go to 'System Preferences.'
3. Click 'Show All' (if necessary).
4. Select 'Energy Saver' from the Hardware row.
5. Set 'Put the computer to sleep when it is inactive for' using the slider.
6. Set 'Put the display to sleep when the computer is inactive for' using the slider.





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