# Introduction

The Feasibility Study is an investment-grade review of the site's condition and potential efficiency improvements and a detailed assessment of both the technical and economic viability of the proposed energy conservation measures (ECM). The Study should validate all or most of the efficiency measures recommended in the Project Proposal as well as the net savings forecast therein. As well, the Study may include additional measures that the engineering firm or energy services company (ESCO) feels are worth considering, which may not have been in the original Proposal.

## Purpose

Once the Project Proposal (Step 5) is complete, the team has produced an increasingly detailed document describing the ECM that are worth investing further time and energy to determine their feasibility. After presenting the Proposal, the team has secured resource commitments from senior staff and council members to proceed with the next stage.

If it appears from the Proposal that some or all of the proposed measures may be economically marginal, the municipality could opt for a two-stage Study – preliminary and then detailed. The preliminary study would include more detail than the Proposal, including initial cost estimates, but would not have the investment-grade engineering and financial detail required to proceed with a full implementation. The preliminary Feasibility Study could be presented to staff and Council to aid in deciding whether to proceed with the detailed Feasibility Study and subsequent Project Implementation, or stop the process if the economics are not favourable. If the Feasibility Study is to be split into preliminary/detailed stages, this must be clearly outlined in the Request for Proposals (RFP), along with the appropriate escape clauses following the preliminary study.

The purpose of the detailed Feasibility Study is to move from a clearly defined Proposal to the engineering and economic details necessary to make the decision on whether or not (or to what degree) to proceed to the next step (Project Implementation – Step 7).

A Feasibility Study, sometimes known as a Technical Energy Audit, includes a detailed audit of your facilities, which helps your organization define your retrofit project more precisely, especially in terms of desirable efficiency measures, baselines, and project economics. The Study positions you for the preparation of your business case and the detailed design of the individual measures.

The RFP is the link between the Project Proposal and the Feasibility Study. A clearly defined and comprehensive RFP can help to avoid misunderstandings and disagreements later in the project. The scope of the RFP could include the feasibility study, engineering design, project management, general contracting, commissioning and testing, monitoring and verification, training, performance guarantees and financing. If an ESCO performs all functions it is referred to as a “bundled” option. Sample RFPs and guides for different scenarios are included in the Resource Manual under Model Documents.

Before beginning the preparation of the RFP for the Feasibility Study (or the entire project), the project team should consult with the insurer (if you are using one) who will be insuring the savings performance of your project. You should also give insurer the opportunity to review the RFP to ensure that it includes all of the necessary elements for their due diligence review.

## Team/Partnership

There are at least three implementation options for the management of the Study:

1. ESCO-managed study (a municipality hires an ESCO for the entire project and this includes the preliminary and detailed feasibility studies).
2. Third party-managed feasibility study (a municipality hires a third party to manage the engineering firm selected to do the Study).
3. Internally-managed feasibility study (a municipality engages and manages an engineering firm to complete the Study).

A project manager should co-ordinate all aspects of the Study. In option 1 above, this would be an employee of the engineering firm or ESCO. In option 2, this would be an outside person or firm. In option 3, it should be someone from within municipal staff who has the requisite knowledge and skills to address issues as they arise and to keep the Study on schedule and budget.

## Information Requirements

The detailed Feasibility Study typically requires the most data and information of any of the project steps. Some of this information will come from the engineering firm or ESCO (ECM costs and predicted savings, weather data), but most of it must be gathered on site. This may include, but is not limited to:

**Technical**

- Building physical conditions
- Hours of use or occupancy
- Areas and use of conditioned space
- Inventory of energy consuming equipment or systems
- Inventory of energy consuming equipment operating conditions and loads
- Baseline weather

**Costing**

- Estimated annual operating cost
- Project cost by ECM
- Estimated annual cost savings by ECM
- Unit cost by major components and systems
- Breakdown of implementation cost and estimate of annual energy savings
- Annual maintenance expense figures for measure development
- Asset renewal plans to ensure the scope addresses renewal needs
- Financing criteria from your finance team to support the financing method recommendation

## Action Items

During the detailed Feasibility Study, the primary function of the municipality would be to support the engineering firm or ESCO to facilitate the Study in a timely and efficient manner. A typical task list for the municipality leading up to and including the Study would include:

- Issue RFP/RFQ
- Provide prospective engineering firms or ESCOs with information and access to the facilities
- Evaluate proposals and select an engineering firm or ESCO
- Support the engineering firm's or ESCO's detailed Feasibility Study
- Evaluate the Feasibility Study and update the Project Proposal
- Analyze and understand municipal financing constraints and risk position, and recommend appropriate financing options

The engineering firms or ESCO's tasks in carrying out the Study fall generally into the following five stages:

1. **Data Gathering:** This stage represents the most significant portion of the study. In this stage the engineering firm or ESCO endeavors to establish the current operating parameters and conditions of most of the facilities' energy-consuming equipment. This is done through on-site interviews with maintenance staff, reviews of drawings, document searches at the facility, as well as on-site measurements and evaluation by technicians.
2. **Baseline Development:** In this stage, the engineering firm or ESCO analyzes the historical usage at the facility. The primary objective of this stage is the baseline period selection for use in energy cost avoidance calculation of the facility.
3. **Measure Development:** During this stage the engineering firm or ESCO conceptualizes the measures that could be implemented given the current systems, and the operating conditions. Preliminary savings and costs are estimated to determine the merit in further detailed analysis of these potential measures.
4. **Savings Establishment:** The energy and operating savings associated with each measure are determined in this stage. This may be done using sophisticated building simulation application and/or spreadsheet applications. Measures are carefully analyzed taking into account weather, utility rates, and interactions between ECMs.
5. **ECM Cost Development:** The ECM costs are determined by establishing a budget grade specification detailing the concept and broad operating parameters for each measure. Suppliers and contractors then use this specification as the basis for cost development.
6. **Reporting:** This is the final stage of the Study in which all data is summarized, and presented as a report.

### Template Material

- Sample Feasibility Study (this document)
- Model Energy Performance Request for Proposal for use by Municipalities with Appendices and Notes (see Resource Manual)
- Model Request for Proposal for Third-Party Services for Energy Performance Contracting, with Appendices and Notes (see Resource Manual)
- Model Energy Performance Contract for Use by Municipal Government (First-Out Style Contract), with Appendices and Notes (see Resource Manual)

### Next Steps

- Present detailed Feasibility Study to senior staff or Council as required to obtain commitment to proceed with specified recommendations (Project Implementation)
- Build external partnerships as required to move to Project Implementation (possibly including further RFP/RFQ process for implementation in the case of unbundled option)
- Apply for implementation funding as required and available

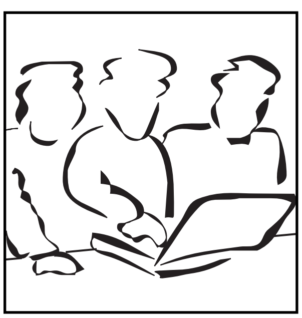
### FCM Support

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

### References


1. U.S. DEPT. OF ENERGY. *FEMP Utility Project Financing Workshop PowerPoint Presentation*, Federal Energy Management Program.
2. FLANNIGAN, Bryan. P.Eng., *Sample Feasibility Study*.
3. COWAN, John. U.S. Dept. of Energy, *International Performance Measurement and Verification Protocol*, Oct. 2000, Office of Energy Efficiency and Renewable Energy.
4. REBUILD COLORADO PROGRAM STAFF. *Sample Documents for Performance Contracting*, Colorado Governor's Office of Energy Conservation, November 2001.
5. 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.
6. Various documents from FEMP Website: *Implementing a Super ESPC Project*. http://www.eren.doe.gov/femp/financing/espc/implementing.html.

**Federation of Canadian Municipalities**
**Municipal Building Retrofits**



## Section 6
# Feasibility Study

## 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.

**Template Section 6**
**Page 1 ☛**

The introduction summarizes the actions proposed by the Study and the resulting financial merit of the retrofit program.

## 1.0 INTRODUCTION

This Feasibility Study is for the provision of Energy Management Services in the possible form of an Energy Performance Contract. The firm proposes to provide a turnkey energy and operations management solution resulting in reduced operating costs. These operational savings will pay for implementation costs and could be guaranteed by the ESCO.

The ESCO is aware of the challenges facing building ownership and management and the specialized demands placed on your organization. With a strong commitment towards partnership and customer satisfaction, we propose a turnkey solution encompassing:

- Design engineering
- Innovative and proven energy conservation measures
- Project management and installation
- Energy management and monitoring of the results
- Technical support and service

The proposed program includes a variety of measures that would benefit the facility:

- System scheduling and capacity control
- Fuel conversion from electric to natural gas and heat recovery strategies
- High-efficiency lighting retrofit
- Load shedding and peak demand limiting
- Various capital equipment upgrades including high-efficiency motors and replacement of chillers
- Installations to address building codes and guest complaint issues

Our study indicates that for [the facility name], an energy savings of $[insert amount] per year is achievable, along with operational savings of $[insert amount]. Given a seven year simple payback criteria, this could translate to a $[insert amount] capital improvement program for [the facility name].

## 2.0 STUDY OBJECTIVES & METHODOLOGY

In this section the engineering firm or ESCO should clearly demonstrate an understanding of the overall retrofit program objectives.

### *2.1 Objectives*

The objectives of the Feasibility Study are to:

- Analyze the facilities' characteristics (architecture, electrical systems, heating, ventilation, air conditioning, controls, etc.) and its present modes of operation.
- Analyze the energy profile for the last several years to establish an energy consumption reference year, taking into account the weather and other operating factors that may influence consumption.
- Establish relevant conservation and recuperation measures that could be implemented, carefully calculating the interaction of one measure in relation to others.
- Define the monthly savings to be expected within a year, with the application of each of the measures.
- Develop cost figures on the amount of investment required to apply to each of the measures.
- Identify the cost effectiveness of each of these proposals.
- List a choice of all of the proposals that could be implemented on the basis of the cost effectiveness of each.

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In this section it is customary to describe the methodological approach to the data collection, measure development, and analysis of savings.

This Feasibility Study will permit the establishment of an implementation schedule and a financial plan as well as an evaluation of the project's advantages and financial risks. Particularly close attention, therefore, is paid to the examination of building operations, the value of the anticipated savings and anticipated construction-related costs.

## *2.2 Methodology*

This Feasibility Study will involve six stages:

### 2.2.1 Data Collection

This stage represents the most significant portion of the Study. In this stage the engineers endeavour to establish the current operating parameters and conditions of most of the facilities' energy-consuming equipment. This is done through on-site interviews with maintenance staff, reviews of drawings, document searches at the facility, as well as on-site measurement and evaluation by technicians.

### 2.2.2 Baseline Development

In this stage, the engineers will analyze the historical usage at the facility. The primary objective of this stage is the baseline period selection for use in energy cost avoidance calculations of the facility.

### 2.2.3 Measure Development

During this stage, the engineers conceptualize the measures that could be implemented given the current systems, and their operating conditions. Preliminary savings and costs are estimated to determine the merit in further detailed analysis of these potential measures.

### 2.2.4 Savings Establishment

The energy and operating savings associated with each measure are determined in this stage. This is done through the use of sophisticated building simulation applications and the engineering firm's or ESCO's custom built spreadsheet applications. Measures are carefully analyzed taking into account weather, utility rates, and measure interactions.

### 2.2.5 Measure Cost Development

The measure costs are determined by establishing a budget grade specification detailing the concept and broad operating parameters for each measure. Suppliers and contractors then use this specification as the basis for cost development.

### 2.2.6 Reporting

This is the final stage of the Study in which all data is summarized and presented as a report.

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In this section a description of the facility is provided to serve as the backdrop to the savings measures development and to demonstrate a solid understanding of the overall facility from a features and operational perspective. It should identify significant changes that will have an impact on energy use.

Also included in this section should be an overview of the operating schedules of the facility with separate descriptions for any areas that depart from normal operating schedules.

The types of data and information dealt with in this section should include:

- Building square footage
- Construction data of buildings and major additions
- Utility company invoices
- Occupancy and usage information
- Description of all energy-consuming or energy-saving equipment used on the premises, as available
- Description of energy management procedures utilized on the premises
- Description of any energy-related improvements made or currently being implemented
- Description of any changes in the structure of the facility or energy-using or water-using equipment
- Description of future plans regarding building modifications or equipment modifications and replacements
- Drawings, as available (may include mechanical, plumbing, electrical, building automation and temperature controls, structural, architectural, modifications and remodels)
- Original construction submittals and factory data (specifications, pump curves, etc.), as available
- Operating engineer logs, maintenance work orders, etc., as available
- Records of maintenance expenditures on energy-using equipment, including service contracts
- Prior energy audits or studies, if any

## 3.0 FACILITY DESCRIPTION – GENERAL

The facility is a municipal office building with a number of distinct areas, described in the sections that follow.

The facility was built in approximately 1977, and has had no major additions since original construction. With some exceptions, the facility has in fact had relatively few modifications from the original design. These modifications have taken place largely in the first basement, the lobby area, and on the fourth floor, where usage has changed significantly from the original design.

The building's major systems are largely original equipment. These include mostly all electric terminal reheat air handling systems with largely original pneumatic controls, the original R11 chiller and associated pumping equipment, as well as mostly original auxiliary equipment such as sump pumps and garage ventilation fans.

Some equipment upgrade projects have been done in the past. These include the conversion to natural gas of the domestic hot water system. This project was carried out in approximately 1984 and involved the installation of two 750,000 Btu atmospheric boilers on the fourth floor mechanical room, with space heating water to the hydronically heated portions of the facility.

The original cooling plant was upgraded in 1987 with a small 100 tonne centrifugal chiller serving the entire facility.

### *3.1 Facility Description for Area 1*

The lobby area of the facility operates on a seven day 24 hour schedule and serves the typical functions of receiving guests who check in and out with the security desk. This area occupies [insert #] square feet on the first floor only. The lobby area also has approximately [insert #] square feet of retail occupancy, which generally operates on a 7:00 am to 6:00 pm schedule with the exception of the convenience store, which is open until 11:00 pm.

This area's air handling is served by unit SF2 from the fourth floor mechanical room. This is an all-electric constant volume terminal reheat system that operates 24 hours per day. In the cooling season, this system in supplied by chilled water from the cooling plant.

### *3.2 Facility Description for Area 2 ...*

### *3.3 Facility Description for Area 3 ...*

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## 4.0 ENERGY USAGE ANALYSIS AND BASELINE SELECTION

This section presents an overview of the utility meters and usage at the facility, and presents a summary of the baseline period selection for use in energy cost avoidance calculations of the facility. Typically the information presented in this section or associated appendices should include:

- Examination of utility bills for the past three years to establish base year consumption for electricity, gas, steam, water, etc., in terms of energy units (kWh, kW, cubic meters, GJ, litres, or other units used in utility bills), in terms of dollars, and in terms of dollars per square meter.

### *4.1 Current Energy Usage*

The Facility is currently serviced by three utilities as follows:

**Table: Utility Accounts**

| Utility | Supplier | Account | Rate | Serves |
|---|---|---|---|---|
| Electricity | Waterloo North Hydro | 1230-123456-7 | General Service Under 1000 kW | Entire Facility |
| Natural Gas | Union Gas | 1-12-1234567-3 | Rate 20 | Domestic Hot Water Boiler Plant and Rooftop Air Handling Units |
| Water | City of Waterloo | 1234-12345-123 | Regular | Entire Facility |

There are no known sub-meters used on site. These three utilities account for the total 1997 utility cost of $1,225,000. A complete data set of historical utility data is presented in tabular and graphical format as Appendix A.

- Description of the process used to determine the base year (averaging, selecting most representative contiguous 12 months, etc.).
- Accounts of consultation with facility personnel to account for any anomalous schedule or operating conditions on billings that could skew the base year representation.
- Adjustments for periods of time when equipment was broken or malfunctioning in calculating the base year.
- Estimates of loading, usage and/or hours of operation for all major end uses of total facility consumption including, but not limited to:
  - Lighting
  - Heating
  - Cooling
  - HVAC motors (fans and pumps)
  - Plug loads
  - Kitchen equipment
  - Other/miscellaneous
- Where loading or usage are highly uncertain (including variable loads such as cooling), a subjective assessment of loading, spot measurements or short-term monitoring.
- Reconciliation of annual end-use estimated consumption with the annual base year consumption. This reconciliation will place reasonable “real world” limits on potential savings.
- Proposes adjustments to the baseline for energy- and water-saving measures that will be implemented in the future and that may remain separate from the proposed facility retrofits.

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### *4.2 Baseline Selection*

The purpose of the baseline selection process is to define a utility usage period and pattern that best describes the utility usage in the facility before any modifications have taken place. This "pre-retrofit" consumption pattern is then used as the scenario to which the post-retrofit consumption can be compared to evaluate energy savings.

The methodology is generally as follows:

- Three years of energy data (hydro, gas & water) are first analyzed for consistency in operation.
- The data is then analyzed with statistical methods for correlation to various operating conditions. In the case of the facility, these are weather – Heating Degree Days (HDD) and Cooling Degree Days (CDD) – and occupancy. The objective of the statistical analysis is to develop a mathematical model that can create statistically accurate projections of energy usage based on these ongoing operating parameters.
- These statistical models are then used after the retrofit to evaluate what energy usage would have been given current operating conditions, if the building had been left untouched.
- This is then used as the reference point to calculate savings from the actual consumption.

The following baseline periods are the outcome of the baseline period selection exercise.

**Table: Baseline Selection Summary**

| Service | Period From | Period To | Methodology | Variable Correlation |
|---|---|---|---|---|
| Electrical Consumption (Peak) | 10/01/98 | 9/30/99 | Billing Comparison with Weather & Occupancy Adjustment (with Offset) | HDD, CDD, Occupancy |
| Electrical Consumption (Off-Peak) | 10/01/98 | 9/30/99 | Billing Comparison with Weather & Occupancy Adjustment (with Offset) | HDD, CDD, Occupancy |
| Electrical Demand | 10/01/98 | 9/30/99 | Billing Comparison with Weather & Occupancy Adjustment (with Offset) | HDD, CDD, Occupancy |
| Natural Gas | 10/09/98 | 11/11/99 | Billing Comparison with Weather & Occupancy Adjustment (with Offset) | HDD, Occupancy |
| Water | 1/03/98 | 12/31/99 | Billing Comparison with Weather & Occupancy Adjustment (with Offset) | HDD, Occupancy |

Several adjustments (offsets) have been applied to the baseline period consumption to correct for atypical changes in the facility operation during this period. These adjustments, as well as details of the baseline selection, are presented in Appendix B.

By and large the savings determination methodology for the program will be the billing reconciliation method (billing comparison), also referred to as Option C in the International Performance Measurement and Verification Protocol with appropriate weather adjustments.

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## 5.0 PROGRAM MEASURES

This section explains each element of our technical solution in detail. The following is a sample of the type of information required for each measure. Information may be provided in the body of the report or attached as appendices.

**Written Description**

1. Existing conditions
2. Recommendations. Include discussion of facility operations and maintenance procedures that will be affected by installation/implementation. Present the plan for installing or implementing the recommendation.

### *5.1 Program Measure 1 - Building Automation*

At present throughout the facility, virtually all of the mechanical systems are operated by manual controls, or through the use of outdated and unsophisticated electro-mechanical or pneumatic controls. These controls do not allow for any system scheduling or for any energy-efficiency routines to be practically implemented.

This bundle of measures, therefore, focuses on bringing the facility into control through the use of Direct Digital Controls that will allow for system scheduling and the implementation of some energy-efficient system control strategies.

These measures apply mostly to the air handling equipment in the facility, as well as to the cooling plant, and miscellaneous heating systems.

#### 5.1.1 AHU Scheduling

**Present Condition**

Currently, most air handling units, exhaust fans and make-up air fans operate at full capacity 24 hours per day regardless of the occupancy or use of the areas they serve. This is largely a function of the outdated pneumatic controls that are currently fitted on these systems.

The air handling systems currently do not take advantage of any significant energy-saving controls strategies. Outdoor air dampers permit a fixed amount of outdoor air to enter the systems, and discharge air temperatures are generally maintained at fixed set points. This mode of operation is again a result of the inflexible pneumatic controls currently fitted to the systems. This mode of operation is very wasteful of energy.

Generally, the pneumatic controls appear to be in good operating condition. A detailed review of each system by a pneumatics technician did uncover several minor deficiencies.

**Retrofit Condition**

In the retrofit condition, air handling units will be fitted with direct digital controls, which will allow the units to be scheduled off when the areas they serve are not in use. The damper economizer controls will be improved to ensure that an adequate amount of fresh air is provided at all times while ensuring that excessive amounts of outside air with high cooling or heating loads are not introduced needlessly. The economizer will analyze the total heat content of the air including the humidity content in deciding when it is beneficial to bring in outside air for free cooling. The carbon dioxide levels within the spaces will be monitored in areas with variable occupancy, so that the amount of fresh air intake can be adjusted to meet dynamic requirements.

Control of the electric heating coils within the air handling units will be changed to allow rotational stage sequencing, if possible, to eliminate over use of the likely very worn first and second stages. The heating and cooling will be controlled sequentially to ensure that none of the potential for overlap remains.

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Furthermore, the digital controls will allow the implementation of more sophisticated control strategies such as discharge air temperature reset scheduling. This will ensure that the air is delivered to the reheat coils at the maximum possible temperature that can still provide all of the cooling requirements of the reheat zone that has the highest cooling demand. This will eliminate much of the simultaneous heating and cooling that is present. A dehumidification override will be used to ensure that space humidity levels do not rise unacceptably.

**Savings Calculations**

- Base year energy use and cost
- Post-retrofit energy use and cost
- Savings estimates including analysis methodology, supporting calculations and assumptions used
- Annual savings estimates. The cost savings for all energy-saving measures must be estimated for each year during the contract period. Savings must be able to be achieved each year (cannot report average annual savings over the term of the contract)
- Savings estimates must be limited to savings allowed by the customer as described above
- Percent of cost-avoidance projected
- Description and calculations for any proposed rate changes
- Explanation of how savings interactions between retrofit options is accounted for in calculations
- Operation and maintenance savings, including detailed calculations and descriptions. Ensure that maintenance savings are only applied in the applicable years and only during the lifetime of the particular equipment
- If a computer simulation is used, include a short description and state the key input data. If requested by the customer, access will be provided to the program and all assumptions and inputs used, and/or printouts shall be provided of all input files and important output files and included in the Technical Energy Audit with documentation that explains how the final savings figures are derived from the simulation program output printouts
- If manual calculations are employed, formulas, assumptions and key data shall be stated
- Conclusions, observations, caveats

**Cost Estimate**

Detailed scope of the construction work needed, suitable for cost estimating. Include all anticipated costs associated with installation and implementation:

- Engineering/design costs
- Contractor/vendor estimates for labor, materials, equipment. Include special provisions, overtime, etc., as needed, to accomplish the work with minimum disruption to the operations of the facilities
- Permit costs
- Construction management fees
- Environmental costs or benefits (disposal, avoided emissions, handling of hazardous materials, etc.)
- Conclusions, observations, caveats

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This section should provide details on measures that were investigated and for which savings and costing analyses were likely conducted, but for some specified reason, have been rejected for inclusion in the proposed retrofit.

**Other Information**

- Estimate of average useful service life of equipment
- Preliminary commissioning plan
- Preliminary measurement and verification plan explaining how savings from each measure is to be measured and verified (stipulated by contract, utility bill analysis, end-use measurement and calculation, etc.)
- Discussion of impacts that the facility would incur after the contract ends. Consider operation and maintenance impacts, staffing impacts, budget impacts, etc.
- Compatibility with existing systems. This could include the name of existing controls system, if new controls systems will have to be compatible with an existing brand of controls, etc.
- Complete appendices that document the data used to prepare the analyses. Describe how data were collected

### *5.2 Program Measure 2 ...*

### *5.3 Program Measure 3 ...*

## 6.0 OTHER MEASURES

This section should provide an outline of savings measures that were noted during the Study.

### *6.1 Measures Considered but Rejected*

**COOLING TOWER CAPACITY CONTROL - VSD**

**Existing Condition**

The cooling tower is used to reject heat from the cooling plant. At present, the fan draws air through the cooling tower that controls the tower's capacity by cycling on and off.

Energy savings can be achieved by controlling the cooling tower capacity through fan speed modulation instead of through fan cycling. The speed modulation can be achieved through the used of a variable speed drive.

**Reason for Rejection**

Unfortunately, the cooling season for this facility is somewhat short and the payback could not be justified.

**CHILLED WATER DISTRIBUTION CAPACITY CONTROL - VSD**

**Existing Condition**

The pumps that distribute cooling water to various fans run at full capacity throughout the cooling season, despite capacity requirements that vary widely from day to day and hour to hour.

The existing chilled water control valves are all 3-way type requiring full system flow whether or not there is a cooling demand.

The pumps can be equipped with electronic variable speed drives to slow the motors down when capacity requirements are lower. This measure offers the added benefit of extending expected motor life. The existing 3-way control valves could be replaced with 2-way valves thereby allowing the load to throttle down and consume less flow when cooling demand is decreased.

**Reason for Rejection**

Unfortunately, the cooling season is somewhat short and the payback could not be justified.

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This section would provide a list of measures that were identified but not studied in detail. These measures may be beyond the scope of this Study, but may be viable measures for inclusion in a 2nd phase of retrofits.

### *6.2 Measures to be Considered for Further Study*

- VAV conversion of terminal reheat systems
- Increasing return volume and reducing unoccupied make up air
- Fuel conversion of pre-heat coils to natural gas
- Co-generation
- Building pressurization and exhaust - MAU scheduling
- Load shedding and peak demand limiting

## 7.0 MONITORING AND VERIFICATION

It is expected that a substantial plan for the verification of savings be presented in this section. This subject is dealt with in detail in Section 8 of the MBR Guide and in Section 8 of the Resource Manual on the accompanying CD ROM, or on the Knowledge Network at: http://kn.fcm.ca.

It is critical that the plan for verification be established at this stage, so that any required physical measurements of the pre-retrofit condition can be conducted. While the measurements for estimation of savings potential may provide this basis, in many cases more detailed monitoring may be required. These needs must be clearly stated for each recommended measure included in the Feasibility Study.

**Feasibility Study Checklist**

The following table provides key items for a critical analysis of a Feasibility Study submitted by an ESCO or engineering firm.

**Table: Baseline Selection Summary**

| | Item | Comments |
|---|---|---|
| | Inclusion of all required ECMs | Compare to Project Plan |
| | Reasonable savings for each ECM used? | No double counting; order of ECM implementation; was energy balanced |
| | Reasonable baseline | Typical year(s); look at long term trends; are all routine and non-routine situations accounted for? |
| | Reasonable assumptions and interaction of multiple ECMs | Conservative assumptions; one cannot always assume ECM interaction is minimal (i.e., lighting retrofit impact on heating and cooling may not be balanced) |
| | Inclusion of ECMs for water and renewables | If applicable and/or requested. |
| | Fuel neutrality | Or, do fuel switching opportunities mitigate energy cost risks, or do they increase risk exposure? |
| | Price reasonableness | Are all markups disclosed? |
| | Reasonable financing rate | Multiple financing options considered |
| | Reasonable term | Be cautious of long-term payback periods for bundled measures (>7 yrs). |
| | Recognition of site-specific issues | Ensure that the measures will not impact unique service delivery conditions. |
| | Consideration of environmental benefits | Are they recognized, are calculations of GHG emissions made? |
| | Check to see if the engineer looked at the rate schedule when calculating savings | Does the ESCO fully understand rates applied to savings calculations? (Especially important with electric rates) |
| | Analyze the project implementation costs | Are construction costs firm? |
| | Use cost estimating handbooks and past experience to compare | If in doubt, get a third party opinion |

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**Table: Baseline Selection Summary** - continued

| | Item | Comments |
|---|---|---|
| | Examine adders: project management, hourly rate, operating hours and profit (both % and basis), taxes | |
| | Consider early ECM payoffs and financial impacts | Have different scenarios been analyzed? |
| | Acceptable ECM assumptions - Operating hours, weather data | Consider both past and future usage when validating assumptions. |
| | Acceptable variance between Project Proposal and final figure in Feasibility study | If the savings expectations raised in the project proposal were not met, why? |
| | Compare with an independent estimate and check the savings calculations | Consider retaining a third-party consultant to represent your interests. |
| | Does what you see comply with the levels you asked for? | Do the measures deal with both the energy and operational issues that were requested? (i.e., is IAQ or equipment renewal addressed adequately? |
| | Monitoring and verification cost benefit analysis | See Section 8 of the MBR Guide and Section 8 of the Resource Manual for monitoring and verification details – does the Study provide optional levels of cost for reduced savings uncertainty? |

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