Introduction

The Project Implementation phase primarily involves project management for the construction of retrofits in energy-saving projects. It may include the final negotiation of an energy performance contract or other types of services contracts.

An energy audit was previously completed that identified the costs and savings of each project. The subsequent Feasibility Study confirmed and provided detailed costs and savings for specific measures identified by the audit. The audit and Feasibility Study provide the basis to develop and negotiate the energy performance contract (EPC).

A critical decision that precedes this step in the Municipal Buildings Retrofit process is the selection of an internal or external implementation strategy. If the choice is external, it may involve the use of an ESCO or a general contractor. If the choice is internal, project management responsibilities, including contracting with suppliers, will reside within the appropriate department of the municipality.

During Project Implementation, the ESCO, or other contractor, installs or completes all the efficiency measures. The amount of time required will depend on the scope and complexity of those measures. In the external option, the municipality will assign project management responsibility to the ESCO or general contractor. The ESCO or general contractor will use a combination of its staff and subcontractors, and will issue and manage all the subcontracts. Of course, installation may also involve your organization's staff as set out in the EPC.

When an external implementation option is selected, the internal project team should oversee the installation and completion of all efficiency measures. It would be prudent for the project team to meet at least bi-weekly with the ESCO or general contractor to review progress. For each efficiency measure installed or completed, the municipality will receive a completion notice from the ESCO for review and approval. Completion notices must provide sufficient information to demonstrate that the retrofit measure is implemented according to specifications as outlined in the design documents, and that the assumptions regarding the net savings it produces are valid.

In the context of an EPC, the municipality may also be asked to approve baseline changes if the ESCO identifies variances that affect net savings projections. If the project's net savings are to be insured, you should provide the insurer with the opportunity to conduct an engineering review of the installed measures as well as any proposed baseline changes before you sign off on the completion notices. Once the insurer has approved the measures and any baseline changes, you are in a position to sign off.

Whether the implementation strategy is internal or external, various issues are likely to arise that need resolution by the municipality, alone or in consultation with its contractors. This section will walk you through the typical issues that may arise during Project Implementation.

Purpose

Project Implementation follows the detailed Feasibility Study and the signing of the contracts to carry out the approved projects. The purpose of Project Implementation is to successfully complete building retrofits. The purpose of this section is to identify issues that are likely to arise during project implementation and to offer guidance on resolving them.

Supporting documents are available including a sample EPC in the Resource Manual. The EPC is your road map for implementing and tracking the project over the life of the contractual agreement. It should clearly define roles and responsibilities and explicitly state how savings are determined and how the guarantee will function.

The EPC is provided as a sample and reference only. It may not identify or address all the circumstances or conditions you may encounter. Consequently, it is recommend that your legal counsel and procurement staff carefully review the document and adapt it to meet your needs.

Team/Partnership

Your internal project team should receive feedback from, and provide input into, the Project Implementation on a regular basis. Taking ownership of the project is the best way to ensure its success after the contractors have left the site.

As suggested above, during this step you may choose to work with various external partners. An ESCO is an obvious one. There are different approaches you may use to procure the services required for the retrofit project.

A “bundled” project involves contracting a single firm to provide a comprehensive range of services to see a retrofit project from inception through to completion.

“Unbundling” refers to contracting a number of firms to deliver different services, such as the Feasibility Study, design, retrofit and monitoring. It can also mean hiring different contractors for different retrofit measures.

When dealing with a number of different contractors or consultants, you may find it useful to appoint or hire a project manager to co-ordinate all aspects of the project.

Information Requirements

Information requirements during Project Implementation are minimal. Rather this step involves verifying that work is being completed as agreed. For this reason several sample checklists are provided.

Action Items

During this step project management is the critical activity. Several project management checklists are provided and can be used as templates for agendas for project meetings. Some of these items may not be relevant to your project.

Template Material

- Information requirement checklist
- Document submission checklist
- Project Management checklist
- Model Energy Performance Contract for Use by Municipal Government (First-Out Style Contract), with Appendices and Notes (Resource Manual)
- Model Energy Performance Request for Proposal for use by Municipalities, with Appendices and Notes (Resource Manual)
- Model Request for Proposal for Third Party Services for Energy Performance Contracting, with Appendices and Notes (Resource Manual)

Next Steps

- Ensure your Monitoring and Verification system/plan is in place by the time the retrofit is complete (Section 8 of the MBR Guide and Section 8 of the Resource Manual)
- Design and implement a training plan to involve all employees in the on-going task of energy use reduction through operational actions
- If you haven't already done so, implement your Communications Plan. The Communication Manual is provided as reference

FCM Support

- Resource Manual: Sections on Financing and Implementation Options, Renewable Technologies, and Waste Disposal
- Strategic Energy Planning Workshop (Optional)
- Spot the Energy Savings Opportunities Workshop (Optional)
- Monitoring and Verification Workshop (Optional)

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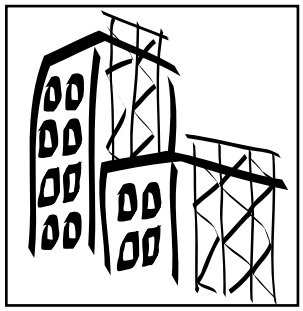

Section 7
Project Implementation

Guide

All templates in this guide are available in text and PDF format on the accompanying CD ROM or on the Knowledge Network at http://kn.fcm.ca.

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Monitoring and Verification:
See Section 8 of the MBR Guide and Section 8 of the Resource Manual for details.

Health and Safety Impacts:
The ESCO is contractually liable to maintain the required standards of comfort throughout the contract term. The Canada Occupational Safety and Health standards are used to reflect realistic ranges of heating, cooling and hot water temperatures, lighting levels, chilled water requirements, and other specified comfort and operating parameters to be maintained.

Warranties:
Warranties provided should ensure that all installed equipment is new and protected by appropriate written manufacturers' warranties for parts and performance for a minimum of one year. Warranties should provide for replacement with new parts (not used or reconditioned) during the warranty period. While equipment warranties will be transferred to the customer after completed project installation, the ESCO is responsible for pursuing any necessary remedies during the warranty period. If the ESCO fails to exercise the warranty and damages occur, the ESCO is responsible for all costs of repair and any lost savings.

Information Requirement Checklist

	Responsibility	
	In-house managed	**ESCO-managed**
Item		
Certificate of Insurance		
Performance Bond		
Payment Bond		
Work Schedule		
Work Arrangements – Outside Normal Hours		
Design & Construction package		
ECM Installation Quality Control Inspection Program		
Commissioning Plan		
Safety & Health Plan		
Notification of Utility Interruption		
Operation Work Procedure		
Maintenance Work Procedure		
O&M Manuals		
Post-Installation Monitoring and Verification Report		
As-built Drawings		
Annual Monitoring and Verification Report on ECM Performance		
Notes:		

Commissioning

Lots of information is provided on commissioning but it was not mentioned in the introduction as something of importance.

Overview
Commissioning is a separate activity from construction, but successful commissioning requires that certain quality assurance and quality control procedures, envisioned in the commissioning plan, be performed either as part of or in co-ordination with the construction contract.

These procedures fall into three categories: 1) those procedures that have traditionally been required to prove the contractor's compliance with the contract documents, 2) those procedures that establish that a necessary, but not contractually required, level of system performance is attained, and 3) those optional procedures that afford the building owner extra features or tools.

In the first category are shop drawings and product data submittals, factory inspections, tests, and other source quality control, punchlist inspections, equipment acceptance tests, field inspections, pre-startup procedures, functional tests, and other field quality control procedures.

In the second category are testing, adjusting, and balancing to a basis of design, and performance verification to the design intent. Even though a contractor in a given situation cannot be compelled to achieve a stipulated level of performance, the contractor can be (and often is) required to perform the procedures and report the results. Long term monitoring and verification (detailed in Section 8 of the MBR Guide and Section 8 of the Resource Manual) could be considered a part of the commissioning process.

The third category includes preparing operation and maintenance manuals, and training operations and maintenance personnel.

Responsibilities of Commissioning Participants

Each member of the commissioning team has specific responsibilities to ensure that the commissioning process is completed according to the commissioning plan and commissioning specifications. The following descriptions provide general commissioning responsibilities for team members.

Owner: The owner defines the overall vision for the project, establishes operational goals and requirements, and establishes and defines the commissioning team.

Commissioning Authority: The commissioning authority organizes and leads the commissioning team and is responsible to the owner to verify that the design intent of the ECMs is satisfactorily achieved.

Commissioning Team: The commissioning team prepares the commissioning plan, implements the commissioning process and prepares the final commissioning report.

Design Team: The design team prepares the design contract documents that reflect the design intent of the building owner.

Construction Manager: The construction manager is responsible for managing the construction process and assuring completion of the project on time and within budget. Specific commissioning responsibilities could include co-ordinating interactions between the commissioning team and other facility team members.

General Contractor: The general contractor is responsible for constructing the facility in accordance with the contract documents. Specific commissioning responsibilities could include co-ordinating and scheduling performance tests, compiling and organizing O&M documentation, and co-ordinating training sessions.

Subcontractors: The subcontractors are responsible for performing work and supplying equipment as stated in their respective contracts. Specific commissioning responsibilities could include performing performance tests and providing training and documentation for O&M staff.

Suppliers and Manufacturers: The suppliers and manufacturers provide specified systems, components and equipment to the owner, contractor and subcontractors. Specific commissioning responsibilities could include conducting factory and site performance tests and providing O&M documentation for specific equipment.

Operation and Maintenance Staff: The facility O&M staff provides continual services to effectively operate and maintain building systems, subsystems and equipment. Specific commissioning responsibilities could include defining O&M requirements in the design intent, defining training requirements, and conducting performance testing.

Commissioning - Sample Scope of Work

Commissioning

Commissioning typically occurs before the municipality's final project acceptance, although language can be included in the contract to provide for testing after project acceptance. It should also require that the ESCO notify the municipality when testing will take place and gives the municipality (or its designated representative) the right to be present during all tests. Have the commissioning report include manufacturers' start-up and performance sheets.

The construction manager may hire an independent commissioning agent depending on the complexity of the project. If commissioning is the responsibility of the contractor, the contractor shall prepare a commissioning plan and schedule and submit them to the construction manager for approval. The contractor shall provide all the instrumentation and tools required for commissioning. The construction manager or its designated representative shall supervise the commissioning process and the pre-functional and functional tests for the specified energy-efficiency equipment. The contractor shall prepare a commissioning report and shall submit it to the construction manager for review and approval.

Training
During the commissioning process the contractor shall start training the operations and maintenance personnel. The training shall consist of classroom training, a facility walk through, and actual staff involvement during commissioning, performance inspection, and a trial run. The contractor shall ensure that the staff is capable of properly operating, maintaining, and handling emergency situations in an efficient and safe manner.

Trial Run
The contractor shall complete the trial run as specified in the design document or as recommended by the equipment manufacturers. The operating staff shall be involved during this process but the contractor shall be responsible for any malfunction or operating errors. The contractor shall take readings of the operating parameters, as recommended by the manufacturers, and shall submit these readings to the construction manager for review and approval.

Performance Testing
Depending on the complexity of the project the construction manager may hire an independent agent for this process. If the contractor is to conduct testing, the contractor shall provide all the instrumentation and tools required for performance testing. The contractor shall prepare a test plan and schedule and provide these to the construction manager for review and approval. The construction manager or its designated representative shall supervise the performance testing process. The contractor shall prepare a performance test report and shall submit it to the construction manager for review. The contractor shall discuss the results of the tests with the construction manager. The contractor shall ensure that the equipment and the building perform according to the specifications written in the design document. If the equipment and the building fail to meet the performance standards, the contractor shall recommission the equipment, modify or change any equipment with the pre-approval of the construction manager. The construction manager or its designated representative will make the final determination of whether the equipment meets the designed performance standards.

Documentation
The contractor shall submit all the required documents to the construction manager. The documents to be submitted include, but are not limited to, the following:

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Document Submission Checklist

Item	Complete
Operating procedures	
Maintenance procedures	
Operation check lists	
Maintenance check lists	
Operation and maintenance manuals	
Lists of recommended spare parts	
Contact information for any questions	
As-built drawings	
Construction and installation reports	
Construction and installation inspection reports	
Commissioning reports including set points	
Performance test reports including test and balance reports	
Trial run reports including operating parameter readings	
Waste disposal reports	
Material safety data sheets	

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There should be a standard construction provision requiring the ESCO to comply with all code requirements, pay all associated permit fees, and provide the customer with copies of each permit and license required to do the work. The municipality should agree to assist the ESCO to the best of its ability to obtain required permits and approvals.

You should ensure that there is adequate integration between the firm's implementation schedule and your Communications and Training Plans.

Project Management Checklist Template

	Responsibility	
	In-house managed	**ESCO-managed**
Safety & Environmental		
Carry out job site safety walk-down and develop supervisor orientation schedule.		
Evaluate and identify safety aspects of job; inform workers.		
Check worker licensing and certifications.		
Clarify burn permit approval requirements.		
Ensure appropriate health cards up-to-date as required by site.		
Sign scaffolding inspections signed.		
Check job site for any confined spaces and ensure compliance with entry.		
Check to ensure any underground utilities have been located and identified.		
Check to ensure any in-the-wall utilities have been located and identified.		
Check to ensure all hazardous materials, either stored or as a part of the facility, have been located and identified. Site-specific requirements for hazardous material handling identified.		
Ensure all personnel have been made aware of fire exit corridors and procedures.		
Review site injury reporting and response requirements.		
Establish emergency notification process.		
Secure environmental permits prior to construction.		
Organization and Communications		
Identify and list key contractor and site contacts (names/phone/cell/pager).		
Establish schedule for design/construction update meetings.		
Clarify change order review and approval process.		
Establish emergency notification process.		
Timeline – Design/Construction Schedule		
Establish design and design approval schedule.		
Establish construction schedule.		

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The ESCO will prepare the detailed design of all efficiency measures in the project, revised operating procedures, an implementation schedule, a commissioning plan, and performance testing procedures for the project team's approval.

If there are potential occupancy issues with individual efficiency measures (e.g., the location and quality of lights), it may be wise to have the firm prepare a display or demonstration site.

Your insurer will need to review the detailed specifications and drawings for the proposed efficiency measures to ensure that they are consistent with the approved Feasibility Study.

Clearing of Site:
Additional resource material regarding construction, renovation, demolition and waste removal/recycling is provided in Section 7, Waste Disposal - Closing the Loop, of the Resource Manual.

Project Management Checklist Template

	Responsibility	
	In-house managed	**ESCO-managed**
Design		
Establish engineering drawings approval requirements – prior to construction.		
Establish redline authority approved for as-build drawings during construction.		
Establish equipment data sheets submittal and approval requirements.		
Facility Access & Security Requirements		
Contractor personnel site and/or building access requirements.		
Security badges.		
Requirements for site escorts.		
Allowable equipment.		
Vehicle access approval requirements.		
Outages		
Utility service interruption permits approval.		
Utility reconnect permits approval (including hot-wire permits).		
Site personal support for outages.		
Construction		
Excavation permits approval requirements.		
Crane movements and locations reviewed for overhead hazards.		
Construction start-up co-ordination requirements (building manager and occupants).		
Materials and equipment confirmed at job site or scheduled to arrive prior to need.		
Establish acceptable lay-down yard and/or office space allocations for contractors.		
Job/work lists prepared and approved.		
All worker certifications (welding, electrical, etc.) up-to-date.		
All vehicle licensing up-to-date.		

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References

1. NATIONAL INSTITUTE OF BUILDING SCIENCES, WASHINGTON, DC., *Total Building Commissioning General Principles and Procedures*.
2. COLORADO GOVERNOR'S OFFICE OF ENERGY CONSERVATION, *Sample Documents for Performance Contracting*, November, 2001, Rebuild Colorado Program Staff.
3. GOVERNMENT OF BRITISH COLUMBIA, *How-To Guide – A guide to building retrofits that lower energy and water use and reduce greenhouse gas and waste generation*, Green Buildings, BC, BC Buildings Corporation, the Ministry of Competition, Science and Enterprise.
4. KOEHLING, Erick, *Design/Construction Kickoff Agenda Items*, U.S. Department of Energy, Hanford Site.