

SCHEDULE F – PROJECT COMPLETION REPORT TEMPLATE

VERY IMPORTANT:

Timing: You need to email a report, to your GMF project officer (contact info is in Schedule C), on the dates indicated in Schedule C or whenever FCM asks for such a report.

Copyright: Before you submit a report to FCM, make sure you hold the copyright for the report. If you're hiring a consultant to prepare the report, please make sure to get the copyright (see FCM's copyright tips document), or else FCM will not be able to disburse the Grant Amount.

Accessibility for people with disabilities: Please do not change the format, font, layout, etc. of this report. This template has been specially designed, following FCM's Accessibility Guidelines, in order to be accessible to people with disabilities.

Confidentiality: If your report contains any Confidential Information that you would prefer not be made available to the public (e.g. through a case study or other materials produced by FCM that relate to your Project), please submit two versions of the report:

- 1. Complete report including Confidential Information:** Please clearly label this report with the word "**Confidential**" or similar wording and FCM will treat it as confidential.
- 2. Abridged report excluding Confidential Information:** This report may be posted on the FCM website and otherwise made available to interested third parties, to help FCM meet its knowledge sharing objectives.

Please contact your project officer to receive an electronic copy of the Completion Report Template.

Upon completion of the project, a copy of the Final Deliverable must be submitted along with this Completion Report.

FCM will post your report on the [Green Municipal Fund™ \(GMF\) website](#). This is because one of FCM's mandates is to help municipal governments share their knowledge and expertise regarding municipal environmental projects, plans and studies.

How to complete the Completion Report

The purpose of the Completion Report is to share the story of your community's experience in undertaking your project with others seeking to address similar issues in their own communities.

Please write the report in plain language that can be understood by people who are not specialists on the subject. A Completion Report is typically in the range of 5–10 pages, but may be longer or shorter, depending on the complexity of the project.

GMF grant recipients must enclose **final** copies of the Completion Report and the Final Deliverable with their final Request for Contribution. The reports, including all attachments and appendices, must be submitted in PDF format with searchable text functionality. Reports that are not clearly identifiable as final reports, such as those displaying headers, footers, titles or watermarks containing terms like "draft" or "for internal use only," will not be accepted by GMF. Additionally, reports must be dated. If you have questions about completing this report, please consult GMF staff.

GMF number	16909
Name of lead applicant (municipality or other partner)	City of Charlottetown
Name, title, full address, phone, fax and e-mail address of lead technical contact for this study	Hammad Ahmed, Energy Coordinator, 199 Queen Street, Charlottetown, PE, C1A7K2, +1 (902) 978 0691, hahmed@charlottetown.ca
Date of the report	24 th March 2021

1. Introduction

- a) Who was involved in doing the Feasibility Study, and what are their affiliations? Please include name, title and contact information. Those involved could include municipal staff, engineers and other consultants, a representative from a non-governmental organization, and others.

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2. The Feasibility Study

- a) Describe the process that you undertook to make this feasibility study a reality, from concept, to council approval, to RFP, to final deliverable.

The process of development of the feasibility study is broken down into bullet points below for simplicity in language:

- The project started with a kickoff where all the major stake holders met to discuss the overview and set goals for the project.
- Solution development: stage was divided in to three main sections 30%, 60%, and 90% the senior staff took the results and discussed them with the environmental and sustainability committee and occasionally to others as needed
 - o 30% Conceptual review took place of the potential scope, it was refined by staff and council's feedback
 - o 60% refined program scope with saving, cost estimate review, financing options, contract types, guarantee workshops took place
 - o 90% final scope was selected, legal review financial plan took place
- After solution development report completion took place, the report was completed to accommodate of City's wants which were addressed in the solution development phases.
- Lastly extensive efforts went in to make sure Council, boards and legal were happy with the report and the contract

b) What were the objectives of the Feasibility Study (what was it seeking to determine)?

- Supply permanent cost reductions through increased energy and operational efficiencies
- Upgrade equipment
- Increase operational flexibility and implement a program consistent with the City of Charlottetown Energy Plan.

c) What approach (or methodology) was used in the Feasibility Study to meet these objectives?

The Blitz Energy Engineering Tool (BEE-Tool) was used to predict energy benefits from implementation of complex retrofit solutions in commercial and institutional buildings.

The tool models the tree-like energy flow distribution throughout the building which outlines the paths of energy flows from the utility meter to heating and chilled water plants; from the plants to air-handling and terminal units and from the terminal units to the atmosphere through building envelope. The tool models the multiple energy conversions along the paths depends on the plants' and systems' arrangement and performance parameters. The approach allows creating an accurate account of the energy allocation throughout the building. The tool cross checks the simulation results like the accounting debit-credit system: even a one Btu imbalance is detected.

The tool simulates the hourly loads of air-handling units and plants using the ASHRAE₁ recommended thermodynamic equations described in Section III of the manual. The engine's integrator sums up the instant loads into annual loads of system elements. The integrator converts the annual loads into the primary energy used by the plants.

d) Please describe any public consultations conducted as part of the Feasibility Study and their impact on the Study.

The only public consultation which took place was for the learning lab facility conversion which mainly included stake holders from University and College for their feedback on the topic.

3. Feasibility Study Findings and Recommendations

a) What were the environmental findings related to the options explored in the Feasibility Study? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

The City of Charlottetown, their staff and the surrounding communities will all benefit from GHG reductions generated through the planned facility improvements. Table 1 shows the emission rates per unit of energy. These rates are based on the Community Energy and Greenhouse Gas Inventory, 2015” report.

Table 1: GHG Emission Rates

Energy Type	CO2 equivalent (kg)
Electricity (kWh)	0.28
Light Oil (L)	2.735
District heat (kWh)	0.24

The planned upgrades at City of Charlottetown’s facilities will have a positive effect on both the internal and external environments. Project measures will reduce CO2 emissions by an estimated 526 tons per year. This reduction is equivalent to removing 176 medium size cars from the road.

Monetizing the GHG reductions can potentially generate revenue. When and if the carbon market is reinstated, the cost benefits of the GHG reduction estimated at a CO2 cost rate of \$15 per metric ton would be \$7,890 per year.

- b) What were the financial findings related to the options explored in the Feasibility Study (for example, results of a cost-benefit analysis, financial savings identified, and so on)? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

The project guaranteed annual utility and operational cost savings are \$323,727. The guarantee period is 20 years from the commencement date.

The GHG emission reduction of 526 tons can be monetized as a future GHG credit of \$7,890 — available to the City. The value was evaluated at a \$15/eCO2-ton cost rate

This project offers many benefits that will add value to the City of Charlottetown’s facilities. Some of these benefits are summarized below:

- \$222,264 in Year 1 utility savings
- \$101,463 in Year 1 operational and maintenance savings
- \$318,477 in incentives for energy conservation and project development
- 526 metric tons of eCO2 greenhouse gas reduction, which is equivalent to removing 176 medium-size cars from the road
- Minimizes risk through a guaranteed savings model
- Reduces utility escalation risk by reducing the energy required to run the City of Charlottetown’s facilities

- Generates savings that will help fund other critical priorities
- Supports the City of Charlottetown's capital planning initiatives and the City Energy Plan
- Addresses the City of Charlottetown's deferred maintenance issues
- Renews the City of Charlottetown's facilities infrastructure
- Improves the ability of the City of Charlottetown's building operators to maintain building comfort conditions
- Enhances the work environment for the City of Charlottetown's occupants and staff
- Promotes energy awareness and environmentally responsible behaviors
- Positions the City of Charlottetown as an environmental leader in the community.

c) Based on the environmental and financial findings above, what does the Feasibility Study recommend?

The project portfolio includes 23 sites with a total floor area of 400,635 ft².

Many factors were considered during the analysis of the facilities and in the development of the energy retrofit and facility renewal program. The Honeywell team reviewed information from many different sources to help identify all potential energy conservation, facility renewal and sustainable technology opportunities (collectively referred to as 'Measures').

Each measure applies to an individual system or group of systems and includes the following metrics: unique identification number, name, scope of work, energy and operational savings, greenhouse gas (GHG) reduction, cost and simple payback.

The measure metrics have been calculated in such a way that addition or removal of a measure from the project scope would eliminate or minimize changes of the other measure metrics. The scope of measures selected in this project is presented in Table 2.

Some of the information collected and reviewed during the audit includes:

- Utility rates, annual utility spend and energy profiles
- Facility infrastructure (mechanical, lighting, select electrical systems and building envelope.)
- General operation of facility spaces (usage and hours of operation)
- Occupancy type and usage patterns
- Select process systems (refrigeration systems, waste treatment process systems...).

Honeywell performed an exhaustive audit of each of these facilities. The audit included visual inspection of building systems, review of existing drawings, and interviews with facility staff.

The Honeywell team used a proprietary hourly building energy modelling tool to analyze the audit data collected from the facilities and build the building energy balance models. This modeling helped the team understand how each subsystem (lighting, HVAC, etc.) operates within the building, as well as calculate the utility energy savings for each proposed measure. The building energy balance and savings calculation workbooks can be provided separately, upon request.

Table 2: Project Scope

Measure ID	Measure Name	Measure ID	Measure Name
Eastlink Centre		City Works	
EL-L2	Option 2. Replace interior fixtures with LED fixtures (w/o ice rink)	CWRKS-M2a	Upgrade HVAC in Parks and Recreation and Central Supply (former MUA-01)
EL-L3	Replace outdoor fixtures	CWRKS-M2b	Upgrade HVAC in Public Works (former MUA-02)
EL-L4	Replace lighting over the ice with TV-quality LED fixtures (alternative to EL-L1)	CWRKS-M2c	Upgrade HVAC in Utilities area (former MUA-03)
EL-M1	Install ice plant heat recovery	CWRKS-M2d	Upgrade HVAC in Mechanical Shop (former MUA-04)
EL-M3	Upgrade ice plant controls	CWRKS-M2e	Upgrade boiler plant
EL-M2	Redesign HVAC of the ice rink	CWRKS-C1	Install Enterprise Building Integrator (part of CH-C1)
EL-C1	Install Enterprise Building Integrator (part of CH-C1)	CWRKS-C7	Replace pneumatic t-stats on L2
EL-C7	Upgrade A/H3,4&5 and RTU-1 controls	CWRKS-O2	Improve Building Envelope
EL-E2	Install Power Quality Measures	Cody Banks Arena	
EL-E3	Replace Transformers	CB-L2	Option 2. Replace interior fixtures with LED fixtures
EL-O2	Improve Building Envelope	CB-E3	Replace Transformers
Bell Aliant Centre		CB-O2	Improve Building Envelope
BAC-L2	Option 2. Replace interior fixtures with LED fixtures	Police Station	
BAC-L5	Redesign the lighting system in the Aquatic Centre	PS-L2	Option 2. Replace interior fixtures with LED fixtures
BAC-L6	Upgrade centralized lighting panels to BAS	PS-L3	Replace outdoor fixtures
BAC-E2	Install Power Quality Measures	PS-O2	Improve building envelope
BAC-O2	Improve building envelope	Hillsborough Park Civic	
City Hall		HB-L2	Option 2. Replace interior fixtures with LED fixtures
CH-M2	Redesign HVAC infrastructure	HB-L3	Replace outdoor fixtures
CH-C1	Install Enterprise Building Integrator (city-wide)	HB-O2	Improve building envelope
CH-C5a	Upgrade Controls of Unit RTU-01	JE Blanchard	
CH-C5b	Upgrade Controls of Unit AHU-01	JEB-L1	Option 1. Upgrade interior fixtures with LED lamps
CH-O2	Improve Building Envelope	JEB-L3	Replace outdoor fixtures
Fire Station		JEB-O2	Improve building envelope
FS-L2	Option 2. Replace interior fixtures with LED fixtures	Maple Avenue Hall	
FS-M2a	Upgrade space heating system	MAV-O2	Improve building envelope
FS-M2b	Upgrade units S-1 and S-2	West Royal Civic	
FS-C5	Install HRV-1 in the Bay area	WRC-M2	Install Solar PV System
FS-C1	Install Enterprise Building Integrator	WRC-O2	Improve building envelope
FS-O2	Improve building envelope		

Honeywell's research resulted in a list of measures that the City could move forward with. The City selected most of the measures and removed a few which were cost prohibitive due to their low or negative return on investment. The City even decided to move forward with all the measure that were cost prohibitive but were

addressing comfort issue. Table 2 show a list of measures selected by the City to be implemented. Honeywell will be executing all these measures in 18 months from signing the contract with the City.

4. Lead Applicant's Next Steps

- a) Taking the Feasibility Study's recommendations into account, what next steps do you as the municipality plan to take? What potential benefits or internal municipal improvements would result from these next steps?

The project scope has been finalized with inputs from the City of Charlottetown's during our 30/60/90% measure review process. Some complex measures considered and analyzed during the project development have been removed from the project scope. All measures in the project are intended to meet the requirements of applicable codes, standards and regulations. The next steps taken by the City of Charlottetown is to move forward to the implementation stage. The benefit of this project have been discussed section 3b of this report.

5. Lessons Learned

In answering the questions in this section, please consider all aspects of undertaking the Study — from the initial planning through each essential task until the Final Study was prepared.

- a) What would you recommend to other municipalities interested in doing a similar Feasibility Study? What would you do differently if you were to do this again?

I would recommend other municipalities to make use of big ESCO's that can promise a program with guaranteed savings. Better coordinate COVID restriction for out of province person travel.

- b) What barriers or challenges (if any) did you encounter in doing this Feasibility Study? How did you overcome them?

Lack of in-house technical information to keep up with the audits and review, we tackled it by training our staff through CIET for CEM and hiring a third party consultant to look at the shop drawings.

6. Knowledge Sharing

- a) Is there a website where more information about the Feasibility Study can be found? If so, please provide the relevant URL.

No, but I will attach two reports, one is going to be public facing and the other will be the confidential one for internal use.

- b) In addition to the Feasibility Study results, has your Feasibility Study led to other activities that could be of interest to another municipality (for example, a new policy for sustainable community development, a series of model by-laws, the design of a new operating practice, a manual on public consultation or a measurement tool to assess progress in moving toward greater sustainability)? If so, please list these outcomes, and include copies of the relevant documents (or website links).

Not yet, but there have been discussions with not-for-profit groups, college, smaller municipalities that are willing to learn more about this project.

This project was carried out with assistance from the Green Municipal Fund, a Fund financed by the Government of Canada and administered by the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.