



An Exelon Company

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Full Building Tune-up (BT) & Monitoring-Based Commissioning (MBCx) Technical Resources Manual

Pepco C&I Energy Savings Program

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1.0 INTRODUCTION & PROGRAM DESCRIPTION

The Full Building Tune-up (BT) program is designed to promote energy efficiency and reduce electrical consumption and usage in existing buildings. The program offers technical and financial assistance to identify and implement low cost measures, tune-ups and adjustments that improve the efficiency of buildings operating systems, with a focus on building controls and HVAC systems. The goal is to bring them to the intended operation or design specification.

Monitoring-Based Commissioning (MBCx) is an ongoing process to resolve operating problems, improve comfort, and optimize energy use in existing buildings.

2.0 PARTICIPATION REQUIREMENTS & SERVICE PROVIDERS

The Pepco Energy Savings for Business Program is for all Pepco commercial and industrial customers in Maryland. Pepco has approved a number of BT Service Providers (aka Service Providers) to assist Pepco customers in fulfilling the requirements for the Building Tune-up (BT) incentives. BT Service Providers can act as the customer's authorized provider and therefore can submit applications on the customer's behalf. The customer is the responsible party to the Pepco Energy Savings for Business Program and is required to sign the application. Customers wishing to use a Service Provider who is not currently recognized by the program must ensure that the Service Provider successfully completes the Pepco BT Service Provider Application and is approved by the Pepco Energy Savings for Business Program before starting any work. MBCx Service Providers are not required to be BT Service Providers.

3.0 BUILDING TUNE-UP (BT)

A. WHAT IS BUILDING TUNE-UP?

Building Tune-up (BT) is a systematic process that optimizes energy use and overall energy efficiency in an existing building over a sustained period of time. In addition to reducing operational inefficiencies which yield energy savings, the process also provides non-energy related benefits such as improved comfort, enhanced air quality, and reduced occupant complaints. Incentives are designed to encourage a comprehensive review and implementation of as many improvements as possible. Retro- Commissioning consists of:

- Full Building Tune-up
- Monitoring Based Commissioning (MBCx)

B. OBJECTIVES OF THE BUILDING TUNE-UP INCENTIVES

- Development and implementation of a comprehensive operation and maintenance plan that meets the business objectives and constraints of the facility owners or managers.
- BT develops a comprehensive energy efficiency plan that includes:
 - A prioritized list of low-cost/no-cost measures that would lead to electricity savings
 - A prioritized list of potential future capital investment projects that could lead to substantial electricity savings

- An education and training component for building operations personnel on how to operate the building efficiently, focusing particularly on O&M changes implemented during the Building Tune-up project
 - Identification of peak load shaving options that can be implemented during peak periods
 - Reduction of customer operating costs during peak and off-peak periods
 - Development of a plan to educate and train the building personnel how to operate the building efficiently
 - Documentation of findings and develop an action plan to implement recommended measures that reduce electricity usage.
- MBCx is an ongoing process to continuously monitor building system performance, to resolve operating problems, improve comfort, and optimize energy use within the building.

C. BENEFITS OF BUILDING TUNE-UP

The Building Tune-up Incentive helps Pepco's commercial and industrial (C&I) customers determine energy usage in their facilities, identify energy-savings opportunities and optimize the existing systems in their facilities. This is done through the use of BT Service Providers and MBCx service providers who will examine all of the building's major energy-using systems for cost-effective savings opportunities, with the primary focus on existing HVAC and control systems.

D. CUSTOMER ELIGIBILITY / TARGET MARKET

The criteria for participation in the Building Tune-up program are:

- High electric use intensity (per the EPA Portfolio Manager¹)
- Building is over 2 years old (this requirement recognizes that buildings less than 2 years old may not have the requisite full year of utility data that reflect a "fully occupied" building and consistent operating pattern)
- Building has an Energy Management System (EMS)
- Mechanical equipment in relatively good condition (i.e. not near end of life)
- Demonstrated management commitment to implement low-/no-cost measures

E. ELIGIBLE MEASURES

BT and MBCx typically involve reviewing and enhancing the performance of existing energy related equipment. Examples of measures are:

¹ EPA Portfolio Manager: http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager#rate

- Control System
 - Modifying a control system's programming and perhaps adding one or more sensors and/or circuit-control devices

- Lighting
 - On/Off Switching with Rewiring
- Ventilation
 - Clean/Replace Filters
 - Reduce Ventilation and Exhaust Fan Operating Hours
 - Tighten/Replace Belt Drives on Fans
 - Interlock Exhaust Fans with Machine Operations
 - Repair/Replace/Add Insulations on Ducts
 - Eliminate Duct Leakage
- Space Cooling
 - Lower Condenser Water Supply Temperatures
 - Adjust Chilled Water Supply Temperatures
 - Eliminate Simultaneous Heating & Cooling
 - Increase Thermostat Set-Point during Unoccupied Periods
 - Repair or Addition of Chilled-Water Pipe Insulation
 - HVAC Tune-Ups
 - Upgrade to Enthalpy Economizer Control
 - Repair Air-Side Economizer
 - Service DX Units (Ensure DX Unit is fully charged with Refrigerant)
 - Outdoor Air Damper Adjustment or Modification
- Space Heating (to the extent that electricity use is affected)
 - Reduce Thermostat Set Points for Unoccupied Periods
 - Adjust Discharge Air Temperature/Minimize Reheat
 - Repair and/or Modify Controls on Electric Space Heater
 - Repair/Replace/Add Insulation on Steam or Hot-Water Piping
 - Repair/Replace Steam Valves and Steam Traps
 - Reduce Stem Leaks
- Water Heating (to the extent that electricity use is affected)
 - Reduce Thermostat Set-Point
 - Repair/Replace/Add Insulation on Storage Tank and Hot-Water Piping
 - Configure Supply Piping to Maximize Free Pre-Heating
- Compressed Air
 - Reduce Compressed Air System Leaks
 - Install No-Loss Condensate Drains on Compressed Air System
 - Install Solenoid Valves on Compressed Air Drops and Interlock with Machines
 - Provide Compressed Air Storage and Lower System Pressure/ Replace Regulator Valves in Compressed Air System
- Multiple End-Uses
 - Modify Time Clock or EMS Scheduling, Assign New Points as Necessary
 - Calibrate/Replace Sensors

4.0 FULL BUILDING TUNE-UP TRACK: PROCESS & INCENTIVES

The Full BT track consists of three (3) phases for a total incentive amount of \$0.25 per square foot of conditioned building space or 75% of the BT Development Plan, whichever is less. The incentive phases are:

- Phase I - Development of a Building Tune-up Plan
 - Phase I pays an incentive of \$0.05 per square foot of conditioned building space not to exceed 75% of the BT Development Plan costs. This incentive will be held in reserve for the customer until Phase II is completed.
- Phase II – Detailed Investigation Report
 - Phase II pays an incentive of \$0.10 per square foot of conditioned building space, not to exceed 75% of the BT Execution Plan costs.
- Phase III - Implementation of Building Tune-up Recommended Measures
 - Phase III pays an incentive of \$0.10 per square foot of conditioned building space not to exceed 75% of the BT Implementation costs.

Pre-approval is required to participate in the BT track. The customer must submit the BT application, Phase I proposed scope of work, projected cost for the development of the Building Tune-up Plan, and EPA Portfolio Manager Statement of Energy Performance or DOE CBECs data indicating higher than average energy use intensity. Pepco reviews all applications and approved or denies participation by customer at the Pepco Energy Savings for Business Program's sole discretion. If the requirements of any given phase have been completed without pre-approval, the customer is not eligible for an incentive for that phase. The customer is still able to participate in a subsequent incentive phase as long as the prerequisites of the prior phase have been met. The customer must submit the required documentation for all completed phases and apply for incentive for the subsequent phase not yet begun.

For example, if the customer has already completed an BT Development Plan that meets all of Phase I requirements of the Program, the customer can submit the documentation required for Phase I for pre-approval of Phase II. Once Phase II has been pre-approved, the customer can proceed with subsequent phases.

At the end of each phase, the customer must prepare and submit a report for review and approval by the Program prior to incentive payment processing.

4.1 PHASE I – DEVELOPMENT OF A BUILDING TUNE-UP PLAN

Phase I of Full BT requires preparation of a report that includes a preliminary audit, development of the BT plan and the scope of work and budget for Phase II.

A. Pre-Approval Process

The BT application is submitted to the Program prior to starting the BT track of Building Tune-up. BT requires a copy of the Phase I proposed scope of work, projected cost for the development of the Building Tune-up Plan, and EPA Portfolio Manager Statement of Energy Performance or DOE CBECs data indicating higher than average energy use intensity be submitted with the BT application. Upon pre-approval by the Program, the BT track can proceed.

B. Develop BT Plan

Upon review and approval from the Program, the BT Plan development begins. Elements that must be included in the Building Tune-up Plan are:

- Title Page and Table of Contents
- Executive Summary of the findings
- Introduction section, including names and contact information for the Building Owner, Building Manager, and BT Service Provider
- Building and Energy Systems Description, including an equipment list and equipment capacities (e.g., tons, horsepower, amps, volts, gpm, cfm)
- Energy Baseline, Energy Star Rating, including at least 1 year (3 years preferred) of actual monthly electricity and fuel usage data
- Operations and Maintenance Review
- Operational Scheduling of major systems
- Documented evidence of any energy use reductions resulting from immediate changes made in Phase I
- A list of systems and equipment, and possible Energy Efficiency Measures (EEMs), to be investigated in Phase II. Follow ASHRAE guidelines for a Level 1 energy audit
- Scope of work and budget for Phase II - Detailed Investigative Stage

C. Final Approval for Incentive

After the plan is completed, the customer submits:

- The BT Plan
- The signed invoice for the work performed
- The signed statement that the work was completed

Once the Program has received this documentation, an incentive payment is awarded and held until confirmation that Phase II requirements have been met. If the customer completes Phase I, but does not proceed to complete Phase II, the incentive award may be forfeited, at the Program's sole discretion.

4.2 PHASE II - EXECUTING THE FULL BT PLAN – DETAILED INVESTIGATIVE STAGE

Phase II of BT requires preparation of a report that includes the findings from a comprehensive site assessment.

A. Pre-Approval Process

The approval of the Final BT Plan from Phase I will serve as the pre-approval for Phase II. During Phase II, the scope of work identified in Phase I must be implemented. This will include extensive monitoring of the equipment parameters and engineering calculations of expected energy reductions.

B. Deliverable: BT Investigation Report

Elements that must be included in the Building Tune-up Investigation Report are:

- ASHRAE Level 2 Energy Audit report template, including:
 - Title Page and Table of Contents
 - Executive Summary of the findings
 - Introduction section, including names and contact information for the Building Owner, Building Manager, and BT Service Provider
 - Detailed building and energy systems description, including more accurate estimates (relative to Phase I) of the equipment usage profiles
 - Detailed operations and maintenance review
 - Documentation of O&M refresher training for facility O&M staff
 - Detailed operational scheduling of the major systems
 - Documented evidence of any energy use reductions resulting from immediate changes made in Phase II.
 - A list of EEMs identified for implementation:
 - Description
 - Projected Costs
 - Projected Savings
 - Simple Payback with and without incentive
 - Total of Low-Cost/No-Cost Items
 - Total of Major Capital Items
 - Assessment of the Existing Equipment Over-Sizing and Recommendations for Right-Sizing when HVAC equipment needs replacement, including, but not limited to recommended capital items
 - Scope of work and budget for Phase III – Implementation Stage

C. Final Approval Process

To qualify for an incentive, the customer submits the completed BT Investigation Report, a signed invoice for the services provided, and a signed statement that the work was completed.

4.3 PHASE III – IMPLEMENTATION OF BT RECOMMENDED MEASURES

The approval of the Final BT Investigation Report from Phase II will serve as the pre-approval for Phase III.

Phase III of Full BT requires preparation of an Implementation Plan documenting EEMs to be implemented. Following Program pre-approval of the Plan, the findings of the Phase II study are implemented, including all low cost/no-cost measures. Finally, an BT Implementation Report is prepared that documents savings expected to accrue from all the work performed.

Note: Phase III does not pay an incentive for capital measures; however other Program incentives may be available for capital project implementation. It is recommended that Standard, Alternative and/or Custom Program Applications be submitted for incentive pre-approval. Visit the website for application details.

A. Responsibilities and Deliverable: BT Implementation Report

In Phase III, the customer must:

- Implement the findings of the Phase II Investigation Report, including all low-cost/no-cost items that meet the customer's financial criteria.
- Evaluate major capital items for future implementation, and implement those that meet the customer's financial criteria, taking advantage of other Program incentives where possible.
- Prepare an BT Implementation Report on the projects completed. Report elements must include:
 - Title Page and Table of Contents
 - Executive Summary of the findings
 - Introduction section, including names and contact information for the Building Owner, Building Manager, and BT Service Provider
 - List of EEMs implemented, providing copies of invoices for the work performed. For each EEM implemented, provide:
 - Cost of implementation
 - Estimated annual electricity savings and demand reductions
 - Results/documentation of training of O&M staff associated with each EEM
 - A plan for future capital energy efficiency projects and/or an accounting of projects completed
 - Contract with a Program approved BT Service Provider for commissioning of the improvements to ensure that the implementation stage has been completed properly and the energy savings continue

B. Final Approval Process

To qualify for the incentive, the customer must submit the BT Implementation Report, a signed invoice for the services provided, and a signed statement indicating that the scope of work has been completed. Incentives in this Phase are available only for measures that reduce electricity usage and demand.

5.0 MONITORING-BASED COMMISSIONING TRACK

Monitoring Based Commissioning (MBCx) is an ongoing process to resolve operating problems, improve comfort, and optimize energy use in existing buildings.

The MBCx Track consists of three (3) phases:

- Phase I – Installation
 - Phase I includes a scoping document and installation of automated remote monitoring and diagnostic equipment. Software upgrades may be necessary to implement MBCx measures and are acceptable in this phase. Phase I incentives are 25% of the three year contract cost capped at a maximum of \$8,000.
 - Applicants will be eligible for an additional incentive of \$0.04 per conditioned square foot if an ASHRAE Level 2 Audit is submitted.
- Phase II – Monitoring Phase
 - Phase II consists of long-term monitoring, including recommendation of additional operations and maintenance measures. A Quarterly Equipment Monitoring Report is submitted to fulfill this phase. No incentives are available for Phase II.
- Phase III – Implementation Phase
 - Phase III consists of implementation of operation and maintenance measures recommended in the Phase II MBCx Monthly Equipment Monitoring Reports. The Implementation Summary and MBCx measure implementation report must be submitted on a quarterly basis to qualify for incentives. For each reporting period, please fill in a separate Implementation Summary section, for a maximum of six (18 months total). Measures may be implemented quarterly or over an 18 month period. Phase III incentives are available only for measures that reduce electric usage. The one-time incentive for each measure will be paid at a rate of \$0.20 per kWh saved annually.

Pre-approval is required to participate in the MBCx track. The customer must submit the MBCx application, a three year contract executed with the Service Provider, as well as EPA Portfolio Manager Statement of Energy Performance or DOE CBECs data indicating higher than average energy use intensity. Pepco reviews all applications and approves or denies participation by customer at the Pepco Energy Savings for Business Program's sole discretion. Upon pre-approval by the Program, the MBCx track can proceed.

⁴ American Society of Heating, Refrigeration and Air Conditioning Engineers - Procedures for Commercial Building Energy Audits

5.1 PHASE I - COMPREHENSIVE ENERGY SAVINGS STUDY SUBMISSION AND INSTALLATION OF AUTOMATED REMOTE MONITORING AND DIAGNOSTIC EQUIPMENT

A. Pre-Approval Process

The MBCx application is submitted to the Program prior to starting the MBCx track of Building Tune-up. MBCx requires a three year contract executed with a Service Provider, as well as EPA Portfolio Manager Statement of Energy Performance or DOE CBECs data indicating higher than average energy use intensity.

B. Deliverable: BT Investigation Report

Phase I of the MBCx track requires submission of a scoping document (ASHRAE Level 2 Audit is optional) and the use and/or installation of automated remote monitoring diagnostic equipment and controls which connect to an Energy Management System (EMS).

For capital improvement equipment EEMs, it is recommended that Standard, Alternative and/or Custom Program Applications be submitted for incentive pre-approval. Visit the website for application details.

C. Final Approval Process

To qualify for the incentive, the customer must submit the scoping document, a signed statement indicating report acceptance, and a signed invoice for the services provided.

5.2 PHASE II - LONG-TERM MONITORING, INCLUDING RECOMMENDATION OF ADDITIONAL OPERATION & MAINTENANCE MEASURES

Program approval of the scoping document from Phase I will serve as the pre-approval for Phase II.

Phase II of the MBCx Track requires quarterly monitoring activity reporting and documentation on operation and maintenance (O&M) measures implemented. Long-term monitoring-based commissioning helps ensure that the equipment performs at optimum levels over an extended period of time. Identification, recommendation and implementation of additional measures will also qualify for an incentive.

A. Responsibilities and Deliverables

- MBCx Monthly Equipment Monitoring Report requirements:
- Title Page and Table of Contents
- Executive Summary of the findings
- Introduction section, including names and contact information for the Building Owner, Building Manager, and MBCx Service provider
- Monitored Equipment Listing

- O&M measures identified for implementation, including current operating conditions, proposed operating conditions, anticipated cost of implementation and annual project savings (kW, kWh, fuel and water)
- Measures should include unique identification number and description (e.g. O&M-1 – Re-initiate Enthalpy Economizer Operation for AHU-1)
- O&M measures implemented, measure number, description, date of implementation, cost of implementation and estimated annual savings (kW, kWh, fuel and water)
- Cumulative listing of O&M measures recommended
- Cumulative listing of O&M measures implemented

B. Final Approval Process

No incentives are paid under MBCx Phase II, however Equipment Monitoring Reports are reviewed.

5.3 PHASE III – OPERATION & MAINTENANCE MEASURE IMPLEMENTATION

Submission of the first MBCx Quarterly Equipment Monitoring Report will serve as the pre-approval for Phase III. Phase III of the MBCx track provides detailed savings calculations and costs associated with implemented O&M measures, and incentive payment. Program incentive payment requests are to be submitted quarterly.

A. Responsibilities and Deliverables

- MBCx Measure Implementation Report for projects completed for the quarter. Report elements must include:
 - Title Page and Table of Contents
 - Executive Summary of the findings
 - Introduction section, including names and contact information for the Building Owner, Building Manager, and MBCx Service Provider
 - List of O&M measures implemented, measure identification number, date of implementation, cost of implementation, estimated savings (kW, kWh, fuel and water) including detailed calculation methodology and results/documentation of training of O&M staff for each measure
 - Customer-signed O&M measure invoice and quarterly invoice for contract services
 - MBCx implementation summary completion form

B. Final Approval Process

To qualify for an incentive, the customer must submit the MBCx Implementation Report quarterly as well as the MBCx implementation summary form.

Appendix A: Commissioning Certification Organizations

For the Building Tune-up track, the customer's commissioning Service Provider must be certified by one of the organizations listed below. When a customer wishes to use a non-certified Service Provider to perform the Building Tune-up, an exception to the rule may be granted only if (1) the proposed Service Provider provides evidence of having completed similar commissioning projects for two or more buildings of at least 75,000 square feet (conditioned space) each, and (2) the Service Provider submits at least two verifiable and satisfactory references from customers or clients who used the Service Provider to complete the similar projects. For the Monitoring-Based Commissioning track, service providers are not required to be Service Providers. However, commissioning certification is preferred.

RESOURCES: Commissioning Certification

The following five organizations currently certify commissioning providers. Visit the organizations' web sites for more information on their certification incentives and to obtain lists of certified commissioning providers.

- “Certified Commissioning Professional (CCP)”: Building Commissioning Association (BCA), www.bcx.org/certification/index.htm
- “Certified Commissioning Provider”: Associated Air Balancing Council Commissioning Group (ACG), www.acgcommissioning.com/membershipcertification
- “Accredited Commissioning Process Provider”: University of Wisconsin at Madison (UWM), <http://epdweb.engr.wisc.edu/courses/index.lasso> (use link to Building Systems and Construction to find certification training)
- “Systems Commissioning Administrator”: National Environmental Balancing Bureau (NEBB), www.nebb.org/bcccertif.htm
- “Certified Building Commissioning Professional (CBCP®)”: Association of Energy Engineers (AEE), www.aeecenter.org/certification

Pepco Energy Savings for Business Program
Contact: 1-866-353-5798 | pepcobusiness@icf.com