# Yellowknife Community Energy Planning Project

## Action Area 1b - Financing Options for Internal Green Energy Projects


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# Executive Summary

The City of Yellowknife's interim Community Energy Plan (CEP) recommended establishing a revolving internal green fund that would finance energy and climate projects within municipal operations and be replenished through the resulting reductions in energy expenditures. This research is intended to support that recommendation by examining green financing mechanisms and showing how a specific mechanism could best be applied within Yellowknife. For the purposes of this research, internal green financing mechanisms are defined as the means of providing all or part of the financial resources needed to advance a project where the project impacts municipal operations and is financed by the municipality. It is important to stress that through the course of the research, the scope has expanded to encompass green energy financing mechanisms in general as opposed to just revolving green funds, which are one specific mechanism that can be used to finance green energy projects.

A preliminary list of 28 green financing mechanisms was first prepared to provide a quick look at the models in use in different jurisdictions to help decide which would provide the most valuable package of mechanisms to review in greater detail. The list of 28, was filtered down to the 12 shown in Table 1. It is important to note that this list includes both internal and external funds, and although external mechanisms are the focus of a separate CEP action area, they have many similarities to internal financing mechanisms, and as such are relevant to this discussion. To counter the potential for biases to be introduced due to the small sample size, the financing mechanisms were selected to achieve the following:

- A cross-section of fund types (the list contains five internal, two internal/external, and five external funds).
- A geographic mix of funds with Canadian and Northern focus (9 of 12 funds are based in Canada to ensure local relevance and applicability to Yellowknife).
- A variety of supported project types (some, such as the Toronto Atmospheric fund are open to a broader spectrum of possible projects while others, such as Saskatchewan's High Efficiency Furnace Loans, are very focused).

| Name of Financing Mechanism | Type of Mech. | Types of Projects Financed |
|---|---|---|
| Edmonton's Energy Management Revolving Fund | Internal | Energy retrofits in City facilities |
| Stuttgart's Intraction Program | Internal | Energy retrofits in City facilities |
| Kelowna's Energy Management Program | Internal | Energy retrofits in City facilities |
| Toronto's Energy Management Program | Internal | Energy retrofits in City facilities |
| Phoenix's Energy Conservation Savings Reinvestment Plan | Internal | Energy retrofits in City facilities |
| Toronto's Atmospheric Fund | Both | Energy efficiency, partnership-building, education, and research projects |
| Oslo's Ekon Fund | Both | Energy efficiency retrofits |
| GNWT's Municipal Rural Infrastructure Innovation Fund | External | Alternative energy, energy efficiency, behavior change, transportation, and policy |
| GNWT's Energy Conservation Program | External | Energy or water retrofits in territorial, community, or non-profit buildings. |
| Yukon's Rural Electrification and Telecommunication Program | External | Grid connection or distributed renewable electricity generation |
| Yukon's Green Mortgage Program | External | Reduced interest rates on mortgages of energy efficient houses |
| Saskatchewan's EnergyStar Loan Program | External | Reduced interest loans for EnergyStar furnaces |

Table 1 – List of green financing mechanisms reviewed in detail

Answers to the following five questions are needed to properly define a green financing mechanism:

- How is financing made available to project proponents?
- How are projects identified and advanced?
- How is project eligibility defined?
- How is the financing repaid?
- How is program success and sustainability monitored and evaluated?

Based on discussions with various staff familiar with the 12 financing mechanisms, the following key success factors were identified:

- Clearly defined objectives and eligibility requirements
- Clearly defined targets
- Simple, transparent and consistent process
- Council and staff support for financing mechanism and its objectives
- People designated (and allocated time) to identify and steward projects
- Systems in place to identify opportunities and track success
- Flexibility to finance varying project sizes
- Conservative assessment of project economics
- Recognition of, but not paralysis from, uncertainty

Based on the above finding and a review of relevant legislation in Yellowknife and GNWT, the following recommendations are being made for an internal green financing mechanism in Yellowknife:

- Establish a mixed financing mechanism that includes a revolving fund component to finance relatively small scale regular retrofits and an annual allocation component that would be reserved for larger projects that would require Council approval. The revolving fund component would be sufficient to finance the feasibility and evaluation studies needed to maintain a steady flow of projects.
- Limit eligibility to projects that produce energy savings capable of paying off the initial investment within eight years at an annual interest rate of 4.7% and ensuring that GHG emissions will not increase. Beyond these minimum requirements, projects will be selected to maximize GHG emission reductions, so that low GHG reduction opportunities are only financed if the available funds for a given year cannot be allocated on better opportunities. For projects that demonstrate a rate of return greater than 4.7%, the amortization period will remain constant at 8 years.
- Create an energy management committee that would be responsible for identifying, assessing, and implementing green energy projects within municipal operations.

- Require financed projects to undergo periodic evaluations such that the actual savings can be compared to the anticipated values. Most projects will undergo a one year evaluation study to ensure the feasibility studies are making realistic estimations, and the projects anticipating significant energy savings or demonstrating significant risk will undergo additional long-term evaluations to ensure the savings are being sustained.

Table 1 provides a summary of the expected financial and environmental implications of the proposed financing mechanism. These results are based on a series of assumptions of how a fund would be established and operated in Yellowknife, and they only represent one potential scenario for such a mechanism, and Yellowknife should feel comfortable exploring other scenarios. The energy savings and GHG reductions do not include estimates for the annual allocation component of the financing mechanism, but they do account for the feasibility and evaluation studies needed to support these larger projects. A detailed discussion of the calculations and assumptions underlying Table 1 are provided in Section 7.2.

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|---|---|---|
| Contributions to the fund | | | | | | | | | |
| Seed financing ($) | 660,000 | 676,500 | 693,413 | 710,748 | 0 | 0 | 0 | 0 | 0 |
| Savings reinvested in fund ($) | 0 | 42,281 | 86,677 | 133,265 | 182,129 | 233,353 | 287,024 | 343,233 | 402,073 |
| Expenditures from the fund | | | | | | | | | |
| Feasibility study spending ($) | 20,000 | 20,500 | 21,013 | 21,538 | 22,076 | 22,628 | 23,194 | 23,774 | 0* |
| Project implementation spending ($) | 300,000 | 307,500 | 315,188 | 323,067 | 331,144 | 339,422 | 347,908 | 356,606 | 0* |
| Evaluation study spending ($) | 10,000 | 10,250 | 10,506 | 10,769 | 11,038 | 11,314 | 11,597 | 11,887 | 0* |
| Savings generated by the fund | | | | | | | | | |
| Total energy savings ($) | 0 | 46,154 | 94,615 | 145,471 | 198,811 | 254,726 | 313,313 | 374,670 | 438,899 |
| Remainder accrued in general revenues ($) | 0 | 3,873 | 7,939 | 12,206 | 16,681 | 21,373 | 26,289 | 31,437 | 36,826 |
| GHG reductions (tonne CO2e) | 0 | 174 | 348 | 522 | 696 | 870 | 1044 | 1,218 | 1,392 |

*No expenditures are shown in year 9, but this would only be the case if the fund were discontinued at that point.

Table 1 – Summary of economic and environmental flows for financing mechanism

Accounting for the investments made over the first 8 years of fund operation, the financing mechanism will result in 13,920 tonnes of GHG reductions and have a net present value (discounted at 2.5%) of $294,879 above and beyond the savings and capital flows needed to sustain the fund. This calculation is based on an average project lifespan of 10 years, and it accounts energy savings and GHG emission reductions that will continue to accrue for the full lifespan of an improvement, even if no further investments are made (i.e. 10 years of additional savings are not shown in the table).

# Yellowknife Community Energy Planning Project

## Financing Options for Internal Green Energy Projects

## Table of Contents

# 1 Introduction

The City of Yellowknife's interim Community Energy Plan (CEP) recommended establishing a revolving internal green fund that would finance energy and climate projects within municipal operations and be replenished through the resulting reductions in energy expenditures. This research is intended to support that recommendation by examining green financing mechanisms and showing how specific mechanism could best be applied within Yellowknife. For the purposes of this research, green financing mechanisms are defined as the means of providing all or part of the financial resources needed to advance a project. The financing could be provided in the form of a loan or grant, and in advance of or after the completion of a project.

It is important to stress that through the course of the research, the scope has expanded to encompass green energy financing mechanisms in general as opposed to just revolving green funds, which are one specific mechanism that can be used to finance green energy projects. The scope is still confined to internal projects (i.e. those related to municipal operations) because a separate CEP action item has investigated potential financing mechanisms for external projects. Figure 1 illustrates the greenhouse gas (GHG) emissions and energy expenditures resulting from the operation of municipal buildings and infrastructure in 2004. All figures are reported from the updated 2004 baseline study and do not include the emissions and expenditures of Yellowknife's fleet because they were not distinguished in the analysis. For context, the total GHG emissions and energy expenditures in 2004 for the entire community are 376,016 tonnes and $113 million. It is important to note that the 2004 baseline study grouped Institutional and Municipal energy consumption, but they have been separated for the purposes of this study so that the Institutional sector would not be eligible for internal financing.

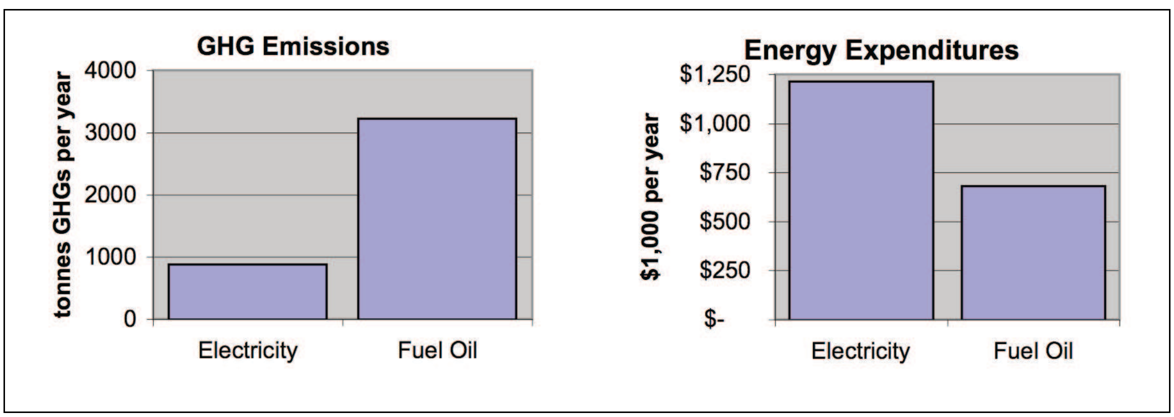


Figure 1 – GHG emissions and energy expenditures from municipal operations.

Working with the revised scope of financing mechanisms for internal green energy projects, the specific objectives of the project are as follows:

- Research various mechanisms that have been used successfully to finance internal green energy projects in other municipalities.

- Determine which of those models would be possible, effective, and attractive in a Yellowknife context.
- Demonstrate how the applicable options would be implemented in Yellowknife.

Although financing is an important aspect of project implementation, it is important to remember that it is not the only way a municipality can advance green energy projects. Figure 2 presents a spectrum of policy instruments that can be used to advance projects and some examples of policies that would fit in each category. The stringency, or forcefulness with which they influence choices increases from left to right as they shift from voluntary, information-based approaches to regulatory approaches.

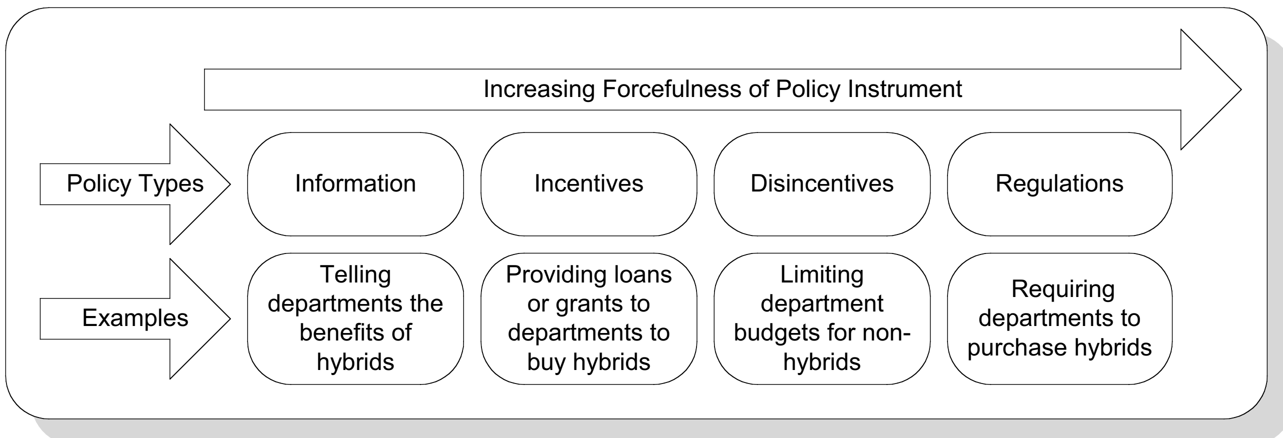


Figure 2 – Types of policy instruments available to achieve green energy goals

A single City initiative or program will often incorporate multiple policy types to achieve a good balance of characteristics from across the policy type spectrum. A comprehensive financing program is a good example of this, because it would draw on elements of the incentives category (in the form of grants and/or loans) and the information category (to advertise and communicate the financing mechanism). Although not the focus of this research, the purpose of introducing these ideas within this report is to encourage Yellowknife to think critically about the projects they are trying to advance and assess whether or not financing is the best way to achieve those goals. For example, financing might be the key approach needed to advance building retrofits, whereas an information campaign might be the best way to ensure City vehicles are not being idled unnecessarily.

The remainder of this report is structured as follows:

- Section 2 describes the research approach.
- Section 3 discusses the different green financing approaches reviewed for this research.
- Section 4 breaks the different approaches into their key components.
- Section 5 presents some key success factors for any green financing mechanism.
- Section 6 discusses several local context issues that will influence any Yellowknife green financing decisions.

- Section 7 recommends and describes a potential green financing mechanism for Yellowknife.
- Section 8 presents next steps in the process for Yellowknife.

# 2 Method

The research was conducted according to the following eight-step approach:

1. Drafts of the templates that were used to review existing green financing mechanisms and a draft outline for the final report were prepared. These were submitted to, and reviewed by the CEP committee.
2. A project kick-off meeting was held to ensure that the project team, clients, and other stakeholders were in agreement regarding the objectives of the project and the proposed steps.
3. A preliminary list of known green financing mechanisms was compiled and prioritized for the CEP to indicate which mechanisms would be reviewed in greater detail. The list was refined to ensure that an adequate cross-section of financing mechanism characteristics were captured in the review.
4. The selected funds were reviewed in detail to better understand how other jurisdictions finance green energy projects. The review was conducted using published municipal reports and email and telephone correspondence with municipal staff.
5. Key staff members with the City and the Government of the Northwest Territories (GNWT) were interviewed to determine which of the mechanisms reviewed were applicable to Yellowknife given any legislative constraints that might not exist in other jurisdictions.
6. A presentation was made to the CEP committee to provide preliminary recommendations and receive feedback on the interim findings.
7. The economic and environmental implications of the recommended financing options were modelled to understand their significance in a Yellowknife context.
8. The finalized analysis and recommendations were provided to the CEP committee.

# 3 Green Financing Examples

A preliminary list of green financing mechanisms was first prepared to quickly look at the models used in different jurisdictions to help decide which would be the most valuable to review in greater detail. As shown in Table 2, a total of 28 mechanisms were identified, and they were subsequently categorized according to the type of mechanism (internal, external, or both) and the type of projects being financed. Also worth noting is the Alliance to Save Energy paper titled "Funds for Energy Efficiency Projects", which includes a brief review of almost 100 municipal and state level energy efficiency financing mechanisms.[1] The report is a useful resource for basic information, and contains many US and European examples not captured below.

| Name of Financing Mechanism | Type of Mech. | Types of Projects Financed |
|---|---|---|
| Edmonton's Energy Management Revolving Fund | Internal | Energy retrofits in City facilities |
| Stuttgart's Intraction Program | Internal | Energy retrofits in City facilities |
| Kelowna's Energy Management Program | Internal | Energy retrofits in City facilities |
| Toronto's Energy Management Program | Internal | Energy retrofits in City facilities |
| Phoenix's Energy Conservation Savings Reinvestment Plan | Internal | Energy retrofits in City facilities |
| Toronto's Atmospheric Fund | Both | Energy efficiency, partnership-building, education, and research projects |
| Oslo's Ekon Fund | Both | Energy efficiency retrofits |
| GNWT's Municipal Rural Infrastructure Innovation Fund | External | Alternative energy, energy efficiency, behavior change, transportation, and policy |
| GNWT's Energy Conservation Program | External | Energy or water retrofits in territorial, community, or non-profit buildings. |
| Yukon's Rural Electrification and Telecommunication Program | External | Grid connection or distributed renewable electricity generation |
| Yukon's Green Mortgage Program | External | Reduced interest rates on mortgages of energy efficient houses |
| Saskatchewan's EnergyStar Loan Program | External | Reduced interest loans for EnergyStar furnaces |
| Penrith's Sustainability Revolving Fund | Internal | Energy and resource conservation projects |
| Harvard's Revolving Environmental Fund | Internal | Projects which minimize environmental impact |
| Manly's GHG Challenge Reinvestment Fund | Internal | Energy efficiency projects |
| Moreland's Sustainable Energy Management Reserve Fund | Internal | Energy retrofits in City facilities |
| Newcastle's Revolving Energy Fund | Internal | Energy retrofits in City facilities |
| Halton's Healthy Community Fund | Both | Healthy living, public/personal safety, service delivery improvements |
| Sacramento's Conservation Power Financing Program | Both | Electrical efficiency measures |
| Bronx Initiative for Energy and the Environment | External | Energy efficiency projects for businesses |
| California's Energy Efficiency Financing Program | External | Energy efficiency projects, water consumption |
| Maine State Revolving Loan Fund (SRF) | External | Construction of wastewater facilities |
| Missouri's Energy Revolving Fund | External | Energy efficiency projects |
| Montana Department of Environmental Quality Alternative Energy Revolving Loan Program | External | Alternative energy projects |
| Ohio Energy Efficiency Revolving Loan Fund | External | Energy efficiency, renewable energy projects |
| Scotland's green fund | External | Energy efficiency projects |
| Texas LoanSTAR Revolving Loan Program | External | Energy efficiency retrofits |
| The Penelec Sustainable Energy Fund of the Community Foundation for the Alleghenies | External | Renewable energy, energy conservation and efficiency, and RE business initiatives |

Table 2 – Initial list of green financing mechanisms considered for further review

[1] Available at http://www.ase.org/section/topic/financingee/.

Working from this list of 28, the 12 shaded financing mechanisms were selected for more detailed review[2]. It is important to note that this list includes both internal and external funds, and although external mechanisms are the focus of a separate CEP action area, they have many similarities to internal financing mechanisms, and as such are relevant to this discussion. A relatively limited review of 12 financing mechanisms cannot be considered comprehensive, but was all that was feasible given the available resources for the project. To counter the potential for biases to be introduced due to the small sample size, the financing mechanisms were selected to achieve the following:

- A cross-section of fund types (the list contains five internal, two internal/external, and five external funds).
- A geographic mix of funds with Canadian and Northern focus (9 of 12 funds are based in Canada to ensure local relevance and applicability to Yellowknife)[3].
- A variety of supported project types (some, such as the Toronto Atmospheric fund are open to a broader spectrum of possible projects while others, such as Saskatchewan's High Efficiency Furnace Loans, are very focused).

Each of the selected financing mechanisms is described in brief below. These descriptions are intended to provide an overview of each mechanism and highlight any interesting features. A copy of the research template used to collect information about each mechanism and contact information for each of the mechanisms can be found in Appendices A and B respectively.

## 3.1 Internal Financing Mechanisms

*Edmonton's Energy Management Revolving Fund*

Operating since 1995, the program is designed to finance energy retrofits in municipal facilities. Since its inception, the fund has grown from $1 million to $5 million to help meet the demand for projects. The initial seed funding was set aside following a budget surplus. Cost savings have always been the funds objective, and these are now limited to projects with simple paybacks between 5 and 10 years because the Alberta ME First! program is available to finance projects with shorter-term paybacks. The ME first! program was launched in September 2003 by Alberta Municipal Affairs and Alberta Environment as is a four-year, $100 million interest-free loan program designed to help municipalities achieve energy savings, reduce greenhouse gas emissions, and replace conventional energy sources with renewable or alternative sources. In addition to the ME First! program, departments are able to access additional funds by: 1) making additional budget requests for projects with acceptable paybacks that don't fit within the annual availability of the fund, and 2) treating the energy retrofits as facility upgrades, which have a

[2] The Toronto Energy Management Program, Phoenix Reinvestment Plan, Oslo Ekon Fund, and GNWT Energy Conservation Program were not mentioned in April 20, 2006 correspondence with the CEP committee but were included in the final list for detailed review because they were discovered later in the process and deemed particularly relevant and/or had readily available documentation.

[3] Most examples from US jurisdictions were not included because US cities are able to draw upon federal and state tax-exempt or partially tax-exempt bonds, which is not an applicable model in Canada. The Phoenix fund was included because documentation describing the fund was found when researching one of the other selected models.

separate budget allocation.

Individual departments/facilities and the building engineering division are all able to advance possible projects to the 10-member energy management committee that determines project priorities. The committee is comprised of department heads for public works, buildings, engineering, and finance, and facility managers. If the audited projects provide an acceptable payback, the financing is provided and repaid from general revenues. Although not a universal opinion, some Edmonton staff expressed concern that the project costs and savings were being estimated too optimistically resulting in a situation where fund's financial sustainability was being overstated.

*Stuttgart's Intraction Program*

In 1995, Stuttgart's energy management department (12 staff) established the intraction program to provide a mechanism to facilitate energy retrofits of City buildings. The intraction model operates by arranging internal loans between the benefiting department and the environment department which provides the financing. The interest free loans are based on energy audits completed by the energy management department. The energy management department also assumes responsibility for monitoring the energy and cost savings. Results from the monitoring program are used to set subsequent energy budgets for the benefiting department to the levels they would have been without any energy improvements. This approach allows the benefiting departments to directly realize the energy savings and therefore pay off the internal loan. The City's construction department is also involved in the system, as they are responsible for arranging any retrofit work when external contractors are required.

*Kelowna's Energy Management Program*

Operating since 1996, Kelowna's program is intended to reduce energy costs in City buildings, and has successfully spurred retrofits in more than 80 buildings for an estimated annual savings of 4 million kWh ($170,000). The program is based on an energy management committee which is comprised of staff from relevant departments and the local gas and electric utilities. The committee prioritizes projects based on their potential to reduce energy costs and proposes the top projects to Council for approval each year. Unlike other programs, there is no set allocation for retrofit work, and all project funding must be approved by Council. Although a potential source of project delays, in practice the Council approval system has resulted in a relatively steady flow of projects being identified. The flow of projects has slowed more recently as committee focus has shifted to the development of a sustainable building pilot project for the residential sector. Historically, the program has resulted in 1 to 2 year simple paybacks on investment, but they will proceed with paybacks of up to five years.

In addition to the regular meetings of the energy management committee, a second key component of the program's success is the close involvement of Fortis BC, the local electric utility. Fortis BC works closely with the City to identify projects and also provides rebates to the City for successful projects that are subsequently used to finance future studies on other retrofit opportunities. Although the program was designed to focus on both electricity and gas, the close involvement and strong support of Fortis BC has resulted in electricity savings being the program's primary focus.

*Toronto's Energy Management Program*

Although Toronto has been engaged in improving the energy efficiency in its' buildings for over 15 years, their current initiative is based on a loan of $35 million. The loan has been obtained from a variety of sources (including the Federation of Canadian Municipalities) with interest rates ranging from 3.5% to 5%. The City is intending to spend the $35 million over six years (starting in 2004), which they expect will result in annual savings of $4.3 million once all of the projects are complete. The main criteria for potential projects is having a payback of eight years or less, but the initiative is also embedded within the City's overall climate change strategy. The City tracks actual energy savings using consumption meters and pays off the loan based on those confirmed savings.

*Phoenix's Energy Conservation Savings Reinvestment Plan*

In 1984, Phoenix established the Energy Conservation Savings Reinvestment Plan to finance energy retrofits in City facilities and help municipal departments pay for the incremental costs of new energy-efficient equipment. In addition to supporting retrofits, the fund helped finance a district cooling system and a thermal storage system for the new Phoenix City Hall, as well as small-scale cogeneration, solar, air volume, and waste water systems. Part of the fund also goes toward research into new technologies and approaches to energy efficiency.

The fund was established with seed money from state oil overcharge funds, and currently has a limit of $750,000 per year. Energy savings are established by comparing energy consumption before and after a retrofit, for the first year the improvement is in place. For the following ten years, half of this amount replenishes the plan, while the other half goes into the City's general fund. Minor problems that have been encountered by the plan include underestimating the turnover of stock and buildings and building leases not being renewed. These are both problems because the economic justification for a project is based on a certain lifespan (or turnover time), and if this is overestimated, there is less time to accrue energy savings and repay the capital investment.

## 3.2 Internal/External Financing Mechanisms

*Toronto's Atmospheric Fund*

Established in 1993 through the $20 million sale of downtown land for development, the fund is focused on a broad range of projects including those that: reduce GHG emissions throughout Toronto, improve local air quality, improve local carbon sinks, provide public education on these issues, and facilitate partnerships between different sectors. The fund is self-sustaining in that it now operates independently from the City and does not require any ongoing funding to support projects. Four staff members are employed by the fund to ensure efficient and adequate administration, and they are overseen by a board of directors comprised of City Councilors and independent citizens. A particularly interesting component of the fund is that it provides a mix of loans and grants to recipients. Interest earned on the initial endowment and project loans are used to both grow the fund and provide grants to research and advocacy type projects that are unable to directly demonstrate paybacks. The loan stream of the fund charges relatively high interest rates to reflect the longer paybacks associated with projects being financed and the risk that the projects may or may not be successful in the long term. Examples of financed projects include the wind turbine at Exhibition Place, seed financing for Toronto's car-sharing service, and capital to finance energy efficiency retrofits in two Toronto artists' facilities.

*Oslo's Ekon Fund*

In 1982, Oslo established the Ekon Fund to finance energy efficiency retrofits throughout the City. A surcharge on electricity initiated at the same time provides an ongoing input to the fund amounting to approximately $0.0015 / kWh. This financing mechanism is comparable to the public benefits charges used commonly throughout Europe and in many US states, but it appears to be relatively unique for municipalities. Currently, the efficiency surcharge charge adds approximately $9 million dollars per year to the fund. The fund provides grants for energy audits and an additional grant to cover approximately 15 percent of project costs. The fund is also able to provide a loan for the remaining 85% of project costs. Ongoing payments from the efficiency surcharge and loan repayments have led to a situation where the City is not able to identify enough projects on an annual basis to spend the available capital.[4]

## 3.3 External Financing Mechanisms

*GNWT's Municipal Rural Infrastructure Innovation Fund*

The innovation program is a component of a general infrastructure fund that was initiated in January 2005 as a three way cost sharing partnership between the Federal, Territorial, and Municipal governments. The broader fund consists of $32 million (not including municipal contributions), and although it was initially designated for any green infrastructure program, the entire fun has been allocated towards water and sewer projects. The innovation component of the fund accounts for $2.8 million and is only available to tax-based communities to support projects focusing on renewable energy, transportation, and air and soil quality. Because the program is relatively new and the focus to date has been concentrated on the general infrastructure fund ($32 million being used for water and sewer projects), no projects have been funded from the innovation fund yet.

*GNWT's Energy Conservation Program*

Operating for over 20 years, the program is intended to support energy retrofits in buildings or assets that are owned or leased by territorial or community funded departments, boards or agencies, or non-profit organizations. The program provides grants to eligible projects of up to $50,000, working within a total budget of $400,000 per year for the past five years. The funded projects (described in greater detail in Section 6) have been achieving simple paybacks of approximately 2 years, but projects are eligible for funding if they can demonstrate a five-year or better simple payback. In addition to the retrofits themselves, the program is also available to finance feasibility studies for retrofit work within the same types of buildings.

[4] The International Council for Environmental Initiatives, whom provided the information about the Ekon Fund, was asked about the current status of the fund and how Oslo resolved the dilemma of having too much available capital, but no answer was provided.

### *Yukon's Rural Electrification and Telecommunication Program*

Operating since 1984, this program was established to provide loans to pay for electricity and telecommunication services to near-grid communities and houses in the Yukon. Of relevance to this research is that the program is intended to help communities move away from diesel generated electricity and will also finance distributed renewable electricity systems in addition to grid connection. The program has financed approximately 600 grid connections since its inception, and approximately 30 of those have included the installation of a renewable electricity source (mostly solar). Loans of up to 25% of the assessed property value can be provided.

The projects are financed using a local improvement charge (LIC) mechanism, which provides a loan to the homeowner, which is attached to the property as opposed to the owner. The loan is paid off over a period of up to 15 years at a rate 0.25% above Canada's prime lending rate. LIC's are used throughout Canada to finance sewer and sidewalk replacements, and the approach allows homeowners to comfortably proceed with an investment even if they are not certain they'll be living there long enough to realize the payoff. For a much more detailed discussion of LICs and how they could be used to finance energy efficiency and renewable energy, please see the 2005 analysis prepared by the Pembina Institute (available at www.pembina.org).

### *Yukon's Green Mortgage Program*

Established in 1999 by the Yukon Housing Corporation (YHC), the program provides reduced interest mortgages to homes that are able to meet the Yukon's GreenHomes certification. The certification can be applied to new or existing homes, and requires the home to achieve an EnerGuide for houses rating of 80 or better, be built using 75% local materials, be built by a Yukon resident, and have a certified ventilation system. Since its inception, the program has certified 43 homes (approximately 1,200 homes have been built in that time). The program has access to an annual budget of $2.5 million, and can provide mortgages up to $200,000. Payback terms can be set up to 25 years, and the interest rate is set at 1% less than the average of comparable rates from the five major banks. If interest payments cause the fund to grow, the additional funds are directed into the Senior Management Fund, which is a separate YHC fund that supports seniors to build houses.

### *Saskatchewan's EnergyStar Loan Program*

This program was established in 2001 as a five-year partnership between Natural Resources Canada (NRCan), SaskEnergy, SaskPower, and TD Bank to provide prime rate loans for EnergyStar furnaces. Although no longer operational, the program successfully financed approximately 12,000 furnace installations in what amounted to a grant of approximately $500 per installation. Financing was provided by NRCan ($200), SaskEnergy ($200), and SaskPower ($100), but the program's success was largely based on the way it was able to leverage each partner's strengths. NRCan provided technical expertise and the support for the EnerGuide audits that were required to apply for a loan, SaskEnergy and SaskPower provided the direct access to customers and suppliers, and TD Bank provided the financial expertise. As mentioned, the program is no longer operational, and none of the partners interviewed could provide a clear explanation as to why the partnership (that they all deemed successful) was not continued.

# 4 Key Differences in Financing Options

This section attempts to strip out the key components of the different financing mechanisms that were reviewed and describe the primary differences between them.

*How is financing made available to project proponents?*

There are two steps involved in answering this question:

1. Defining the way in which capital is generated to finance projects (four options were identified).
    - An *interest fund* operates by having a significant endowment set aside so that future projects can be financed solely by the interest generated from the endowment. The advantage of this model is that project loans or grants do not need to be repaid to the fund because it is able to sustain itself. The disadvantage is that a much larger amount of initial financing is required and setting those funds aside has an associated opportunity cost.
    - A *revolving fund* operates by setting aside sufficient funds such that the ongoing repayment of loans is enough to continually finance the demands for new loans. The fund needs to be sufficient to account for escalating costs due to inflation, and other costs associated with projects such as feasibility studies.
    - An *annual allocation* operates by setting aside a certain amount of funds each year to finance the specified projects. The key difference between an annual allocation and a revolving fund is that the annual allocation is typically set aside from general revenues, whereas the renewal of a revolving fund is directly linked to the savings generated by financed projects.
    - A *program* is somewhat different from the three previous models because it is established with an explicit intent to expiry within a certain time period or after a specific amount of money has been distributed. A program could be renewed, but that is not the explicit intent when it is established.

2. Deciding how much financing is made available to project proponents. The two options identified were a fixed allocation mechanism where roughly the same amount of financing is available every year and projects are identified and selected to use up that amount, and a variable allocation mechanism where the amount of financing is dependant on the eligible projects identified in a given year.

*How are projects identified and advanced?*

There was only one step involved in answering this question:

1. Defining the responsibility for identifying and advancing potential projects. The two options in use in other municipalities are where individual facility managers are responsible for the

opportunities, and where a central energy or environmental department holds the responsibility. Both models seem to work well as long as there is adequate communication between the various facility managers and any other departments involved. The primary factor that helps decide between the options appears to be the size of the municipality, where larger administrations can justify a separate department that focuses on energy or the environment. In either case, municipal Council can be involved if they are required to approve any project spending. Their involvement typically occurs under a variable allocation model, but is less common in a fixed allocation model.

*How is project eligibility defined?*

There were five steps involved in answering this question:

1. Defining the objective of the financing mechanism. The two options identified are to focus on reducing GHGs or to focus on reducing energy expenditures. This is a particularly important question in Yellowknife because the most expensive energy source is electricity while the energy source with the highest GHG intensity is fuel oil[5]. Therefore, setting GHG reductions as the primary objective would direct most of the focus to projects that reduced oil consumption, while setting cost reductions as the primary objective would direct most of the focus to projects that reduced electricity consumption. Most of the internal financing mechanisms reviewed had a primary objective of reducing energy expenditures and ensuring any investments had an acceptable return on investment, but they also typically had a second filter to ensure that none of those measure would lead to increased GHG emissions.
2. Selecting the types of proponents that are able to advance projects. The two basic options identified are those that limit eligibility to projects affecting city operations and those that finance a combination of internal and external projects. Combined approaches can vary from those that accept a very broad range of internal and external projects (e.g. Toronto's Atmospheric Fund) to those that provide a limited extension of an internal financing mechanism by making institutional buildings eligible.
3. Determining the types of projects that will be eligible for financing. The two options identified are to explicitly declare certain types of projects eligible or allow any types of projects so long as they help achieve the financing mechanisms objectives. An example of the first option would be a mechanism designed to only finance furnace retrofits, while an example of the second option would be a mechanism that financing any projects the reduce GHGs from City operations.
4. Figuring out the information that needs to be available to fairly assess a potential project. This information can potentially include: the expected capital costs, the current and anticipated energy consumption, energy expenditures, and GHG emissions, the expected life of the project, a discussion of similar types of projects previously supported by the municipality, and a discussion of potential risks. Ideally, all of these variables are included in the assessment so that a proper life cycle cost analysis can be conducted.[6] The information is

[5] It is important to note that this situation exists in Yellowknife due to excess hydro-electric capacity, which resulted from two mine shutdowns. If electricity demand continues to grow, new sources of supply will be needed and there is no guarantee that they will have as low a GHG emissions intensity. For example, if new supply needs were met with diesel generation, electricity would have the highest cost and GHG intensity.

[6] Calculating the cost of a system or product over its entire life span including upfront planning, development, and capital costs, production costs, operating and maintenance costs, energy costs, disposal or salvage costs, and environmental remediation costs.

typically collected in an energy audit, which relies on an effective system to track energy issues on a facility-by-facility basis. Alternatives to energy audits include basing the analysis on the results of previous projects, and computer models, which can be the only possibility in projects involving new construction.

5. Defining the boundaries between projects. The two identified options are to define project boundaries based on individual improvements or to take a broader view to combine, or bundle, similar projects into a single evaluation (e.g. a number of individual retrofits in the same facility). The latter option leads to larger and more complex projects that can slow, or even prevent, their approval. The main advantage cited by proponents is that a building approach allows certain projects that have higher risks or longer paybacks to be justified because they are viewed in combination with less uncertain investments.

*How is the financing repaid?*

There were five steps involved in answering this question:

1. Deciding how much of the financing the proponent is expected to repay. Options range from a pure grant model, where no repayment is expected, to pure loan models, where a full repayment (possibly including interest) is expected. Combination approaches are also possible, where a portion of the financing is a grant and the remainder needs to be repaid.
2. Determining how loan based mechanisms are repaid. The two options identified were direct and indirect repayment, where a direct repayment model is one in which the project proponent is required to repay the financing, and an indirect model is one in which the financing is repaid from general revenues.
3. Setting the interest rate applied to loan based mechanisms. A wide range of options was identified, starting at no interest rate and increasing to upward of 15%. The interest rate can be set to account for the following costs: the municipality's borrowing rate, inflation, program administration, feasibility studies, monitoring an evaluation, risk, and revenue generation. The models that had interest free loans typically included a separate mechanism to add to the fund in order to account for some or all of these costs.
4. Defining the amortization period for loan based mechanisms. The options ranged from three to ten years, where the length of time that a municipality is willing to wait for investments to be repaid dictates the number of potential projects and the amount of money that needs to be set aside to ensure the mechanism's sustainability. In other words, the longer the acceptable payback, the more projects that will meet the threshold, and the more capital that will be tied up in those projects.
5. Determining how defaulted loans are dealt with is the fifth step, but this step is not relevant for internal financing mechanisms where the City is lending to itself.

*How is program success and sustainability monitored and evaluated?*

There were two steps involved in answering this question:

1. Assessing how successful projects have been and how the actual results compare with earlier estimates. A variety of options were observed, ranging from those that do not conduct any follow-up analysis and simply base any reported savings on the estimated values, to those

that look at the energy consumption for a year to provide a comparison with the anticipated energy savings, and finally to those that rely on a combination of actual energy consumption and energy modeling to adjust the observed data so that it accounts for changes in climate and facility use. With the exception of those financing mechanisms that do not conduct any follow-up analysis, all of the options require a data system in place that tracks energy consumption and expenditures on a facility-by-facility basis.

2. Determining the timeframe over which the monitoring and evaluation is conducted (if at all). Although many cities conduct short-term evaluations regarding the effectiveness of their projects, none of the examples reviewed for this research evaluated the long-term sustainability of those energy savings. Undertaking this degree of analysis would certainly be possible given that most cities are already tracking energy consumption and energy expenditures in their facilities. Despite the feasibility, cities seem to prefer focusing on a short-term analysis and projecting those results over the life of the asset.

# 5 Key Factors in Successful Financing Mechanisms

The following section describes a number of key factors that have been identified throughout the reviewed financing mechanisms. For the purposes of this section, they have been positioned in terms of success factors, but in all cases, the inverse of a factor could be taken as a mistake to avoid when designing a financing mechanism.

*Clearly defined objectives and eligibility requirements*

To minimize confusion regarding the types of projects that a financing mechanism is intended to support it is important to have clear objectives and eligibility requirements. The objectives will likely be defined in terms of reductions in energy expenditures or GHG emission reductions, and can often include a combination of the two. Clearly defined eligibility requirements will include the specific types of projects allowed (or not allowed), the range and types of costs that can be financed, and the allowable time for payback.

*Clearly defined targets*

Targets are important because they ensure that there are agreed upon benchmarks that will be used to measure a financing mechanisms success. In cases where targets are not present it becomes too easy to claim success regardless of how much has actually been accomplished. A target can be set in terms of the number of projects to be financed, the dollar value to be financed, the energy savings to be achieved, or the GHG reductions to be realized.

*Simple, transparent and consistent process*

From the perspective of a project proponent, it is critical to set clear expectations for the process of advancing a project and then be able to meet those expectations. This builds upon the previous points of having clear objectives and eligibility requirements that represent a first line of filters for potential projects. Once it is clear that a project is eligible it is important to have clear steps and timelines

*Council and staff support for financing mechanism and its objectives*

These two key pieces of institutional support help build a foundation on short-term successes and ensure that the mechanism has the longer-term backing to sustain itself in the face of changing short-term priorities. A key mistake to avoid is assuming that a mechanism has long-term security simply because it has been approved and is in place. There are many examples where revolving funds and other pools of financing have been "raided" for other priorities, and much of this can be attributed to a lack of understanding and support.

*People designated (and allocated time) to identify and steward projects*

A financing mechanism will not be successful unless it has people that clearly hold responsibility for projects and those people have been designated sufficient time to take on that responsibility. A common pitfall of financing mechanism seems to be underestimating the time required of facility managers, engineering staff, and energy and environment managers to identify and steward projects. When this occurs, the end result is that even though there may be an effective mechanism in place, the projects either aren't being identified or they are getting stalled in the system. The successful financing mechanisms are those that draw on a wealth of expertise available in different departments and facilities so that they can effectively identify and prioritize projects. Such groups are commonly referred to as energy management committees.

*Systems in place to identify opportunities and track success*

In order to make sure the people designated to identify and steward projects are able to do so in an effective manner, it is critical to have a data system in place that allows for energy consumption, energy expenditures, and GHG emissions to be easily monitored on a facility-by-facility basis. Trends in these statistics can help identify areas of high potential and where problems may need to be addressed. The same system also allows completed projects to be monitored and evaluated.

*Flexibility to finance varying project sizes*

Although it is important to develop a system that brings forward a steady flow of project opportunities, it is also important to recognize that there will inevitably be fluctuations in the size of those projects. A successful financing mechanism should be established so that it is able to handle these fluctuations. This does not mean that the mechanism needs to be designed to have funds set aside to handle very large projects because this can have the drawback of tying up a large portion of a city's resources that would only actually be drawn upon occasionally.

*Conservative assessment of project economics*

A successful financing mechanism is one that achieves its objects and is able to sustain itself if desired. This factor helps achieve both of those needs by ensuring that projects are assessed with conservative estimates of capital costs and energy prices. All of these numbers are uncertain quantities when a project is being evaluated, so it is important to account for the fact that costs could be higher or lower than the best estimate.

*Recognition of, but not paralysis from, uncertainty*

Estimates of energy savings (and corresponding cost savings) are inevitably uncertain for several reasons. Energy consumption is dependant on the efficiency of a facility, but also on the climate and number of people of using the building – both of which will likely change from the conditions under which the opportunity was studied. The uncertainty is further complicated by the fact that energy prices also change, so even though savings may be real in comparison with what energy costs would have been without improvements, they may still be higher than the expenditures prior to improvements. These uncertainties cannot be resolved and although it is important to recognize and account for them (using conservative assessments of project economics for example), the irresolvability should not be used as an excuse to avoid action. If the financing mechanism is built around reliable projects the energy and cost savings will be realized on average over the long term.

# 6 Local Context

Understanding the local context is important for two key reasons when considering the design and implementation of a green financing mechanism:

1. It helps identify where existing policy and legislative constraints may make it impossible to apply certain models that have worked well in other communities. These constraints could come from municipal, territorial, and federal governments, and the findings can either point to ways in which a financing mechanism would need to be redesigned or a constraint would need to be adjusted.
2. It helps identify any similar types of programs that are already operating in the community so that any new financing mechanism can be designed to operate in cooperation. The other programs do not need to be operated by the local government and they do not need to be financing mechanisms.

*Policy and Legislative Constraints*

From a borrowing perspective, there are few legal constraints on the amount of funds that Yellowknife can access that would be encountered prior to the point that political constraints would limit access. The Cities, Towns, and Villages Act of the GNWT limits Yellowknife to taking on any more than $160 million in debt and $9 million in debt servicing charges. Current City policy limits these figures even further, with a debt limit of $90 million and a debt-servicing limit of $3 million. The presence of the Federal Government gas tax funds (see below) also provides an opportunity to establish a financing mechanism that would not require City borrowing. A related constraint that arose during the course of the research was Canadian cities' inability to draw on tax exempt or partially tax-exempt bonds to finance their programs. These types of federal and state level bonds are a common source of financing for US cities.

From a lending perspective, there were no legal constraints discovered because the relevant legislation did not view an internal loan as a liability in the same way a loan to an external party would be. Based on operating practice in Yellowknife, loans are not arranged between departments due to the relatively small size of the administration, so direct repayment models as demonstrated by the Stuttgart Intraction model would not be applicable.

*Relevant Programs Currently Operating in Yellowknife*

There are several programs already operating in Yellowknife that should be accounted for in any green financing mechanism implemented by the City:

- The GNWT's "Municipal Rural Infrastructure Innovation Fund"
- The GNWT's "Energy Conservation Program"
- NRCan's "EnerGuide for Existing Buildings Program"[7]

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[7] The future of the EnerGuide program is uncertain due to a variety of cuts made to Federal climate change initiatives in the 2006 budget. Although there may be some short-term interruptions and the specific branding may change, it seems reasonable to expect that some sort of

The first fund could potentially be used to supplement any Yellowknife initiative, whereas, the other two are focused specifically on building improvements.

Although not exactly an existing program, the Federal gas tax transfers are a particularly relevant flow of funds that could be used to support any green financing mechanism considered by Yellowknife. Projects designed to reduce energy consumption and/or GHG emissions would certainly satisfy the sustainability objectives of the gas tax transfers, and Yellowknife faces few external constraints in deciding how to allocate the funds. Table 3 presents funding schedule for Yellowknife's gas tax funds until 2010.

| | Year | | | | |
|---|---|---|---|---|---|
| | **05/06** | **06/07** | **07/08** | **08/09** | **09/10** |
| **Gas tax contributions to Yellowknife ($ Million)** | $1.34 | $1.34 | $1.80 | $2.25 | $4.52 |

Table 3 – Gas tax contributions to Yellowknife

federal program will continue to provide support for energy improvements in existing commercial buildings. This assessment is based on the relative success that the existing EnerGuide program and the high level of expertise built up by the Office of Energy Efficiency.

# 7 Recommended Model

Throughout this research, a number of green financing mechanisms have been reviewed in varying levels of detail. Each municipality or province involved in those mechanisms had different reasons for choosing the specific model they selected, and for the most part, they were satisfied with those decisions. The following two sub-sections present a recommended model for Yellowknife to consider and the potential economic and environmental implications of the model. The financing mechanism presented here is a blend of what has worked well in other municipalities that also attempts to account for the specific context in Yellowknife.

## 7.1 Model Structure

The structure of the proposed financing mechanism is presented in terms of the key questions described in section four, and it attempts to integrate all of the success factors identified in section five. Presentation of the financial and GHG implications of this structure are reserved until section 7.2.

*How is financing made available to project proponents?*

Capital would be made available based on mixed model that would include a revolving fund and an annual allocation component. The revolving fund component would be intended to finance relatively small energy retrofit projects that have a large potential for replication throughout municipal buildings, infrastructure, and vehicles so that a steady stream of projects can be cultivated (e.g. lighting and controls retrofits). This component of the fund would regenerate itself based on the resulting energy savings. The annual allocation component would be for larger projects that arise on an irregular basis, but still present an attractive economic opportunity. These projects would be presented to Council for approval on an annual basis once the feasibility studies have been completed. The annual financing available from the revolving fund would be a fixed amount, whereas the annual allocation component would depend on the requested projects.

In combination, the two components of this financing mechanism provide flexibility to fund a variety of size projects. An annual allocation model could provide this flexibility on its own, but the revolving fund component adds a consistent signal (or pull) that should help encourage new projects to be identified on an ongoing basis. Designating the revolving fund for smaller, replicable projects also avoids a situation where too much capital is tied up in a fund in order to be ready to finance larger scale projects.

In additional to providing financing for project implementation, the mechanism should also be structured so that funds are available to study the feasibility of new opportunities and also conduct follow-up audits to ensure that savings are being realized.

*How are projects identified and advanced?*

In order to ensure that an ongoing flow of projects is identified and continually advanced towards implementation, Yellowknife should establish an energy management committee, which could potentially serve as a sub-committee of the Community Energy Planning committee. The committee's mandate would be to identify the projects that the financing mechanism has been established to support and would be comprised of five to ten individuals including facility representatives, and representatives from public works, engineering and finance. If possible it would also be beneficial to include a member with specific expertise and interest in climate change to ensure that an environmental perspective is present in discussions. Other potential perspectives to include in the committee would include representation from the utilities and an energy efficiency expert. Although the committee's focus would be the City's financing mechanism, they would also coordinate applications to other funding sources for similar types of projects.

As discussed in section 5, this committee will rely on timely information about energy consumption, energy expenditures, and GHG emissions throughout municipal operations in order to make informed decisions about where the best opportunities are. Based on information presented in the 2004 baseline and provided through the course of this research, Yellowknife is doing an adequate job of collecting this data for facility energy consumption. No information was provided on the availability of data for energy consumption in the City's fleet. It will be important that the committee regularly review the quality and availability of this data to ensure that it is meeting their needs when attempting to identify and prioritize new projects.

*How is project eligibility defined?*

Projects should be limited to any opportunities that will reduce energy consumption in Yellowknife's buildings, infrastructure, and fleets (i.e. internal proponents). Without this expectation of reduced energy costs, establishing a self-sustaining fund will not be possible. Potential projects will be passed through two filters. The first filter will ensure that energy savings generated by a project should be able to pay off the initial investment within eight years at an annual interest rate of 4.7% (see the next sub-section for a discussion on interest rate selection). The second filter will direct the energy management committee to select projects that maximize GHG emission reductions, while at a minimum ensuring that they will not lead to an increase in GHG emissions. This approach should allow the energy management committee to focus on the long-term sustainability of the financing mechanism, while also giving them the flexibility to select GHG focused projects that might otherwise be overlooked if economic payback was the only criteria. Projects that meet the economic return filter, but offer low to no GHG emission reductions would only be financed if the available capital for a given year could not be allocated on better opportunities.

The estimated energy savings, GHG reductions, and payback on capital investment will all need to be demonstrated based on a feasibility study that provides a detailed examination of the technology under consideration, and it's applicability in the given facility, infrastructure, or vehicle. The feasibility study should include a discussion of any past experiences with a proposed technology and any potential risks associated with that technology. To allow for a wide variety of project types and scopes to be considered, the financing mechanism should permit bundles of projects within a facility to be evaluated in combination. This approach provides for the potential to balance higher risk, longer payback investments with more certain opportunities and prevents the energy management committee from having to focus on a small subset of project opportunities.

*How is the financing repaid?*

Both components of the financing mechanism would be established as a loan model, in that all investments would be expected to demonstrate a payback on in investment (including interest) within at least eight years. Only the revolving fund component would be repaid to finance additional projects, whereas the annual allocation loan would generate savings that would simply accrue in general revenues. The repayment stream for the revolving fund would come from the energy expenditure savings accrued in general revenues (i.e. an indirect repayment model) as opposed to specific departments.

The internal interest rate used to repay projects would be set at 4.7%. This value accounts for the following costs:

- Inflation (2.5%)
- Feasibility and evaluation studies (2.2%)

The recommended 8-year amortization period falls within the range of thresholds used by other municipalities, and seems to provide enough flexibility to explore a range of projects while still providing a short enough time frame to adequately manage concerns related to risk and uncertainty.

*How is program success and sustainability monitored and evaluated?*

The following proposed auditing system is designed to provide a meaningful way for Yellowknife to evaluate the success of their initiatives and evaluate the financing process, while at the same time minimize the time and cost associated with an audit process. It is recommended that all large projects financed through the annual allocation stream undergo a 1-year audit to assess if the predicted savings are actually being realized, while only a subset of projects financed through the revolving fund would be subjected to such an audit. That subset would be selected based on the size of the project (i.e. smaller projects would be audited less frequently), and the City's familiarity with the results of audits from similar types of projects (i.e. there is no need to audit projects identical to others that have just been audited). As discussed above, a 2.2% interest surcharge has been built into the loan repayment model to provide the funds needed to conduct the feasibility and evaluation studies.

Additionally, it is recommended that Yellowknife design the revolving fund to schedule a number of four and eight-year audits to ensure that the savings are sustaining themselves as anticipated in the original feasibility studies. The projects to undergo these audits will typically be those anticipating the most significant energy savings and those with the most uncertain or risky technologies. In order to minimize the time and resources devoted to studies, the longer term audits could serve two additional purposes: 1) looking for new energy savings opportunities, and 2) using the results to provide updates to Yellowknife's 2004 baseline.

In addition to the project-by-project evaluations, Council and the energy management committee should plan on a review of the financing mechanisms three to five years after they have been established. The main purpose of this review would be to assess whether or not the mechanisms are providing an adequate level of support to project opportunities. If there is interest in increasing the number of projects supported by the mechanisms, some options for consideration would include: increasing the fund size, increasing the acceptable payback length, or making other institutional buildings eligible for financing.

## 7.2 Economic and Environmental Impact Analysis

The analysis provided in this sub-section is an attempt to apply some numerical detail to the structure outlined in section 7.1. Although the components of that structure are based on a considerable number of discussions with other municipalities the numbers presented here should be taken simply one of multiple potentially successful scenarios, and the CEP committee should feel confident in exploring variations on the scenario presented here.

*Annual Spending Expectations*

The GNWT's Energy Conservation Program (ECP) has been financing an average of almost 13 projects per year throughout the GNWT over the past three years, so a reasonable starting point for Yellowknife would be six projects per year financed by the revolving fund component. Given the 32 buildings, facilities, and infrastructure noted in Yellowknife's 2004 energy baseline (not including vehicles), this would equate to projects being completed on approximately 15% to 20% of City's facilities each year. Based on the ECP's experience, projects have cost an average of $44,000 over the same three year period, so assuming a slightly higher average cost of $50,000, a Yellowknife revolving fund would require spending of approximately $300,000 to finance six projects per year.

To support these projects it is anticipated that an average of 10 feasibility studies and 10 follow-up evaluations would need to be conducted per year (this includes the occasional studies that will be associated with the larger projects that fall under the annual allocation component). Discussions with Demand Side Energy (a group that Pembina works with regularly) has suggested an average cost for detailed energy audits of approximately $2,000 per project, and the audit can be used as the basis for any follow-up evaluation so that the evaluation cost should not exceed $1,000 per project. In total, the audits and evaluations will result in an additional $30,000 per year in spending demands on the revolving fund.

In total, a revolving fund in Yellowknife that is expected to finance six projects per year will cost in the vicinity of $330,000 per year in auditing, project implementation, and evaluation. This value does not yet account for inflation, nor does it include any estimate of overhead costs.

*Establishing the Revolving Fund*

If the entire fund was established in its first year, Yellowknife would need to set aside eight years worth of financing requirements ($330,000 per year), or $2,640,000. Recognizing that funds are limited, it probably does not make sense to put all of the money aside in year one because only one eighth of it would be used in the first year. Instead, it is recommended that the City set aside two years worth of financing requirements per year as shown in Table 4 (these values account for inflation). This staged approach allows funds to be set aside closer to the date in which they will be used, while still ensuring that the entire amount has been accounted for during the current schedule of gas tax payments in case they are used to provide the financing. An additional benefit of this schedule is that there will be excess funds available when the overall approach is reviewed in three to five years making it relatively easy to increase the program scope if desired.

| | 06/07 | 07/08 | 08/09 | 09/10 |
|---|---|---|---|---|
| **Annual Contribution** | $660,000 | $676,500 | $693,413 | $710,748 |

Table 4 – Annual contributions required to build revolving fund component of financing mechanism

*Testing Project Economics and Calculating Repayment Streams*

To be eligible for financing, a project needs to generate energy savings that will repay the following costs within eight years at an assumed 2.5% rate of inflation:

- The project's capital costs.
- The project's feasibility study (average cost of $2,000 per study).
- The project's evaluation study (average cost of $1,000 per study).
- The feasibility studies and evaluation studies associated with 1) large projects from the annual allocation component of the financing mechanism and 2) the opportunities that do not end up meeting eligibility requirements. Based on four of these sets of studies for every six projects financed by the revolving fund, the average cost per revolving fund project would be $2,000.

Given an average project cost of $50,000, this amounts to a total repayment cost of $55,000 if it was repaid immediately. Stretching the repayment out over eight years (with the first repayment occurring at the end of year 1 and accounting for inflation reveals the annual repayments shown in Table 5, which are the minimum amounts that would need to be generated in annual energy savings. In terms of the $50,000 cost of the project, these repayment streams represent a simple payback of 7.1 years, and an average annual rate of return of 4.7% (not accounting for any energy savings generated after 8 years). The 4.7% annual interest rate is the value that should be used to assess the eligibility of projects, and can be used without needing to account for the costs of feasibility or evaluation studies separately because the 2.2% surcharge above inflation accounts for them. If any of the variables (i.e. costs, number of projects, amortization period) are changed, the required return on investment would be altered and would need to be recalculated.

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|---|---|---|
| Energy saving threshold for single project | $7,047 | $7,223 | $7,404 | $7,589 | $7,778 | $7,973 | $8,172 | $8,377 | $8,586 |
| Annual contributions needed to regenerate fund* | $0 | $42,281 | $86,677 | $133,265 | $182,129 | $233,353 | $287,024 | $343,233 | $402,073 |
| Annual savings accrued to general revenues* | $0 | $3,873 | $7,939 | $12,206 | $16,681 | $21,373 | $26,289 | $31,437 | $36,826 |

*These values are significantly larger than the first row of the table because they account for six projects per year as opposed to one.

Table 5 – Project repayment eligibility thresholds and anticipated repayment streams

Also shown in Table 5 are the average payments that Yellowknife can anticipate making to regenerate the revolving fund (these would be generated by energy savings) and the additional savings that will remain in general revenues. The additional savings are accrued because many projects will exhibit better rates of return than the minimum eligibility requirements. The values in the table are based on an assumption that the average return will be six and a half years. The six and half year assumption is quite conservative, because over the past three years, the ECP has realized annual energy savings of $0.22 per dollar invested, which translates to an average return of four and a half years. As Yellowknife gains experience with the fund and the types of projects that meet and do not meet the eligibility requirements, the longer term suitability of those requirements will become clearer. If, for example, it appears that there will not be a sufficient flow of projects that meet the 4.7% rate of return, the City could consider adjusting the criteria to accept longer payback projects and/or looking for additional financing partners.

*Estimated GHG Reductions*

Based on the ECP's experience over the past three years, every dollar invested has yielded average annual GHG reductions of 0.00058 tonnes, where this rather low value results from the ECP's focus on quick payback, electricity saving projects. Applying this value to the proposed mechanism is a reasonable starting point because the City will likely continue to maintain a strong focus on electricity savings projects due to the familiarity gained through the ECP. As the energy management committee gains experience with a broader scope of facility improvements, the 0.00058 tonnes per dollar invested will likely prove to be a conservative assumption. With an annual pre-inflation investment of $300,000 in project implementation, this same factor would translate to 174 tonnes GHG emissions. This value will increase each year as additional implementation dollars are invested and the earlier investments continue to produce GHG emission reductions and energy savings. Not included in these estimates are the GHG reductions that would be generated by the annual allocation component of the fund.

*Cash Flow and Energy Flow Summary*

Table 6 summarizes the financial and environmental flows over the first eight years of the fund based on the scenario described in the above sub-sections. As discussed, these cash and GHG flows do not account for the projects financed by the annual allocation component of the financing mechanism, with the exception of the feasibility and evaluation studies that are assumed to accompany those projects. It is important to note that all of these calculations are based on an assumption that approximately $300,000 worth of eligible capital projects are identified each year.

The first two rows of numbers indicate how the fund is established and maintained, where the seed financing establishes initial financing at a rate of two years worth of projects per year, and the savings reinvested in the fund are the amounts needed to maintain the fund. All of the expenditures shown in the table draw down the seed financing, while future expenditures (post year 8) would be covered by the reinvested savings. The savings designated for general revenues are based on an average simple payback of 6.5 years. If the actual realized payback is faster then the values in that row of the table would be larger, but the values reinvested in the fund would be unchanged. The GHG emission reductions are equivalent to the results achieved by the ECP on a dollar-invested basis.

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | Year 6 | Year 7 | Year 8 | Year 9 |
|---|---|---|---|---|---|---|---|---|---|
| Contributions to the fund | | | | | | | | | |
| Seed financing ($) | 660,000 | 676,500 | 693,413 | 710,748 | 0 | 0 | 0 | 0 | 0 |
| Savings reinvested in fund ($) | 0 | 42,281 | 86,677 | 133,265 | 182,129 | 233,353 | 287,024 | 343,233 | 402,073 |
| Expenditures from the fund | | | | | | | | | |
| Feasibility study spending ($) | 20,000 | 20,500 | 21,013 | 21,538 | 22,076 | 22,628 | 23,194 | 23,774 | 0* |
| Project implementation spending ($) | 300,000 | 307,500 | 315,188 | 323,067 | 331,144 | 339,422 | 347,908 | 356,606 | 0* |
| Evaluation study spending ($) | 10,000 | 10,250 | 10,506 | 10,769 | 11,038 | 11,314 | 11,597 | 11,887 | 0* |
| Savings generated by the fund | | | | | | | | | |
| Total energy savings ($) | 0 | 46,154 | 94,615 | 145,471 | 198,811 | 254,726 | 313,313 | 374,670 | 438,899 |
| Remainder accrued in general revenues ($) | 0 | 3,873 | 7,939 | 12,206 | 16,681 | 21,373 | 26,289 | 31,437 | 36,826 |
| GHG reductions (tonne CO2e) | 0 | 174 | 348 | 522 | 696 | 870 | 1044 | 1,218 | 1,392 |

*No expenditures are shown in year 9, but this would only be the case if the fund were discontinued at that point.

Table 6 – Summary of economic and environmental flows for financing mechanism

Accounting for the investments made over the first 8 years of fund operation, the financing mechanism will result in 13,920 tonnes of GHG reductions and have a net present value (discounted at 2.5%) of $294,879 above and beyond the savings and capital flows needed to sustain the fund. This calculation is based on an average project lifespan of 10 years[8], and it accounts energy savings and GHG emission reductions that will continue to accrue for the full lifespan of an improvement, even if no further investments are made (i.e. 10 years of additional savings are not shown in the table).

Because the projects actually demonstrate a positive return, the cost effectiveness in terms of GHG reductions is negative (-$19.26/tonne). As discussed with the CEP committee, a dollar per tonne figure for an enabling mechanism such as a revolving fund is somewhat misleading because the cost effectiveness figures are best associated with the specific measures that the fund is enabling.

[8] The 10-year lifespan for investments is a conservative assumption based on conversations with Demand Side Energy. With the exception of controls, almost all building retrofits should have a lifespan longer than this, but the 10-year value provides some flexibility in case there are unforeseen problems with a technology or there is a major change in the use of a building (e.g. reduced hours for an ice rink)

# 8 Next Steps

In order to proceed with the establishment of an internal green financing mechanism, the CEP committee should undertake the following steps.

1. Assess the recommended structure outlined in section 7.1 and determine if it meets the needs of Yellowknife and the CEP committee.
2. Discuss the scenario of economic and environmental impacts presented in section 7.2 and determine if they represent a scale of fund that fits the scale of projects they foresee in the coming years.
3. To help inform the second point, it is also important to gain a better understanding of the specific opportunities available within municipal operations, which will be available as the remaining CEP action area recommendations are delivered.

# Appendix A: Research Template

**Fund Overview**
How long has the fund been in place?
What are the primary goals of the fund?
What projects have been funded (number, type, scale...)?
What results have been achieved (i.e. energy and GHG reduction)?

**Partners and Roles**
Who are the key public and private sector partners in the fund?
What roles do they each play?

**Accessing Capital**
How is the fund financed (e.g. endowment interest or budget allocation)?
If the fund includes an endowment, how large is it?
If the fund includes an endowment, how is it managed?
Why was this particular funding model chosen?
What is the annual allocation for projects?
What happens if an annual allocation is not fully utilized?
What happens if an annual allocation is over-utilized?
Has the fund had any unforeseen financing requirements?
Have there been any additional challenges in accessing capital?

**Selecting Projects**
How have projects been solicited?
What types of projects are eligible?
What size projects are eligible?
What groups are eligible for funding?
What metrics are used to compare projects?
What time frames do the projects run for?
Are multiple year funding commitments possible?
Have there been any additional challenges to selecting projects?

**Financing Projects**
Does financing include loans and/or grants?
For loans, what interest rate and amortization period is used?
Are loans repaid by the loan recipient or other sources (e.g. general revenue)?
How many projects have defaulted on loans?
What is the penalty for defaulted loans?
What happens after a loan / project is paid off? (back to the city, back to the department, back to the fund, other)

**Monitoring and Evaluating the Fund**
How are a project's energy savings and GHG reductions evaluated?
What happens if the reductions are less than anticipated?
What happens if the reductions are greater than anticipated?
What processes are in place to adjust selection procedures as needed?
What processes are in place to communicate fund successes?
Have there been any additional challenges to monitoring and evaluation?

**Miscellaneous Questions**
How many people are responsible for administering the fund?
What roles do those people fill?
What are the overhead costs of the fund?
What are the advertising costs of the fund?

# Appendix B: Contacts

| Name of Financing Mechanism | Contact | Email | Phone |
|---|---|---|---|
| Edmonton’s Energy Management Revolving Fund | Marc Brostrom | | (780) 496 5992 |
| Stuttgart's Intraction Program | Dr. Volker Kienzlen | u360500@stuttgart.de | |
| Kelowna's Energy Management Program | Kelly Hughson | | (250) 717-0809 |
| Toronto’s Energy Management Program | Jim Kamstra | | (416) 392-8954 |
| Phoenix’s Energy Conservation Savings Reinvestment Plan | Ewa Ciuk (ICLEI) | Ewa.ciuk@iclei.org | |
| Toronto’s Atmospheric Fund | Mary Pickering | | (416)392-1217 |
| Oslo’s Ekon Fund | Ewa Ciuk (ICLEI) | Ewa.ciuk@iclei.org | |
| GNWT’s Municipal Rural Infrastructure Innovation Fund | Olivia Lee | | (867) 873-7238 |
| GNWT’s Energy Conservation Program | Jim Sparling | | (867) 920-6396 |
| Yukon’s Rural Electrification and Telecommunication Program | Clare Robson | clare.robson@gov.yk.ca | (867) 667-8277 |
| Yukon’s Green Mortgage Program | Mark Perreault | Marc.Perreault@gov.yk.ca | (867) 393-7154 |
| Saskatchewan’s EnergyStar Loan Program | Linda Lawrence | | (306) 777-9228 |