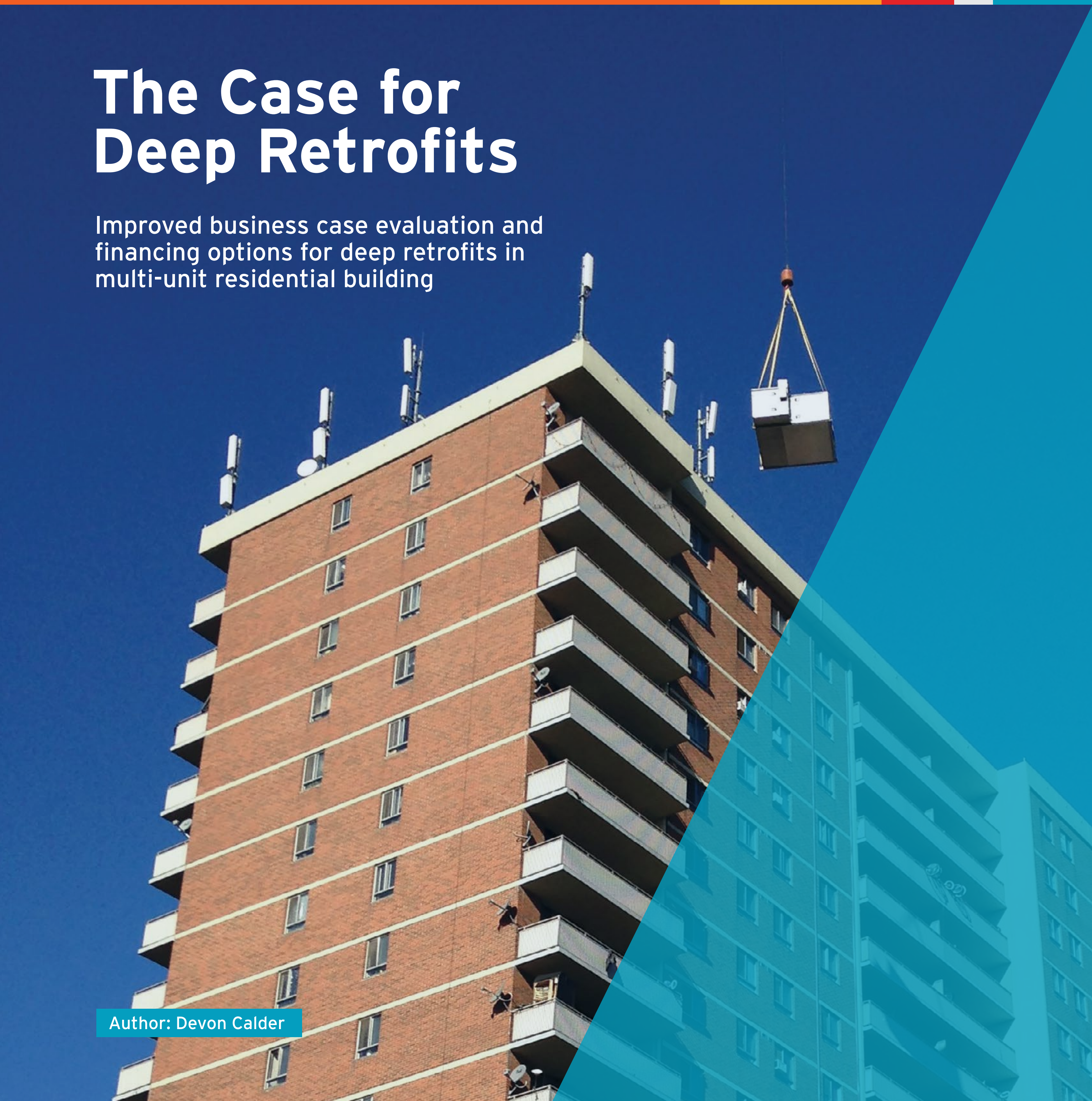
The Case for Deep Retrofits

Improved business case evaluation and financing options for deep retrofits in multi-unit residential building



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TAF The Atmospheric Fund

About The Atmospheric Fund

The Atmospheric Fund (TAF) is a regional climate agency that invests in low-carbon solutions for the Greater Toronto and Hamilton Area and helps scale them up for broad implementation. We are experienced leaders and collaborate with stakeholders in the private, public and non-profit sectors who have ideas and opportunities for reducing carbon emissions. Supported by endowment funds, we advance the most promising concepts by investing, providing grants, influencing policies and running programs. We're particularly interested in ideas that offer benefits in addition to carbon reduction such as improving people's health, creating local jobs, boosting urban resiliency, and contributing to a fair society.

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This research is part of TAF's TowerWise program, aiming to demonstrate solutions and accelerate retrofits across the multi-unit residential building sector. For more info, visit taf.ca/towerwise

This work was supported by financial contributions from The Independent Electricity System Operator, Natural Resources Canada, and the Federation of Canadian Municipalities.

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Foreword

Achieving Canada's goal of net-zero carbon emissions by mid-century requires deep energy retrofits to the majority of Canada's building stock. This fact is increasingly understood and accepted by environmentalists, labour, investors, policy-makers and the real-estate industry. And yet market uptake of deep retrofits remains stubbornly low, with little sign of growth. A myriad of barriers limit market uptake, from insufficient industry capacity and product availability to a patchwork of poorly designed energy policies and programs. But the most fundamental barriers are that the business case for deep retrofits is both challenging and poorly understood. Unless and until the business case is aligned – and perceived to be aligned – with the investment criteria of building owners and investors, the market for deep retrofits will remain underdeveloped.

This report reviews the business case for deep retrofits in the multi-unit residential building sector, and makes recommendations both for improving business case evaluation practices and improving the underlying business case. Multi-residential buildings provide a place to call home for nearly four million Canadian households, and are a critical component of the country's housing infrastructure. Much of the multi-residential housing stock is in or rapidly approaching a mid-life crisis, with significant investment needed not just for energy efficiency but to bring the buildings up to modern standards for indoor environmental quality, accessibility and resilience. The size, scale, and condition of the multi-residential building stock makes it a prime candidate for scaling up deep retrofits.

The perceived business case for deep retrofits can be improved dramatically for most projects simply by improving the quality and completeness of the business case evaluation. The energy efficiency sector is perhaps the only industry in the world that relies on simple payback as the primary – and often only – financial analysis metric. Making a viable business case for a deep retrofit requires a more robust approach, generally including some form of Life Cycle Cost Analysis (LCCA). LCCA exposes the hidden costs of a business as usual scenario. LCCA approaches also allow for the consideration of a wide variety of monetizable non-energy benefits, which are often overlooked. This can include reduced maintenance costs, increased rental income and property values, and tax benefits, among others.

However, even with a full LCCA, there is usually a significant gap between the financial returns of deep retrofits and the investment criteria of building owners and investors. This is particularly the case when targeting near-or-net-zero outcomes, which are increasingly necessary for reaching our climate targets. There is a critical need and a strong case for public funding to close this gap. In addition to being necessary for reaching our climate goals, deep retrofits provide a range of valuable public goods, including green jobs, improved health and wellbeing, and avoided energy infrastructure investments. Monetizing these public goods, through provision of public funding, can close the gap and create a strong business case for deep retrofits. As the deep retrofit market matures and sustainable energy technologies improve, costs will come down allowing a gradual reduction in public support.

This report was largely researched and written prior to the COVID-19 global pandemic and the consequent global economic recession. However, in my view, the events of the past six months only underline the importance of deep energy retrofits, and strengthen the case for greater public and private investment in this sector. As the focus shifts from crisis management to initiating a resilient recovery, job creation, economic growth, and sustainability will be the primary goals. Experts around the world, including at the International Monetary Fund and the International Energy Agency, have recommended prioritizing building retrofits in economic recovery efforts because of their unparalleled potential to deliver on all three of these objectives. Canadians are united in wanting to build back better, and that begins with building better places for people.

Bryan Purcell
VP Policy & Programs, The Atmospheric Fund

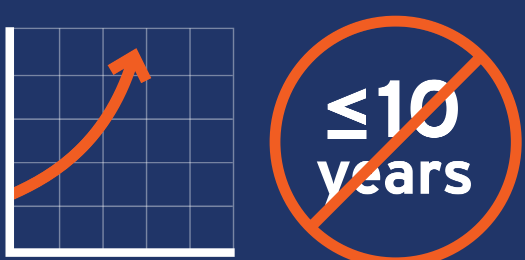
Executive Summary

Achieving Canada's goal of net-zero carbon emissions by 2050 will require deep energy efficiency retrofits that target more than 40 per cent savings across all building types. Despite a few notable success stories, there has been limited market uptake of deep retrofits, particularly in the multi-family building sector where there is excellent potential to achieve other public benefits like improving the quality of housing and creating local jobs. Building owners are dissuaded by many factors such as the long payback period, lack of awareness of financing options, and the perceived high risk of deep retrofits.

This report reviews the business case and financing options for deep retrofits in the multi-unit residential building sector, and makes recommendations for improving business case evaluation and financial supports. Some of the barriers to deep retrofits are caused by gaps in information and capability, and can be addressed through education and awareness efforts. Other barriers are caused by the underlying business case for deep retrofits, and require changes in policies and programs to overcome. This report provides recommendations in both of these areas, with specific recommendations for three key actors: governments and utilities; the green building industry; and property owners and managers.

In terms of education and awareness, improving the capabilities of all actors to evaluate and understand the business case for deep retrofits is critical. Current business case evaluation for energy retrofits places an overwhelming emphasis on simple payback based on energy cost savings, at the expense of more robust Life Cycle Cost Analysis (LCCA). Incorporating financial metrics like Net Present Value and Internal Rate of Return can improve the accuracy of business case evaluation. Furthermore, the evaluation should capture all monetizable non-energy benefits (and costs), over the expected life of the measures or the building. Undertaking and understanding this type of LCCA requires training, tools, and education for a variety of actors. However, improving business case evaluation and understanding is not itself sufficient to drive a major increase in deep retrofit market adoption.

The fact is that, even with a robust LCCA, the business case for deep retrofits is often very challenging, at least from the perspective of building operators. Most multi-unit residential building operators are looking for a positive return on investment within a ten-year horizon to justify energy efficiency upgrades. Deep retrofits generally don't yield positive returns on this time scale, even when factoring in monetizable non-energy benefits. This is compounded for deep retrofits that incorporate fuel switching (i.e. electrification), or which aim to achieve broader benefits such as enhanced resilience or improved air quality. Overcoming this challenge requires actions to improve the underlying business case for building operators.



Positive return on investment

- **Deep retrofits don't yield positive returns on the preferred time scale**

Public funding (grants)

- **Cover 30-50 per cent of total capital costs**
- **Compensate building operators for provision of valuable public goods**
- **Can be scaled back gradually over time**

The business case for deep retrofits can be improved through offering more and better financial supports. Innovative financing options can improve the business case, for example by reducing cost of capital, or transferring risk and/or ownership of energy assets to third parties. However, grants and incentives are needed to help improve the business case sufficiently to induce broad market participation in deep retrofits.

Public investment can be justified by the many non-energy benefits of deep retrofits that are not monetizable for building operators. Deep retrofits can mitigate climate change, improve health and productivity for residents, enhance resilience to extreme weather, and create green jobs and economic growth. Building operators are not compensated for providing these public goods. Generous public funding for deep retrofits can be seen as a way of compensating building operators for provision of valuable public goods that would otherwise be foregone. Public funding can also be used to prevent potential social harms from deep retrofits, such as rent increases that can erode housing affordability. Global experience demonstrates that achieving broad participation in deep retrofits requires grants covering in the range of 30-50 per cent of total capital costs. Best practice programs offer grant funding on a sliding scale, depending on the depth of carbon reduction and/or provision of other public goods. Experience shows that subsidies can be scaled back gradually over time, as economies of scale and industry experience compress the cost structure.

Key outcomes for deep retrofits

- **Mitigate climate change**
- **Improve health and productivity for residents**
- **Enhance resilience to extreme weather**
- **Create green jobs and economic growth**

Key recommendations

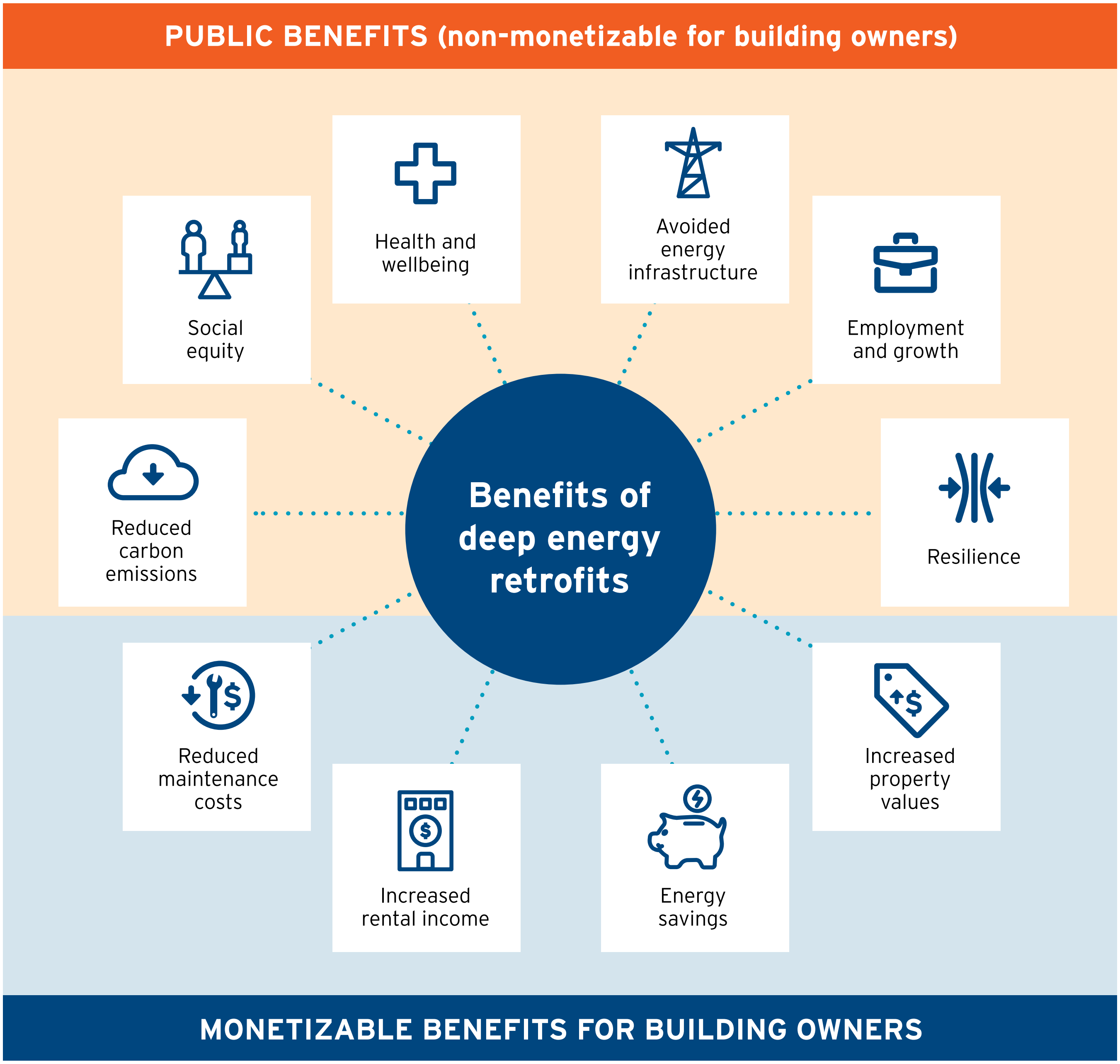
Building Awareness and Understanding of the Business Case for Deep Energy Retrofits

Actor	Recommendation	Actions
Governments and Utilities	Build industry awareness of multiple benefits of deep retrofits and support capacity building specifically around business case evaluation	• Sponsor training programs on business case evaluation • Develop or sponsor development of tools and templates • Integrate Non-Energy Benefits into promotional materials for conservation programs
Green Building Industry	Improve business case evaluation for deep energy retrofits	• Incorporate business case evaluation into professional development • Use Life Cycle Cost Analysis • Account for all relevant Non-Energy Benefits • Factor in repair/replacement costs of business as usual scenario
Property Owners and Operators	Embrace a holistic and long-term approach to building retrofit investments	• Consider all relevant costs and benefits over life of investment (LCCA) • Factor tax benefits/incentives into business case where relevant

Improving the Business Case for Deep Energy Retrofits

Actor	Recommendation	Actions
Governments and Utilities	Provide more and better financial support for deep retrofits	• Consolidate and streamline public funding programs • Provide deeper support for deeper retrofits • Mobilize capital for financing retrofits using loan guarantees or other credit enhancements • Ensure long-term, low-cost financing is available for deep retrofits
Green Building Industry	Provide clients with information on and access to available grants, incentives and financing options	• Identify and understand all available grants, incentives, and financing • Provide information to clients early enough to ensure it is factored into decision-making • Assist clients in accessing programs and completing necessary reporting
Property Owners and Operators	Integrate energy efficiency into asset management approach	• Identify and track the remaining useful life of key energy-related systems and equipment • Consider deep retrofit opportunities whenever major energy system(s) are near end of life • Start planning and design well in advance of critical system failures so there is time to consider all options

Monetizable and non-monetizable benefits of deep energy retrofits



Glossary of Key Terms

- **Business as usual:** business as usual, for the purposes of this report, is defined as not undertaking a major energy retrofit.
- **Business case:** a financial justification for a proposed project.
- **Business case evaluation:** financial analysis of the benefit, cost and risk of a project.
- **Capitalization rate:** the ratio of Net Operating Income (NOI) to property asset value.
- **Deep retrofits (or Deep Energy Retrofits):** a project involving multiple energy efficiency and/or renewable energy measures in an existing building, designed to achieve major reductions in net energy use (40 per cent or greater reductions for purposes of this report).
- **Energy benefits:** reducing dependence on fossil fuels and generating utility savings.
- **Green buildings industry:** professionals and firms providing goods and services related to improving the environmental performance of buildings, from planning to design, construction, operation, maintenance, renovation, and demolition.
- **HVAC:** heating, ventilation, and air conditioning.
- **Indoor environmental quality (IEQ):** the quality of a building's environment in relation to the health and wellbeing of those who occupy space within it. IEQ is determined by many factors, including lighting, air quality, and damp conditions.
- **Internal Rate of Return (IRR):** see page 21.
- **Low hanging fruit:** for purposes of this report, low cost energy efficiency measures that have a relatively short payback (<5 years).
- **Modified Internal Rate of Return (MIRR):** see page 23.
- **Monetary non-energy benefits:** see section "Monetary Non-Energy Benefits".
- **Multi-unit residential buildings (MURBs):** a classification of housing where multiple separate housing units for residential inhabitants are contained within one building or several buildings within one complex. For the purposes of this report MURBs are defined as apartment and condominium low-rise buildings, high-rise buildings, and rowhousing.
- **Net Present Value (NPV):** see page 19.
- **Non-energy benefits:** see page 12 / Table "DEEP ENERGY RETROFIT BENEFITS".
- **Shallow retrofits:** one or few energy efficiency measures evaluated and implemented in isolation.
- **Simple payback period (payback):** see page 18.
- **Stranded Assets:** assets (equipment, materials) that need to be replaced prior to the end of their useful life. See page 27 / section "Replacement/major repair cost savings".
- **Turnover:** the process of residents moving out of a building and being replaced by new residents.

The Case for Deep Retrofits

DEEP RETROFITS PROVIDE FINANCIAL, SOCIAL, OPERATIONAL AND ENVIRONMENTAL BENEFITS

Multi-unit residential buildings (MURBs) represent a large and growing share of the building stock in cities across Canada. Most of these aging buildings are in need of renewal. At the same time, to reduce carbon emissions in cities and reach our climate targets, the majority of these buildings require deep energy efficiency retrofits. This monumental task is also an enormous opportunity to generate multiple social, economic, and environmental benefits. Deep retrofits are an excellent approach to simultaneously:[1,2,3,4]

- Renew our affordable housing stock
- Reduce carbon emissions
- Reduce energy costs and enhance property values for owners
- Improve health and comfort for residents
- Create green jobs in the growing energy efficiency industry
- Provide green investment opportunities to lenders

We define a deep retrofit as a multi-measure energy efficiency retrofit that achieves at least 40 per cent energy savings.

Deep retrofit = ≥ 40 per cent energy savings

Shallow retrofits can miss opportunities or create stranded assets

Shallow retrofits of one or two measures forfeit the synergies that can result from a deeper retrofit targeting more than 40 per cent savings. Deep retrofits combine multiple complementary conservation measures, like building envelope upgrades, that can allow for smaller, simpler HVAC systems. Deep retrofits also provide economies of scale in design and construction costs. For example, replacing boilers and ventilation systems at the same time requires a crane on site only once.

Shallow retrofits also risk creating stranded assets. If Canada is to meet its climate change targets, it is likely that future public policies will either compel or strongly incentivize (through building energy performance standards and carbon pricing >$200/tonne) existing buildings to achieve near-zero carbon emissions by or before 2050.[i] Major building systems have long lifetimes (20-35 years), so if new ones are installed through shallow retrofits in the near future, they will likely require replacement before the end of their useful life.

[i] The final Canada's Ecosfiscal Commission report "Bridging the gap", says getting to 2030 carbon reduction targets requires carbon pricing to rise to $210 per tonne by 2030 (their recommended approach) or imposition of sector by sector regulations requiring dramatic emissions reductions. **https://ecofiscal.ca/wp-content/uploads/2019/11/Ecofiscal-Commission-Bridging-the-Gap-November-27-2019-FINAL.pdf**

An investment opportunity in the green building sector

Studies show that climate change presents serious risks to the global economy and that there is a growing demand for sustainable investments. A survey completed by the Responsible Investment Association revealed that 73 per cent of Canadian investors believe climate change will create risks for the global economy within the next five years, and 66 per cent of those polled would like a portion of their portfolio invested in companies that are providing solutions to climate change and environmental challenges.[5]

This creates an opportunity for the green building sector to leverage private investor power for sound investment opportunities promoted through effective business case framing.

Deep retrofits can mitigate climate change

Cities are major sources of greenhouse gas emissions and nearly half of urban emissions come from buildings-related energy use. Retrofits are regarded a key climate change mitigation action by the Pan-Canadian Framework on Clean Growth and Climate Change and international best practices.[6,7] But without accelerated retrofit activity, climate scientists are highly confident that extreme weather events will lead to catastrophic impacts on city residents, structures, and institutions.[8] Deep retrofits scaled up now can lead to the needed carbon reductions in the building sector to help lower the frequency and severity of extreme weather events expected to afflict cities.

Deep retrofits can build urban resiliency to extreme weather

Deep retrofits can incorporate many resiliency measures for MURBs. For example, energy efficient equipment including lights, sump pumps, heat pumps, potable water booster pumps, and elevator motors, makes it possible to add more buildings systems to emergency generators, which are also often upgraded as part of deep retrofits.[9,10] Non-mechanical solutions like thermal improvements to a building envelope can reduce heat loss or gains, helping residents maintain safe indoor temperatures during longer power outages. Replacement of heating systems with efficient heat pump systems provides high-efficiency cooling to buildings which currently lack it.

Canadian communities are experiencing uncharacteristically frequent extreme weather events (like storms, floods, and heat waves) at magnitudes that had been expected to occur only once in 25 years or more.[11,12] In the case of MURBs, extreme weather can impact resident safety, health, comfort, and mobility.[13] For example, loss of power can result in limited or no access to space heating and cooling, lighting, elevators, and water (most high-rises require booster pumps). As a result, residents are often unable to safely shelter in place during extended power outages, instead requiring alternative accommodations. According to the City of Toronto's Resilience Strategy, "the overlap of climate risks and vulnerability in Toronto's aging high-rise rental apartment towers represents the single most pressing, urgent priority for the city's resilience".[14] And Natural Resources Canada is predicting the frequency and intensity of extreme weather across the country to increase.[15] Extreme weather can be very costly to property owners and insurance companies. Intact Financial, one of Canada's largest property insurers, said it would raise premiums by as much as 20 per cent to deal with added costs of increasingly severe weather-related property damage.[16] Without stronger efforts to mitigate impacts, property owners will continue to bear the cost, and leave residents at risk.

Table 1: Deep Eneregy Retrofit Benefits

		Who Benefits...				
		Property Owner	**Residents**	**Community**	**Energy Benefit**	**Non-Energy Benefit**
Monetary Benefits						
Reduced utility bills	Typically, the greatest monetary benefit	✓	✓		✓	
Reduced maintenance costs		✓				✓
Increased rental income – reduced turnover and rental premiums		✓				✓
Increased property values		✓				✓
Reduced insurance premiums		✓				✓
Avoided capital repair/replacement costs in future years	The order and magnitude of each of these benefits will be based on property characteristics.	✓				✓
Reduced risk of critical system failures		✓				✓
Reduced exposure to risk of energy and carbon price escalation		✓	✓		✓	
Enhanced access to project finance. Larger transactions can be more appealing to lenders		✓		✓		✓
Non-Monetary Benefits						
Reduced carbon emissions *(CO_2 tonnes/year)*		✓	✓	✓	✓	✓
Enhanced indoor environmental quality (IEQ) resulting in improved health, comfort, and satisfaction for residents. *The most relevant components of IEQ for MURBs are indoor air quality and thermal comfort. Indoor air quality can be measured by tracking concentrations of air contaminants (e.g. parts per million of Volatile Organic Compounds and particulate matter), although this is rarely undertaken. Carbon dioxide concentrations can also be used as a proxy for air quality and is more cost effective to monitor. Thermal comfort is a function of indoor temperature (degrees Celsius) and relative humidity (Percentage). Performance is best tracked by monitoring the percentage of time that residences are within an acceptable thermal comfort range (as defined by ASHRAE Standard 55), or by the percentage of time above 26C (as sustained exposure to temperatures above 26C are correlated with significant increases in heat related mortality and morbidity). All dimensions of IEQ can also be tracked via resident surveys, or frequency of resident complaints. See TAF's "Improving Indoor Environmental Quality in Multi Unit Residential Buildings" report for further details*		✓	✓			✓

Table 1: Deep Eneregy Retrofit Benefits

	Who Benefits...			Energy Benefit	Non-Energy Benefit
	Property Owner	Residents	Community		
Non-Monetary Benefits					
Social Equity. MURBs house a disproportionate share of Ontario's low-income and other vulnerable groups. Deep retrofits can improve quality of life for these groups. *(Can be measured through responses from resident surveys/questionnaires to determine subjective-happiness and well-being relative to the broader community compared to best available indexes like Canadian Community Well-Being Index, or Happy Planet Index)*	✓	✓	✓		✓
Stimulate local employment, both through retrofit activity and recycling of resulting utility cost savings. *The employment impacts of retrofits can be estimated based on macroeconomic models. TAF currently uses a factor of 29 job-years created per $1 milion invested in retrofits, based on research commissioned by Natural Resources Canada.[17] Employment impacts can be maximized by working with social enterprises that provide retrofit jobs for people facing barriers to employment (e.g. TAF has worked with Building Up for this purpose[18]).*			✓		✓
Enhanced resilience to adverse impacts from energy supply disruption and/or extreme weather events. *(This can be quantified at a project level by tracking changes in the number of key systems on backup power, or at a regional level by tracking incidents of MURBs with occupancy interrupted due to critical system failures)*	✓	✓	✓		✓

OVERCOMING BARRIERS

TAF's research and experience shows broad uptake of deep retrofits is challenged by[i]:

- Poor understanding of the real business case
- Poor knowledge of financing options
- Industry practice based on single-measure retrofits
- Long investment paybacks (greater than 10 years), within an industry looking for quick payback (5 years and under)
- Project complexity and disruptions perceived as a risk to building operations
- Many of the public benefits are not monetized for building owners or investors, and require public funding

Poor understanding of the real business case

The conventional business case evaluation for deep retrofits is limited by:

- A focus on the simple payback for a project's associated cost and estimated energy savings
- Lack of good metrics such as net present value (NPV) and internal rate of return (IRR) or modified IRR (MIRR)
- The capital costs associated with business-as-usual are not factored into the analysis
- Ignoring non-energy benefits, or 'co-benefits', even monetizable ones

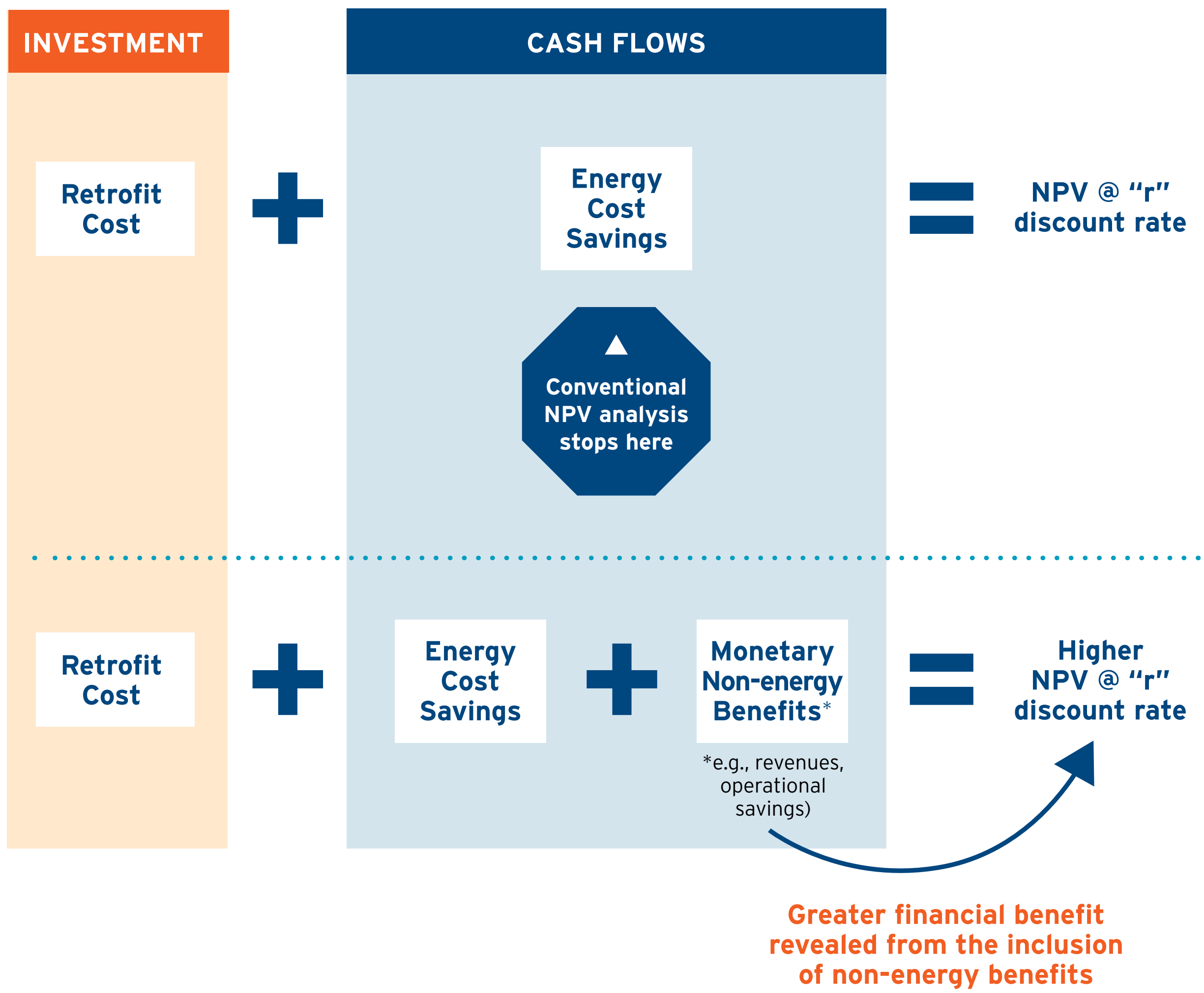
There is a common misconception that building owners can choose between paying for a retrofit or paying nothing and maintaining the status quo. In practice, business as usual is also costly. Most of the systems replaced in a deep retrofit are at or near the end of their useful life and would therefore need to be replaced in the near future anyway. Deep retrofit costs need to be compared with the cost of individually replacing building systems as they reach end-of-life. *The next chapters offer more thoughts on the business case and financing options for retrofits.*

Evaluating Non-Energy Benefits

International research examples[19,20] encourage the utilization of non-energy benefits as part of a deep retrofit business case evaluation. The following figure demonstrates how a financial analysis that factors in monetary non-energy benefits as part of the expected cash flows will reveal the higher true financial benefit of a deep retrofit.

[i] Please see Appendix A to review TAF's research and experience relevant to this topic.

Figure 1: Evaluating the true financial added value of deep retrofits



Industry practice based on single measure retrofits

Typical MURB industry practice is to evaluate the cost and benefit of single-measure retrofits, rather than a multi-measure deep retrofit.[i]

Knowing that deep retrofits are a "hard sell," most green building industry practitioners such as engineers and contractors avoid recommending major systems upgrades in favour of the "low-hanging-fruit" retrofit measures that are thought to be cheaper and faster to implement.

Furthermore, most engineers and contractors do not report the financial viability of a deep retrofit with metrics such as NPV or IRR to assess investment opportunities.

In many cases, property owners wait to implement energy efficiency measures until equipment reaches the end of their service life, or to stage implementation over time due to limited cash flow/reserves. This can result in substantial missed energy savings as well as higher costs associated with mobilizing construction for one measure at a time.

Investment payback: 10 years is not enough

Most MURB property owners do not want to implement measures with over a 10-year payback and, in the rental subsector, ideally not over five years.[ii] The reality is that the payback for deep retrofits is usually longer than 10 years, especially if the payback analysis only considers utility cost savings.[iii] Many of the deep retrofit measures that a deep retrofit would consist of have a useful life well over 15 years, with potential for substantial energy cost savings over the entire life of the system. Therefore, limiting a financial analysis to a 10-year time horizon results in excluding measures that would make a deep retrofit Net Present Value positive (see the section on Net Present Value in the following chapter). The below table shows examples of equipment that could be found as part of a deep energy retrofit and their estimated life expectancy. Please reference the sources in the report end notes as it is beyond the scope of this report to discuss the technicalities of equipment/material choices and life expectancies.

[i] While there is a compelling case for deep retrofits, shallow retrofits can play an important role in helping to move the market towards greater cumulative energy conservation. Property owners are encouraged to carefully evaluate the pros and cons of pursuing deep versus shallow retrofits. If there is not a strong business case for a deep retrofit for a particular property, owners should still pursue individual retrofit measures to avoid delaying savings opportunities.

[ii] This assessment is based on TAF stakeholder feedback in Ontario from larger rental apartment portfolio managers, smaller portfolio landlords, co-operative housing providers, and multiple condominium and co-operative housing boards.

[iii] TAF has worked with several Ontario-based consulting engineers over the past decade to deliver dozens of energy audits for MURB properties. These numerous audits (including a number audits that led to successfully implemented projects under the TAF/ECC ESPA program and through the TAF Towerwise program) have revealed that it is possible to achieve 20 to 25 per cent energy savings with a payback under 10 years. The shortlist of targeted deep retrofit opportunities TAF has analyzed with engineers are used in conjunction with the other audits that were not specifically targeting 40 per cent as a proxy to highlight that achieving 40 per cent or greater energy savings will require more aggressive capital-intensive measures. The increased capital requirements to achieve deep retrofit targets is expected to increase the payback beyond 10 years for most deep retrofit projects under current market conditions in Ontario.

Equipment Item	Life Expectancy
LED lightbulbs (50,000 hours @ 2190 hours/year)	22 years[21]
Commercial air source heat pump	15[22] to 20[23] years
Ground source heat pump system (above ground heat pump equipment)	20 years[24]
Ground source heat pump system (vertical borefield)	25 to 50 years[25]
Windows (depending on frame materials)	15 to 40 years[26]

Project complexity and disruption to building operations

Deep retrofits are complex projects involving multiple trades and vendors, with work often occurring in occupied building areas and potentially disrupting residents. The real and perceived risks of project complexity and disruption to residents can be a deterrent for building owners. Undertaking deep retrofits using an integrated design and project delivery method can reduce project complexity and minimize the project management burden for owners, while maximizing project benefits. Carefully sequencing project components minimizes disruption to building operations and residents. Integrated project delivery or design-build arrangements can simplify implementation for owners by creating a single point of contact and accountability contact for a property owner.

In this type of project delivery, property owners retain a single firm or consortium to design, construct, and commission the retrofit, including applying for any available grants and rebates. This minimizes costs and effort involved in procurement, contracting, and contract administration, while ensuring continuity and clear accountability for outcomes.

Improved Business Case Evaluation

FINANCIAL METRICS

The majority of energy audits and feasibility studies for retrofits only consider simple payback based on utility cost savings. The evaluation results do not capture the full financial perspective and benefits of retrofit measures.[27,28,29] A better evaluation and understanding of the value of deep retrofits can be achieved by improving the business case with:

- **A modified simple payback calculation**
- **More robust financial metrics**
- **The inclusion of non-energy benefits**
- **Comparing deep retrofit costs to capital repair/replacement costs of a business-as-usual scenario**

Simple Payback Period

Simple payback period (SPP) is a way to calculate the number of years required to pay back the cost of a retrofit by dividing the total capital expenditure for the retrofit by annual cost savings. Conventionally this means dividing the net retrofit cost by only the utility cost savings. Simple payback can be improved by monetizing and including non-energy benefits, as well as by factoring in any unavoidable capital costs associated with a business-as-usual scenario. The strengths of SPP is that it is easily calculated and easily understood, including by those without any expertise in financial analysis.

Simple Payback Period (conventional)

$$\text{SPP} = \frac{\text{Gross Capital Expenditure} - \text{Available Incentives/Rebates}}{\text{Annual Utility Savings (energy + water)}}$$

Simple Payback Period (including non-energy benefits)

$$\text{SPP} = \frac{\text{Gross Capital Expenditure} - \left(\dfrac{\text{Available Incentives}}{\text{Rebates}} + \dfrac{\text{Avoided Replacement}}{\text{Repair Costs}} \right)}{\text{Annual Savings (energy + water + maintenance + Insurance) + Increased Revenues (rental premium and/or reduced vacancies)}}$$

More robust financial metrics

Ideally, business case analysis for a deep retrofit should be based on some form of Life Cycle Cost Analysis (LCCA). LCCA refers to a financial analysis that monetizes all costs and benefits over the life of the project. The life of the project would be the weighted average life of the retrofit measures, or a longer period of time (e.g. the remaining expected life of the building). LCCA can be presented using various metrics, most commonly Net Present Value (NPV) and Internal Rate of Return (IRR). LCCA can be expressed in a payback period but it is not a *simple* payback period as defined above. NPV and IRR are well established and commonly used financial metrics suitable for LCCA. They are easily calculated in widely available spreadsheet software using built-in formulas. There is also a variety of specialized software available for LCCA purposes. LCCA, regardless of the metric, should include all benefits that can be monetized, not only energy cost savings. A key consideration in LCCA is the appropriate time horizon to consider. Commonly, time horizon is based on the expected life of the retrofit measures, the period of time over which the project will be financed, and/or the remaining useful life of the building itself. Some owner/operators have a standard time horizon for LCCA purposes. See Appendix E, A Business Case Evaluation Case Study, for details on how LCCA can reveal the greater financial benefits that are already present, but not usually acknowledged.

Net Present Value

Net present value (NPV) is an assessment of a project's financial viability that takes account of the time value of money. NPV calculates the cash flows – both savings and expenditure – expected over a project's time horizon and applies a discount rate to future cash flows. The discount rate represents either the minimum acceptable rate of return (also known as a hurdle rate), or the organization's borrowing cost or cost of capital. Cash flows should include the expected increase in utility costs over time and can include monetary non-energy benefits in addition to utility savings.

A project makes economic sense if the present value of savings and/or revenues over time are greater than the costs over time. A positive NPV means the investment is worthwhile, a NPV of 0 means the inflows equal the outflows, and a negative NPV means the investment will not yield a positive return (at the selected discount rate).

NPV expresses what dollar value a retrofit adds to a company, considering the initial spending and the money earned subsequently from the initial investment. More sophisticated than simple payback, NPV considers when the money is spent and when it is paid back. Unlike simple payback, it also captures the net volume of savings, which better illustrates the materiality of the project to the building operator. However, NPV on long term investments is highly sensitive to the selected discount rate and therefore choosing an appropriate discount rate is critical.

NPV

$$\text{NPV} = \text{Year 0 cash flow (initial investment)} + \frac{\text{Year 1 cash flow}}{(1+r)^1} + \frac{\text{Year 2 cash flow}}{(1+r)^2} + \frac{\text{Year } n \text{ cash flow}}{(1+r)^n}$$

Where: r = discount rate

Simplified Excel formula example

Here is an example of how to write a NPV formula in MS excel. Type the following into an empty cell when structuring your spreadsheet analysis like in the image below:

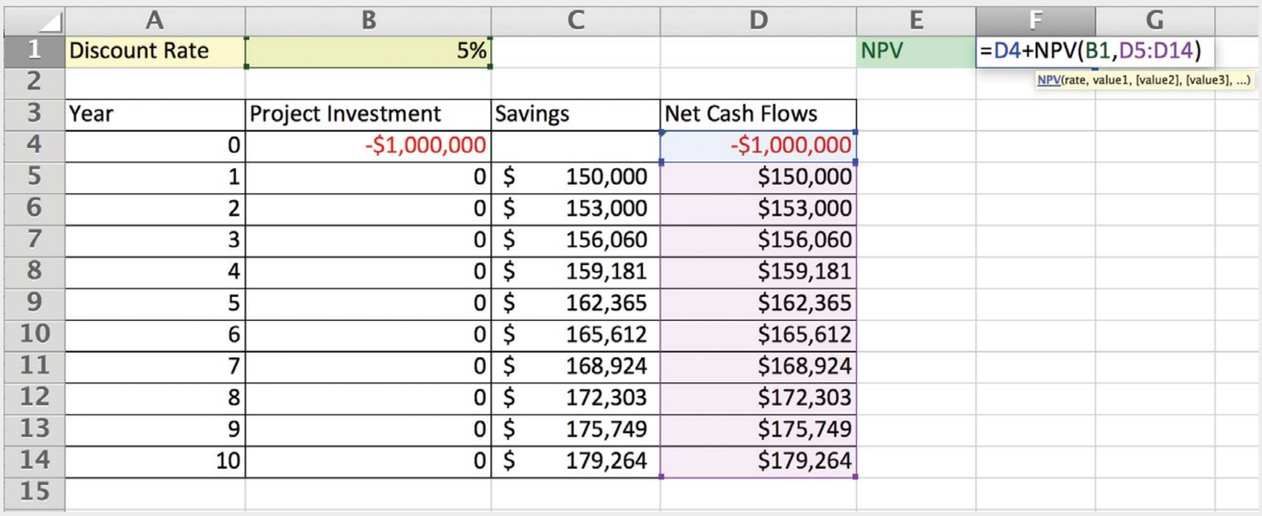
=D4+NPV(B1,D5:D14)[i]

Where:

Cell D4 = Investment output

Cell B1 = Discount rate

Cell range D5 to D14 = savings and revenue



	A	B	C	D	E	F	G
1	Discount Rate	5%			NPV	=D4+NPV(B1,D5:D14)	
2						NPV(rate, value1, [value2], [value3], ...)	
3	Year	Project Investment	Savings	Net Cash Flows			
4	0	-$1,000,000		-$1,000,000			
5	1	0	$ 150,000	$150,000			
6	2	0	$ 153,000	$153,000			
7	3	0	$ 156,060	$156,060			
8	4	0	$ 159,181	$159,181			
9	5	0	$ 162,365	$162,365			
10	6	0	$ 165,612	$165,612			
11	7	0	$ 168,924	$168,924			
12	8	0	$ 172,303	$172,303			
13	9	0	$ 175,749	$175,749			
14	10	0	$ 179,264	$179,264			
15							

Excel XNPV function

If a project has costs and savings/revenues that are not evenly distributed through the year and monthly or calendared cash flows are available, an XNPV function can be used to obtain a more accurate result.

[i] ***Important information on calculating NPV in MS Excel***

Here are just a few online resources explaining why NPV is calculated this way in MS Excel

https://propertymetrics.com/blog/how-not-to-use-npv-in-excel/
https://exceljet.net/excel-functions/excel-npv-function

Internal rate of return

Internal rate of return (IRR) is the expected compound annual rate of return that will be earned on a project or investment. It's 'internal' because it ignores external factors like inflation.

IRR is related to NPV in that IRR is equal to the discount rate that will bring the project NPV to zero. And, similar to NPV, the higher a project's IRR, the more desirable it is to undertake. One strength of IRR is that because it is expressed as a percentage it illustrates financial returns relative to the size of the investment.

Conversely, its primary disadvantage is that it does not take into account the magnitude of the financial return in dollar values. A project with a lower IRR may be preferable to a project with a higher IRR if the net value of financial return involved is higher. For example, an investment of $1 million with an IRR of 10 per cent is generally preferable to an investment of $100 with a 15 per cent IRR.

IRR

$$\mathbf{IRR} = r_a + \frac{NPV_a}{NPV_a - NPV_b}(r_b - r_a)$$

Where:

r_a = lower discount rate

r_b = higher discount rate

NPV_a = NPV at lower rate

NPV_b = NPV at higher rate

Simplified Excel formula example

Here is an example of how to write an IRR formula in MS Excel. Type the following into an empty cell when structuring your spreadsheet analysis like in the image below:

=IRR(D4:D14)

Where:

Cell range D4 to D14 = cash flows net of investment outputs and savings/revenue

	A	B	C	D	E	F
1					IRR	=IRR(D4:D14)
2						IRR(values, [guess])
3	Year	Project Investment	Savings	Net Cash Flows		
4	0	-$1,000,000		-$1,000,000		
5	1	0	$ 150,000	$150,000		
6	2	0	$ 153,000	$153,000		
7	3	0	$ 156,060	$156,060		
8	4	0	$ 159,181	$159,181		
9	5	0	$ 162,365	$162,365		
10	6	0	$ 165,612	$165,612		
11	7	0	$ 168,924	$168,924		
12	8	0	$ 172,303	$172,303		
13	9	0	$ 175,749	$175,749		
14	10	0	$ 179,264	$179,264		
15						

Excel XIRR function

The XIRR function is preferable to the IRR function where mothly or calendared cashflows can be estimated.

Modified IRR

MIRR is a modification of IRR. IRR assumes that cash flow from a project is re-invested in another project that has the same rate of return, which is not always possible. Usually, that cash is re-invested at a more modest rate. MIRR assumes that positive cash flows are reinvested at the firm's cost of capital and that the initial outlays are financed at the firm's financing cost.

Simplified Excel formula example

Here is an example of how to write an IRR formula in excel. Type the following into an empty cell when structuring your spreadsheet analysis like in the image below:

=MIRR(D4:D14,B1,B1)

Where:

Cell range D4 to D14 = cash flows net of investment outputs and savings/revenue

B1 = cost of capital to reinvest

	A	B	C	D	E	F	G
1	Cost of capital (required rate of return)	12%			MIRR	=MIRR(D4:D14,B1,B1)	
2						MIRR(values, finance_rate, reinvest_rate)	
3	Year	Project Investment	Savings	Net Cash Flows			
4	0	-$1,000,000		-$1,000,000			
5	1	0	$ 150,000	$150,000			
6	2	0	$ 153,000	$153,000			
7	3	0	$ 156,060	$156,060			
8	4	0	$ 159,181	$159,181			
9	5	0	$ 162,365	$162,365			
10	6	0	$ 165,612	$165,612			
11	7	0	$ 168,924	$168,924			
12	8	0	$ 172,303	$172,303			
13	9	0	$ 175,749	$175,749			
14	10	0	$ 179,264	$179,264			

Excel XIRR function

The XIRR function is preferable to the IRR function where mothly or calendared cashflows can be estimated.

MONETARY NON-ENERGY BENEFITS

Rental income increase

Other things being equal, buildings with enhanced indoor environmental quality (IEQ) such as cooling, thermal comfort, and improved air quality command higher rents in the marketplace. However, increasing rents may conflict with other public policy priorities around housing affordability, particularly in lower-income areas. For this reason, some public retrofit funding programs (e.g. CMHC's Co-Investment Fund, Toronto's Hi-RIS program) include contractual terms limiting rental increases. Retrofits can also increase rental income without raising rents, by reducing turnover and vacancy, which reduces foregone rental income and turnover related costs like cleaning, painting, and new tenant intake. The impact of a retrofit on rental income will depend on a variety of factors including the baseline conditions in the building like IEQ, vacancy rate, etc., and the nature of the retrofit measures (such as how much the residents can see and feel the measures).

Suggested default value: 2 per cent

Example values identified through research (Not adjusted for inflation and no currency conversion from source):

Table 2: Estimated Rental Income Increases

Estimated Increase in Rental Income	Notes
4.8%	Buildings that underwent retrofits had 4.8% higher rental income, contributing to an overall average increase in net operating income of 1.6% for efficient buildings[30]. Mainly attributed to reduced vacancies.
$0.34 (USD)/ft^2	Rental income increased by $0.34 (USD)/ft^2 six months to a year after a retrofit.[31]
$1.87 (USD)/ft^2	Rental income increased by $1.87 (USD)/ft^2.[32]
$400 (USD) per unit/year	Rental incomes increased by almost $400 (USD) per unit annually in the year after energy efficiency upgrades. No indication from source as to the baseline rent or appreciation of the asset prior to the observed increase.[33]

How to estimate impact on rental income:

- **Review baseline conditions:** Compare rents and vacancy rates against local market average to determine relative potential for improvement. Buildings with lower than average rent or higher than average vacancy rates will have greater potential for rental income increase in a retrofit. Consider if buildings without cooling will have it added as part of a deep retrofit.
- **Resident/Staff Surveys:** Survey residents and staff to ascertain possible reasons for suite vacancy and turnover. While many factors influence a tenant's decision to move, it may be possible to identify if the reason is linked to energy systems (e.g. concerns with thermal comfort, odours, or air quality).
- **Estimate impact:** Based on baseline conditions and/or surveys, determine if the building has high (3 per cent), medium (2 per cent), or low (1 per cent) potential for enhancing rental income through a deep retrofit. Incorporate the corresponding increase in rental income into Life Cycle Cost Analysis.

Maintenance cost savings

- Installing longer life systems, such as LED lighting, can reduce replacement efforts, particularly for existing systems that are close to the end of their service life and tend to require more maintenance.
- Reduced staff time responding to resident complaints.
- Reduced need for repairs (for example, less humidity/mold damage around window frames).
- Reduced inspection frequency.
- Intelligent controls automate operation and provide real-time alerts reducing equipment/system inspection frequency.

Note: Maintenance costs may increase with some implemented measures. For example, replacement of electric resistance baseboards that have virtually no maintenance or repair costs with an energy efficient heat pump requiring filter cleaning, refrigerant level checks, etc., may increase maintenance costs.

A comprehensive analysis of a multi-measure retrofit business case can reveal if net maintenance savings will be achieved.

Suggested default value: 3 per cent

Example values identified through research (Not adjusted for inflation):

Table 3: Anticipated Maintenance Cost Savings

Anticipated Maintenance Cost Savings	Notes
3%	Savings equivalent to 3-150%[i] of expected annual utility bill savings.[34,35]
17%	17% decrease in annual maintenance costs.[36]
3%	Equipment maintenance: 3% of the value of energy saved.
28%	Lighting maintenance: 28% of the amount of energy saved.[37]
Varied – context specific	This review of multiple case studies revealed a broad range of potential maintenance savings contingent on type and scope of measures implemented.[38] Maintenance and repair expenses for multifamily building owners come primarily from addressing equipment, lighting, and building durability issues. Energy efficiency improvements that decrease maintenance costs typically relate to aging HVAC equipment and lighting maintenance.[ii]

How to quantify:

As part of an energy audit or feasibility study for a deep retrofit, qualified service providers should conduct a measure by measure analysis of any expected increase or decrease in maintenance costs.[39,40] Building operators should specify this as part of the scope of service, and can further assist by providing any historical records of maintenance costs that are available.

[i] There is a wide range because reductions in lighting, appliance, and equipment maintenance costs depend on the scope of a retrofit, pre-retrofit maintenance practices and condition of building elements.

[ii] For example, replacing an HVAC system that was beyond its useful life before a significant or catastrophic failure occurred can help to avoid last-minute repair calls and/or emergency equipment replacements that can be very costly temporary fixes. Or, lighting maintenance for single fixtures would be a relatively small cost compared to a building wide retrofit. However, cumulative lighting repairs over time can become costly. The cost savings depend in part on the number fixtures and the frequency of needed maintenance.

Property value increase

Deep energy retrofits generate an increase in net operating income (NOI) as a result of utility cost savings, maintenance cost savings, and enhanced rental income. Other things being equal, higher NOI results in higher building valuation. Greater property values can be a direct financial benefit if owners intend to sell the building. Increasing asset values can also have multiple indirect benefits for building owners depending on how their business is structured.

Suggested default value: Use formula **Property Value Increase = Post-Retrofit Net Operating Income ÷ Capitalization Rate**. See section below "How to quantify" and Appendix B for more details.

Example values identified through research (Not adjusted for inflation and no currency conversion from source):

Table 4: Expected Property Value Increases

Expected Property Value Increase	Notes
$3.13 (USD)/ft^2	Energy retrofits yield energy savings of 10%/ft^2 equating in this example to $3.13 (USD)/ft^2 in incremental property value, using the income capitalization approach to value.[41]
10%	Energy efficiency improvements yield 10% increase in property value.[42]
$15.20 (USD)/ft^2	An increase of at least $15.20 (USD)/ft^2 in the property's value – a 42.5% increase. Every dollar invested yielded $2.14 (USD) in increased property value.[43]
4%	Retrofits contribute to increased building values, with a median increased value of 4% (for business/commercial sites).[44]
5%-14%	Increase in condominium unit values of 5%-14% for LEED certification.[45]

The rental sector can perform typical asset value calculations and compare pre- and post-retrofit values to estimate the expected property value increase (please see example calculations in the section below and Appendix B). Condos may be able to do a comparative analysis against buildings that have similar features but better energy performance.

How to quantify:

A simple method to calculate the property value increase from doing a deep retrofit would be as follows:

Property Value (PV) Increase

$$\textbf{Increase in PV} = \frac{\text{(utility savings + Monetizable non-energy benefits)}}{\text{cap rate}^{\text{i}}}$$

An alternative detailed method of estimating and comparing pre-retrofit and post-retrofit property values is available in Appendix B.

[i] Capitalization rates for the Canadian apartment sector can be found at CBRE. 2020. Q1 2020 CANADIAN CAP RATES & INVESTMENT INSIGHTS. A quarterly snapshot of Canadian commercial real estate cap rates and investment trends. https://www.cbre.ca/en/research-and-reports/Canada-Cap-Rates--Investment-Insights-Q1-20200

Insurance premium cost savings

The insurance industry is beginning to provide lower premium costs for specific energy efficiency measures that lower operational risk and increase resilience to climate impacts. Deep retrofits can incorporate a number of resiliency measures that lower the potential for insurable losses for the property leading to insurance companies offering reductions in premiums.[46] Examples include reduced risk from ice build-up and water damage (due to more efficient windows), from increased snowfall (due to strengthened roofs), and from water damage (due to waterproofing basements).[47] Additionally, energy efficient equipment (e.g. lights, pumps, and motors) makes it possible to add more buildings systems to emergency generators, which are also often upgraded as part of deep retrofits.[48,49]

Suggested default value: 5 per cent

Example values identified through research (Not adjusted for inflation):

Table 5: Expected Insurance Premium Savings

Expected Insurance Premium Savings	Notes
5%	5% discount on property and casualty insurance.[50]
24%	24% drop in insurance premiums.[51]

Replacement/major repair cost savings

Planned major replacements (like roof, window, siding, HVAC, and lighting) provide opportunities to make improvement choices that can significantly increase efficiency at a small incremental cost above the like-for-like replacement option. Leveraging the planned capital budget activities for implementing a deep retrofit can lead to reduced energy costs and create economies of scale from implementing measures at the same time. Green building professionals should factor the avoided equipment replacement costs from business-as-usual scenarios into their retrofit business case analysis for owners by comparing deep retrofit incremental costs to already planned capital improvements (see illustrative example below).

Table 6: Considering the higher efficiency retrofit option in terms of incremental costs and savings over planned replacement costs

Retrofit Project	Replace existing heating system							
Existing Equipment	Old, low-efficiency natural gas boiler (65% efficiency)							
	Retrofit Option Type	Retrofit Measure Description	Net Cost After Rebates	Energy Savings	Simple Payback	Incremental Cost Difference Compared to Option 1	Incremental Savings Compared to Option 1	Payback on incremental costs from incremental savings
	Option 1: business as usual	Standard efficiency boiler (85% efficient)	$175,000	$9,200	19 years			
Recommended Option	Option 2: higher efficiency option	Gas absorption heat pump (115% efficiency)	$246,000	$22,900	11 years	$71,000	$13,700	5 years

Deep retrofits will always be a capital-intensive undertaking but so too are planned conventional capital improvements. Showing the price of energy efficient options as an incremental cost above what the property owner already planned to spend on capital improvements can reveal an attractive business case given the value from energy and non-energy benefits.

How to quantify incremental costs:

Comparing incremental costs would be straightforward for engineers to include as part of an engineer's investment grade energy audit. Property owners may question the need for a detailed energy audit when they may already possess reserve fund studies (RFS) or building condition assessment reports (BCA). RFS and BCA reports are high-level assessments that only provide a preliminary understanding of both the remaining life and replacement cost of building elements; they lack necessary investigative elements to inform an investment decision about a deep energy retrofit. An engineer's audit provides a deeper understanding of what is in the building, what needs to be replaced, and what is needed to make a higher efficiency option technically feasible. An engineer's audit also provides a comparison of costs against utility savings to assist with comparing retrofit opportunities, which a BCA and RFS will not do. An engineer's audit analysis can also include the cumulative blended benefits of implementing multiple energy conservation measures, where as a BCA and RFS hold measure costs in isolation.

An incremental cost comparison can be included as part of a business case analysis whether you are using payback, NPV or IRR. For incremental cost payback analysis, divide incremental cost by incremental savings (instead of total cost by total savings). In NPV or IRR, add the avoided equipment replacement costs as savings in the appropriate years.

TAX INCENTIVES FOR THE RENTAL SECTOR FROM ENERGY EFFICIENCY UPGRADES

Canadian apartment building owners can factor in tax incentives, such as Accelerated Capital Cost Allowances, into financial analysis for energy efficiency retrofits. Building owners are permitted to write off capital expenses against their taxable income. However, capital investments have to be written down gradually, over the expected life of the capital improvement/replacement. How much of the capital investment can be claimed in each year is based on the Capital Cost Allowance for that type of asset as defined by Revenue Canada. Writing down capital expenses allows landlords to lower their taxable income, and therefore reduce their tax burden.

To incentivize capital investments, both the Government of Canada and the Province of Ontario offer Accelerated Capital Cost Allowances (ACCA) for qualifying investments. Under class 43.2, introduced in 2005, certain renewable energy systems qualify for ACCA, including solar thermal, solar photovoltaics, and ground source heat pump systems. These investments qualify for 50 per cent annual depreciation (instead of 4 per cent), with certain technologies installed after February 22, 2005.[52] In the Fall of 2018, the Government of Canada announced the temporary Accelerated Investment Incentive that enhanced ACCA for eligible technologies under class 43.2, allowing 100 per cent of the value to be written off in Year 1.[53] Additionally, the first-year Capital Cost Allowance for all other capital investments was essentially tripled. The Accelerated Investment Incentive, subsequently matched by the Province of Ontario, begins being phased out in 2023.[54]

The below table shows the difference in IRR, ROI, and NPV considering the impact of the current tax incentives for a sample project. More details on this example in Appendix D.

Table 7: Difference in IRR, ROI and NPV considering the impact of tax incentives for a sample project

Difference in business case when eligible technologies under class 43.2[i] receive enhanced accelerated depreciation for the retrofit asset = 100% of the value written off in Year 1	
Example project: Geothermal retrofit	See Appendix D
Net Present Value (NPV)	+1.1%
Internal Rate of Return (IRR)	+7.9%
Return on Investment (ROI)	+10.2%

Determining Income Tax Rates for Apartment Owners

Calculating the gross income tax is essential to determining what net benefits are achieved from applying capital cost allowance from a retrofit. Calculating a landlord's gross income tax is contingent on their applicable income tax rate. The effective marginal tax rates for apartment owners can range from 15 per cent to 50 per cent, see Appendix C for details.

[i] More on the enhanced CCA Class 43.2 in Schedule II of the Income Tax Act regulations here: **https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/2019%20Tax-Incentives-Businesses__EN_v2.pdf**

Barriers to Financing Deep Retrofits

Building owners can face the following financing hurdles:

- **First Cost:** How to finance the initial capital investment in energy efficiency measures at little or no up-front cost.
- **Timing mismatch:** The mismatch between the long lifespan of energy efficiency improvements and the sometimes-shorter expected ownership of the property.
- **Existing property or financing restrictions (existing liens/ability to take on additional debt):** How to undertake retrofits when there are restrictions under existing mortgages on mortgaged property and existing debt financing to property owners. These restrictions can affect the ability to take on additional debt.
- **Lack of confidence in performance:** Lack of confidence that the investment will achieve energy efficiency targets, failing to provide the expected returns on investment. Lack of knowledge surrounding the performance of technologies or retrofit solutions, as well as lack proper design and deployment.

Financing Solutions for MURB Deep Retrofits

There are several viable financing solutions available for deep retrofits of MURBs already in action that can be offered by and/or with support from governments and utilities. Multiple financing options warrant consideration and there is no single ‘best’ approach to financing.

Table 8: Comparison of Financing Solutions for MURB Deep Retrofits

Financing Option	Hurdle the option helps to overcome			
	[First cost] Provides sufficient up-front funding to cover initial capital costs	**[Timing mismatch]** Flexible to deal with short ownership timeframes and can be transferred to new building owners	**[Existing restrictions]** Can work alongside existing property/ financing restrictions	**[Lack of confidence]** Provides some level of protection against under-performance risks
Secured Loan	Established option	Possible but with challenges	Possible, good option	Possible but with challenges
Local improvement charges	Established option	Established option	Possible, good option	
Utility On-Bill Financing	Established option	Possible but with challenges	Established option	
Third Party Ownership Model	Established option	Established option	Established option	Possible, good option
Energy Service Agreements	Established option	Possible, good option	Established option	Established option

Legend

- Established option
- Possible, good option
- Possible but with challenges

EXAMINATION OF FINANCING OPTIONS

Secured Loan

A secured loan is a conventional loan provided by a traditional bank or institutional lender. The borrower pledges some asset (e.g. property) as collateral for the loan, which then becomes a secured debt owed to the creditor. In many instances, building owners will take on debt to finance upgrades to a building, securing the loan against the value of the building. Repayments are not tied to energy efficiency savings and are subject to market interest rates.

Capital requirements
The amount provided through the loan can cover up to the full cost associated with the retrofits.

Advantages
These loans are broadly available from most major banks and financial institutions.

Disadvantages
Existing mortgages on the property may limit a building owner's ability to borrow money. Building owners who are highly leveraged, or with low credit, may be forced to pay higher costs to access this type of financing. And if an owner can qualify for long-term amortization on a secured loan (e.g. 20+ years), the term will be much shorter (e.g. five years), and the downside is interest rates could spike when refinancing after the term is up.

Local Improvement Charges

Municipalities can finance energy retrofits through local improvement charges (LICs), with repayment through the property tax bill.[55] Currently, the City of Toronto is the only municipality in Ontario actively financing retrofits through LICs, although a number of other cities have programs under development. Through the High-Rise Retrofit Improvement Support program, the city offers rental apartment owners financing terms of up to 20 years for energy retrofits, with the interest rate locked in for the full term.

Capital requirements
Upfront funding is provided by a municipal government (or authorized partner) to pay for the initial retrofit/energy efficiency costs.

Advantages
Local Improvement charges are tied to the property and not the individual. As a result, at time of sale owners have the option of passing along the LIC to the new owner, or paying it off prior to sale. This improves the attractiveness of deeper retrofits for building owners who are considering selling the building within the term of the financing.[56] This is in stark contrast to most other forms of financing, where repayment responsibility remains with the borrower.

Disadvantages
Only available in select municipalities (currently). Under the City of Toronto program, landlords must agree not to apply for above guideline increases in rent for any expenses associated with the retrofit project. Approval processes may be slightly more complex than other options and may require consent of existing mortgage lenders.

Examples

Electrical Grid and Landline LICs in Yukon. City of Toronto **Home Energy Loan Program** & **High-Rise Retrofit Improvement Support Program**. National Australia Bank, Low Carbon Australia, and Eureka Funds Management provide PACE funding through an initiative called the Australian Environmental Upgrade Fund.

Utility On-Bill Financing

Utility On-Bill Financing is structured to provide the upfront capital to cover the retrofit costs. Over time, the utility company recovers these costs through an additional charge on the building owner's utility bill. Under most on-bill financing programs, the additional charge added to the energy bill is less than the savings achieved through the retrofits conducted. This ensures that customers won't be paying higher utility bills after the retrofits are implemented.[57]

Capital requirements

The utility company provides the upfront capital to cover the costs of the retrofit and/or energy system, including design, equipment, and installation (labour, insurance, permits).

Building owners or tenants are required to pay an additional fee on their utility bill to pay back the utility.

Advantages

This model is relatively easy to set up given that utility companies have an existing billing relationship with their customers. As the repayment mechanism is an additional charge on the energy bill, there are no additional invoices for the customer. Utility companies generally have the existing legal, financial and project management support to implement capital projects. Utilities can provide a tailored multi-measure retrofit financing solution that can be administered simply as independent on-bill charges. On-Bill Financing is not considered debt for customers in many instances, making it an enticing and easy to adopt option for MURB property owners.

Disadvantages

Few Ontario utilities currently offer on bill financing. In some instances, utility companies are reluctant to take on the role of providing loans or adding additional layers of administration for collecting payments.[58] There would be costly IT requirements for reconfiguring utility billing systems to customize and add new billing items. Most utilities do not have the amount of capital required to support a large-scale program.[59] There are financial and administrative limitations on what energy retrofits can be financed by the model. Some higher cost retrofit measures, such as large-scale HVAC retrofits, might be difficult to finance via on-bill repayment due to long paybacks and the need to associate repayment with a customer versus a building.

Another disadvantage is that capturing and conveying information to customers can be restrained further increasing customer service costs by having to address customer questions and complaints regarding lack of on-bill transparency or misunderstandings. The Ontario Energy Board sets information requirements for customer bills, under O. Reg. 275/04, which limits the amount of available text/formatting space for adding additional line items.[60]

Examples

The How$mart program by Midwest Energy in Kansas provides homeowners with the upfront capital investments required to make energy efficiency upgrades. The program covers a variety of retrofit initiatives including insulation, sealing, and heating and cooling systems. The only requirement of the program is that estimated savings must be greater than the monthly surcharge that the utility charges to recuperate its initial investment.[61] Manitoba Hydro Pay as you Save Program.

Third Party Ownership Model

A Third Party Ownership Model is similar to a Utility On-Bill Financing model in that they are both structured to provide the upfront capital to cover the retrofit costs on par or at a lower fee than baseline energy costs. With this model the third party provider pays for project development, construction, operation and maintenance costs and customers are billed in the form of an "access fee" for the right to access the benefits of the newly installed energy measure.[62] In most instances, this type of financing model is used for high capital renewable energy projects, such as solar or geoexchange.

Capital requirements

The third party company requires the upfront capital to cover the costs of retrofit project implementation and long-term operation.

Building owners pay an ongoing access fee to benefit from the energy installation (as is the case with solar PV and geothermal).

Advantages

This model is relatively easy to set up as it is often a turnkey service treated like a relationship with a utility company. Hypothetically a third party company can leverage the financial merits of the model by combining access to multiple systems (e.g. large scale geothermal and solar PV or solar thermal) onto one bill. Third party ownership also provides the opportunity to combine with other services such as suite metering. It is a proven system, simple to implement, has high reliability of outcomes, and low risk of failure. And it provides a long-term ownership model (e.g. 30-year contract), which helps property owners avoid the limitations of short-term loans. Third party ownership of certain infrastructure can end up benefiting multiple surrounding properties as well through phased expansion, like with a geoexchange or district energy system, that can even lead to access fees coming down overtime given increased efficiencies and economies of scale from a larger pool of participants.

Disadvantages

Third party service providers are responsible for the performance of the equipment they install, but not building maintenance. This can create technical and financial risks when existing building elements need to integrate with new ones. For example, an existing HVAC distribution system in poor repair would directly affect the performance of new third party owned equipment.

Another disadvantage of the Third Party Ownership Model is that service providers risk stranded non-recoverable assets. If a customer has credit problems, it is difficult or impossible for the third party provider to recoup expenses from installed equipment. In the case of geothermal or district energy technology, it is buried deep underground.

In addition, if the Third Party Ownership Model proved to be lucrative and lacked sufficient consumer protections, an influx of competing market entrants might offer low rates, and an influx of low quality projects could follow. New players in the market and newer, cutting edge technologies may not have a long track record to back up promises of decades-long performance. Further risk is added if subcontractors are involved that may take no responsibility for performance results.

Examples

Diverso Energy[63] and Subterra Renewables[64] are successful Toronto companies delivering turnkey third party ownership services. Fortis BC has implemented two major geoexchange projects using the third party ownership model: The Pomaria, a 30 storey condo tower located in Vancouver and Waterstone Pier, a MURB development in Richmond. Corix Utilities owns and operates ground loops as a utility, charging homeowners an "access fee" in addition to their regular utility bill. One of their key projects was developed in Sun Rivers, Kelowna. Sandpiper Energy Solutions has successfully implemented several geoexchange projects under this type of model throughout Ontario, including Ottawa, Burlington, Oakville, and Toronto in a variety of residential and commercial buildings.[65] The Town of Gibsons has a geoexchange energy utility in British Columbia serving 58 homes with plans for expansion to other properties in the community.[66]

Energy Service Agreements

Energy Service Agreements (ESA) are a pay-for-performance, off-balance-sheet financing solution that allows customers to implement energy and water efficiency projects with no upfront capital expenditure.[67] The provider pays for project development, construction, and maintenance costs. Once a project is operational, the customer makes service payments that are based on actual energy savings or other equipment performance metrics, resulting in immediate reduced operating expenses. The ESA is the most common type of arrangement, but other models are also in use, such as the Energy Savings Performance Agreement (ESPA).[68,69]

Capital requirements
Upfront capital for efficiency projects is provided by a third-party private financing party.

Advantages
Since this type of finance agreements are provided as a service, it may be considered non-debt financing (also known as "off balance sheet"), which may be attractive for some owners.[70] Typically, it comes bundled with project delivery support from the project developer, creating a turn-key project delivery system.

Disadvantages
This type of arrangement typically has high transaction costs compared to other financing approaches, as the financing party needs to be comfortable and/or insured against performance risks, and undertake a much greater degree of due diligence. Therefore, this type of financing is typically suited for larger projects. Financing terms are also often limited to 10 years, which may present difficulties in financing projects with longer simple payback periods longer than that.[71]

Examples

The Atmospheric Fund and Efficiency Capital Corporation[72]'s Energy Savings Performance Agreement (ESPA).[73]

Metrus Energy has worked in 19 states across the US providing financing for 34 million sq.ft. To date, the company has abated over 870,000 tonnes of carbon through its energy service agreements, saving a total of 1.1 billion kWh. Metrus Energy provides energy service agreements for energy and water efficiency upgrades.

Not all financing options apply to all MURB types, as the table below outlines.

Table 9: Financing options and their applicability to different MURB types

Financing Option	Market		
	Multi-residential Condo	**Multi-residential Rental**	**Multi-residential Social Housing**
Secured Loan	Well established option	Well established option	Well established option
Local Improvement Charges	Possible but with challenges	Established	Unproven
Utility On-Bill Financing/Repayment	Established	Established	Possible
Third Party Ownership Model	Possible	Possible	Possible
Energy Service Agreements	Established	Established	Well established option

Legend

- Well established option
- Established
- Possible
- Possible but with challenges
- Unproven

Stacking Financing Options

It is possible to combine, or "stack," different financing solutions to finance a deep retrofit. This can be the case when one single financing solution is not enough or appropriate to deliver a project. In practice there is no single universal solution. And so, achieving scale and meeting deep energy retrofit targets will sometimes require leveraging different financing vehicles to deliver a single project. A wide range of scenarios could be arranged, with likely combinations being low to medium-high cost measures financed with secured loan ESAs, or utility on-bill financing, and very high cost measures paid with third party ownership or local improvement charges.

Example

A tailored combination of financing vehicles is utilized to deliver multiple energy conservation measures as part of a single deep retrofit project targeting 40 per cent or greater total volume savings. The retrofit project involves converting geothermal heating and cooling, as well as a range of lower cost measures like lighting, water efficiency, etc. Lower cost measures are financed through a secured loan, with savings more than enough to offset loan repayments. The geothermal retrofit is undertaken through a third party ownership model, with a geo-utilty owning and operating the system and charging an annual access fee equivalent to baseline heating and cooling costs. In this scenario the building ends up cash flow positive from day one.

Recommendations

Scaling up MURB deep retrofits will require coordinated action across three target groups: governments and utilities, green building industry professionals, and property owners/operators. TAF makes the following recommendations for those groups, ranked based on potential to influence scale up.

These recommendations aim to mitigate risk for investors, streamline the financing application process, offer low-cost financing options with customized flexibility for owners, and provide more robust financial analysis on retrofit opportunities. While these recommendations are of particular importance for deep multi-measure projects, many are applicable for all energy efficiency projects, single and multi-measure.

Building Awareness and Understanding of the Business Case for Deep Energy Retrofits

Actor	Recommendation	Actions
Governments and Utilities	Build industry awareness of multiple benefits of deep retrofits and support capacity building specifically around business case evaluation	• Sponsor training programs on business case evaluation • Develop or sponsor tools and templates • Integrate Non-Energy Benefits into promotional materials for conservation programs
Green Building Industry	Improve business case evaluation for deep energy retrofits	• Incorporate business case evaluation into professional development • Use Life Cycle Cost Analysis • Account for all relevant Non-Energy Benefits • Factor in repair/replacement costs of business as usual scenario
Property Owners and Operators	Embrace a holistic and long-term approach to building retrofit investments	• Consider all relevant costs and benefits over life of investment (LCCA) • Factor tax benefits/incentives into business case where relevant

Improving the Business Case for Deep Energy Retrofits

Actor	Recommendation	Actions
Governments and Utilities	Provide more and better financial support for deep retrofits	• Consolidate and streamline public funding programs • Provide deeper support for deeper retrofits • Mobilize capital for financing retrofits using loan guarantees or other credit enhancements • Ensure long-term, low-cost financing is available for deep retrofits
Green Building Industry	Provide clients with information on and access to available grants, incentives and financing options	• Identify and understand all available grants, incentives, and financing • Provide info to clients early enough to ensure its factored into decision making • Assist clients in accessing programs, and completing necessary reporting
Property Owners and Operators	Integrate energy efficiency into asset management approach	• Identify and track the remaining useful life of key energy-related systems and equipment • Consider deep retrofit opportunities whenever major energy system(s) are near end of life • Start planning and design well in advance of critical system failures so there is time to consider all options

Appendix A

HOW THIS REPORT WAS CREATED

TAF leveraged its investing experience to develop financing option recommendations

TAF has a comprehensive and practical understanding of the MURB retrofit opportunity in Ontario. A combination of robust market research and financing due diligence helped TAF develop the recommendations in this report. TAF also has experience with developing innovative financial solutions and financial delivery vehicles, having incubated its proprietary **Energy Savings Performance Agreement** (ESPA™)

TAF's previous research on best practice financing solutions for retrofits includes:

- **TAF Guide Energy Efficiency Financing Tools (2017)**
- **Innovative, High-Impact Energy Efficiency Retrofit Financing Opportunities In The Canadian Commercial Building Sector (2014)**

TAF leveraged its experience reviewing retrofit opportunities and delivering projects to develop business case metrics and evaluation recommendations

This report's recommendations are based on lessons learned from evaluating numerous MURB retrofit opportunities. TAF has a proven track record delivering high performance projects that meet or exceed the preliminary analysis proposed to property owners. From these experiences TAF has identified the opportunities and constraints of conventional business case analysis. Partnering with property owners on living-lab projects through our TowerWise program to better understand the business case for MURB retrofits has helped TAF reveal better ways to capture a deep retrofit's true benefits. TAF's experience and understanding of the deep retrofit business case is shown in:

- **The Towerwise program backgrounder (2019)**
- **Retrofitting R.J. Smith Apartments: a TowerWise Case Study (2019)**
- **Retrofitting Arleta Manor: a TowerWise Case Study (2019)**
- **Retrofitting Trethewey Tedder Apartments: A TowerWise Case Study (2019)**
- **Robert Cooke case study (2018)**
- **Retrofit Case Studies (2017)**

Stakeholders were engaged to vet the content

The report was put through a robust stakeholder review process. TAF received feedback from various stakeholders, including large rental apartment portfolio managers, public housing owner/operators, condo managers, smaller MURB landlords, utilities, government agencies, green building professionals, HVAC manufacturers, and trade associations.

Additional Research

TAF reviewed literature on business case evaluation and financing for deep energy retrofits. TAF also leveraged some of its other research including:

- **Pumping Energy Savings Recommendations Report (2018)**
- **Money on the table: Why investors miss out on the energy efficiency market (2017)**

Appendix B

ESTIMATING INCREASED PROPERTY VALUE – RENTAL SECTOR

Retrofits can increase the value of MURBs by lowering costs and increasing income. Improved comfort and lower utility bills can reduce vacancy and turnover, increasing rental income. In addition, newly installed and more efficient building systems can help to reduce overall maintenance and operating costs, as shown below.

Existing property value = pre-retrofit net operating income / capitalization rate

Pre-Retrofit Net Operating Income Formula

	Potential rental income
–	Vacancy and credit losses
	Effective rental income
+	Other income
	Gross operating income
–	Operating expenses
	= Pre-retrofit net operating income

Post-retrofit property value = post-retrofit net operating income / capitalization rate

Post-Retrofit Net Operating Income Formula

	Effective rental income (applying assumed rental income increase multiplier)
–	Vacancy and credit losses (applying assumed reductions in vacancy)
+	Other income
	Gross operating income
–	Operating expenses (less the savings on utilities, maintenance, turnover related costs, and insurance premiums)
	= Post-retrofit net operating income

Capitalization rates for the Canadian apartment sector in the first quarter of 2020 were (as quoted by CBRE):[74,i]

3.79% High-Rise A	4.41% Low-Rise A
4.36% High-Rise B	4.81% Low-Rise B

The following formula can be used to verify if the CBRE capitalization rate is correct:

$$\text{Capitalization rate} = \frac{\text{net operating income}}{\text{value (previous appraisal)}}$$

Property value increase can be calculated as follows:

$$\text{Deep retrofit property value increase} = \text{post-retrofit property value} - \text{existing property value}$$

[i] CBRE provides the following definitions with regards to capitalization rates for MURB properties:

High-Rise: Multi-unit high density properties typically 5 storeys and above in height.

Low-Rise: Multi-unit properties typically 4 storeys and below in height.

Class A: New properties, which are situated in desirable neighbourhoods, well-serviced by public transit, demand above average rents, and are furbished with top of the line finishes and amenities.

Class B: Older properties, which offer functional space with rental rates near to or below the market average.

The following provides an example of calculating deep retrofit property value increases for rental apartments in Ontario:

Pre-Retrofit Property Valuation

	$	2,240,400	◂ Potential rental income
–	$	40,327	◂ Vacancy losses
	$	2,200,073	◂ Effective rental income
–	$	434,224	◂ Operating Expenses
	$	**1,765,849**	◂ **Pre-retrofit net operating income**

Pre-retrofit Property Value

$$\$\ 40{,}501{,}124 = \frac{\$1{,}765{,}849}{4.36\%}$$

Post-Retrofit Property Valuation

	$	2,240,400	◂ Potential rental income
–	$	20,164	◂ Vacancy losses
	$	2,220,236	◂ Effective rental income
+	$	71,693	◂ Other Income (in this case rental premium for energy efficiency retrofit)
	$	2,291,929	◂ Gross operating income
–	$	330,805	◂ Operating Expenses
	$	**1,961,124**	◂ **Post-retrofit net operating income**

Post-retrofit Property Value

$$\$\ 44{,}979{,}908 = \frac{\$1{,}961{,}124}{4.36\%}$$

Property Value Increase from Deep Retrofit

$ 4,478,784 = $ 44,979,90408 - $ 40,501,124

Pre-Retrofit

Potential Rental Income	Vacancy Losses	Gross Operating Income	Utilities	Maintenance Costs	Insurance Premiums	Administration (including turnover costs)	Total Operating Expenses	Net Operating Income
$2,240,400.00	$40,327.20	$2,200,072.80	$240,221.47	$80,000.00	$37,000.00	$77,002.55	$434,224.02	$1,765,848.78

Post-Retrofit

Potential Rental Income	Vacancy Losses	Increased Rental Premium	Gross Operating Income	Utilities	Maintenance Costs	Insurance Premiums	Administration (including turnover costs)	Total Operating Expenses	Net Operating Income
$2,240,400.00	$20,163.60	$71,692.80	$2,291,929.20	$144,132.88	$77,600.00	$35,150.00	$73,922.45	$330,805.33	$1,961,123.87

Assumed Cap Rate: Apartment High-Rise Class B

Capitalization rates for the Canadian apartment sector in the first quarter of 2020 were (as quoted by CBRE):

High-Rise A	High-Rise B	Low-Rise A	Low-Rise B
3.79%	4.36%	4.41%	4.81%

CBRE provides the following definitions of capitalization rates for MURB properties:

High-Rise: Multi-unit high density properties typically 5 storeys and above in height.

Low-Rise: Multi-unit properties typically 4 storeys and below in height.

Class A: New properties, which are situated in desirable neighbourhoods, well-serviced by public transit, demand above average rents, and are furbished with top of the line finishes and amenities.

Class B: Older properties, which offer functional space with rental rates near to or below the market average.

https://www.cagbc.org/cagbcdocs/CaGBC_National_Energy_Benchmarking%20_Framework_April_2016.pdf

Assumed rates

1.8%*
Assumed Vacancy Rate Pre-Retrofit

0.9%†
Assumed Vacancy Rate Post Retrofit

* based on Average Vacancy Rate for Ontario: 1.8 per cent
https://www.cmhc-schl.gc.ca/en/media-newsroom/news-releases/2018/national-vacancy-rate-down-for-second-year

† Assumes a 50 per cent reduction in vacancy and turnover

Building

Suites	Space heating	Water heating	A/C	Toilets
100	Electric Baseboard	Electric	50% of suites with window mounted air conditioning	6 to 12 lpf

Table 1: Hypothetical Apartment Building Expenses

Utility Costs*	per suite/year	
Baseline Energy EUI	$	2,011.28
Baseline Water EUI	$	390.94
Baseline annual utilities cost	$	2,402.21

* based on an anonymous high-rise apartment building in the Greater Toronto Area currently with 6 lpf to 12 lpf toilets and all suites using electric space and water heating, with approximately 50 per cent of the suites equipped seasonally with window mount air conditioning units.

Other Operating Costs*	per suite/year	
Maintenance and repair costs	$	800.00
Insurance	$	370.00
Management 3.5% of Effective Gross Income	$	77,002.55

* based on From Altus Group, data unknown, Purchasing a Multi-Family Rental Building – New Construction vs. Older Existing. Page 3 **http://goodmanreport.com/app/uploads/2014/04/Altus-RVA-Older-stock-vs-New-rental-building-C-Jagger.pdf**

See table below

Hypothetical Existing Older Apartment Building
Projected Year One

PROJECTED ANNUAL GROSS INCOME[1]					Altus Projected Y/E Jan-15
Projected Annual Rental Income ($1.85 per s.f. per month)					$806,970
Average Rent per Month per Suite					$1,245
Number of Suites			54		
	# Stalls	Monthly	Annually		
Parking ($35.00 per month)	50	$1,750	$21,000		
Laundry ($10.00 per suite / month)		$540	$6,480		
Total Annual Ancillary Income					$27,480
Vacancy & Bad Debts	1.00%				-$8,345
					Altus 2014 Stabilized Forecast
Effective Gross Income (EGI)					$826,106
EGI / Suite per month					$1,275
EXPENSES[2]				Per Suite Altus 2014	Total
Management	3.50% of EGI			*$535*	$28,914
Realty Taxes	8.47% of EGI			*$1,296*	$70,000
Water and Sewer				*$300*	$16,200
Utilities				*$600*	$32,400
Garbage				*$75*	$4,050
Repairs and Maintenance				*$800*	$43,200
Caretaker				*$600*	$32,400
Insurance				*$370*	$20,000
Advertising and Leasing				*$50*	$2,700
Elevator, Licenses, Landscaping, Miscellaneous				*$250*	$13,500
Total Operating Expenses				*$4,877*	$263,364
Operating Expense Ratio					31.88%
Net Operating Income (NOI)					$562,742
Stabilized Capitalization Rate					4.00%
Indicated Value (Overall)					$14,068,545
Indicated Value (Per Sq.Ft. of Rentable Area)					$387
Indicated Value (Per Suite)					$260,529
MARKET VALUE	(ROUNDED)				$14,070,000

[1] *Monthly and Projected Income based on hypothetical existing rents*
[2] *Expenses are estimated based on Altus' experience with comparable properties*

Hypothetical Rental Rates

$ 1,867*

per month / suite

* based on the following: Rentals.ca December 2019 Rent Report **https://rentals.ca/national-rent-report**

Table 2: Top 15 Rental Apartments in Ontario

Top 15 rental apartment markets in Ontario		
Ontario Market	**1-bedroom**	**2-bedroom**
Toronto	2314	2966
Etobicoke	2103	2575
Richmond Hill	1989	2401
Oakville	1950	2591
Mississauga	1934	2416
Burlington	1798	2212
Brampton	1783	1843
Barrie	1621	2041
Scarborough	1617	2080
Ottawa	1597	2018
Hamilton	1510	1537
Oshawa	1319	1656
London	1219	1575
St. Catherines	1178	1516
Kitchener	1138	1503
Average monthly rent		**$1,867**

Table 3: Hypothetical Rental Income Premium

	Used for purposes of this analysis	Comments
Guideline Increase	2.2%	See Ontario Rent increase guideline for 2020 Landlords and Tenants Guide https://www.ontario.ca/page/rent-increase-guideline#section-0 and Residential Tenancies Act, 2006, S.O. 2006, c.17 (RTA) https://www.ontario.ca/laws/statute/06r17#BK182
Above Guideline Increase	1.0%	See RTA s.126(11a), O.Reg 516/06 s.33. regarding 3% maximum above guideline increase for qualifying capital expenditures https://www.ontario.ca/laws/statute/06r17#BK190
Effective Increase post retrofit (%)	3.2%	
Effective monthly rental increase ($)	**$59.74**	

The GTA Market currently reflects a rental premium for increased comfort from cooling: In the GTA new tenants are choosing to pay at least $50 more per month for apartments with efficient cooling.[i] And landlords are eligible to recoup the costs of an energy efficiency retrofit up to a maximum of 3 per cent of the rent for sizeable capital expenditures.

[i] This information is based on interviews with apartment landlords in Ontario. For the purposes of privacy the names and companies will remain anonymous.

Appendix C

DETERMINING INCOME TAX RATES FOR APARTMENT OWNERS

Calculating the gross income tax is essential to determining what net benefits are achieved from applying capital cost allowance from a retrofit. Calculating a landlord's gross income tax is contingent on their applicable income tax rate. Effective marginal tax rates for apartment owners can range from 15 per cent to 50 per cent.

There are essentially two categories that landlords fall into from an income tax perspective:

- **Sole proprietorships and partnerships**
- **Corporations**

Sole Proprietors, Partnerships

For a sole proprietor owner of a MURB rental apartment, income tax is based on the progressive approach, both federally and provincially.

Income Bracket	Tax Rate
Up to $47,630	15%
$47,631-$95,259	20.5%
$95,260-$147,667	26%
$147,668-$210,371	29%
$210,372 and higher	33%

Table 1: 2019 federal income brackets[75]

Income Bracket	Tax Rate
Up to $43,906	5.05%
$43,907-$87,813	9.15%
$87814-$150,000	11.16%
$150,001-$220000	12.16%
>$220,001 and up	13.16%

Table 2: 2019 Ontario income brackets[76]

As a MURB owned by a shared partnership, the same marginal tax rates, both federally and provincially, are applied to the shared income portion of each contributor.

Corporations

For MURBs owned by a corporation, tax rates are applied based on different criteria. To distinguish between a MURB owned by a corporation and one owned through personal investment, the corporation must be composed of five or more employees. It is only then where the rental income is considered as an active business income, which has advantageous tax implications. The active business income qualifies for 17 per cent tax reduction benefits applicable on the first $500,000. The next $500,000 sees a general tax reduction rate of 13 per cent applied. The table below shows the aggregate tax rate applied on corporates; both provincially and federally. The first column highlights corporates with income less than $500,000 and eligible for small business deduction (SBD). The second column is based on general corporates with income higher than $500,000. The last column highlights taxes applied on investment corporates that generate income from multiple properties, including rental income. So, in general, as a corporate MURB owner you qualify for tax reductions (benefits), depending on the rental income generated. However, if the corporation is part of an investment business, additional taxes are applied.

Table 3: Corporate federal & provincial tax brackets[77]

Income Bracket	Small-Business Tax Rate (<$500,000 income)	General Corporate Tax rate (>$500,000)	Investment (Business) Income Tax Rate
Initial federal tax rate	38%	38%	38%
Federal abatement	-10%	-10%	-10%
Small business deduction	-17%	0%	0%
General tax rate deduction	0%	-13%	0%
Additional tax on investment income	0%	0%	6.67%
Net federal tax rate	11%	15%	34.67%
Provincial tax rate	4.50%	11.5%	11.5%
Total tax rate	15.5%	26.5%	46.17%

Appendix D

COMPARING BUSINESS CASE IMPACTS FROM APPLYING AND WITHHOLDING INCOME TAX INCENTIVES

Retrofit description:

Geothermal retrofit – eligible for enhanced accelerated depreciation

Annual retrofit savings:

$64,422

Retrofit cost per unit:

$11,983

Total estimated retrofit cost:

$1,521,841

127

Suites

114,041.3677 ft²

Gross Floor Area

Current Annual Maintenance Cost Intensity: $1/ft²

Annual maintenance costs: $114,041.37

Monthly rent: $1,600

Annual gross rental income: $2,438,400

Annual utility costs: $255,432

Income tax rate: 15%

Annual operating cost escalation rate: 1.5%

Guideline annual increase for rent: 1.8%

SCENARIO 1: **Retrofit technology receiving enhanced accelerated depreciation treatment under class 43.2.**

SCENARIO 2: **Retrofit technology receiving standard depreciation treatment under Canada Income Tax Act.**

SCENARIO 1: RETROFIT TECHNOLOGY RECEIVING ENHANCED ACCELERATED DEPRECIATION TREATMENT UNDER CLASS 43.2.[i]

Year	Invest-ment	Operating Costs	Energy Savings	Undepre-ciated Capital Cost (UCC)	Gross Annual Rental Income	Net operating income	CCA Rate (Accelerated Depreciation Class 43.2)	CCA	Taxable income	Gross Income Tax	Net Cash Flows
0	-$1,521,841	0	0	$1,521,841		-$1,521,841					-$1,521,841
1 (2021)	0	-$369,474	$64,422	$ -	$2,438,400	$2,133,348	100%	-$1,521,841	$611,507	-$91,726	$2,041,622
2 (2022)	0	-$375,016	$65,388	$ -	$2,482,291	$2,172,664	0%	$ -	$2,172,664	-$325,900	$1,846,764
3 (2023)	0	-$380,641	$66,369	$ -	$2,526,972	$2,212,701	0%	$ -	$2,212,701	-$331,905	$1,880,796
4 (2024)	0	-$386,351	$67,365	$ -	$2,572,458	$2,253,472	0%	$ -	$2,253,472	-$338,021	$1,915,451
5 (2025)	0	-$392,146	$68,375	$ -	$2,618,762	$2,294,992	0%	$ -	$2,294,992	-$344,249	$1,950,743
6 (2026)	0	-$398,028	$69,401	$ -	$2,665,900	$2,337,273	0%	$ -	$2,337,273	-$350,591	$1,986,682
7 (2027)	0	-$403,998	$70,442	$ -	$2,713,886	$2,380,330	0%	$ -	$2,380,330	-$357,049	$2,023,280
8 (2028)	0	-$410,058	$71,498	$ -	$2,762,736	$2,424,176	0%	$ -	$2,424,176	-$363,626	$2,060,550
9 (2029)	0	-$416,209	$72,571	$ -	$2,812,465	$2,468,827	0%	$ -	$2,468,827	-$370,324	$2,098,503
10 (2030)	0	-$422,452	$73,659	$ -	$2,863,090	$2,514,297	0%	$ -	$2,514,297	-$377,145	$2,137,152
Total	-$1,521,841	-$3,954,373	$689,491		$26,456,961	$21,670,238		-$1,521,841	$ 21,670,238	-$3,250,536	$18,419,702

[i] More on the enhanced CCA Class 43.1/43.2 in Schedule II of the Income Tax Act regulations: https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/2019%20Tax-Incentives-Businesses__EN_v2.pdf

SCENARIO 2: RETROFIT TECHNOLOGY RECEIVING STANDARD DEPRECIATION TREATMENT UNDER CANADA INCOME TAX ACT.

Year	Invest-ment	Operating Costs	Energy Savings	Undepre-ciated Capital Cost (UCC)	Gross Annual Rental Income	Net operating income	CCA Rate (Accelerated Depreciation Class 43.2)	CCA	Taxable income	Gross Income Tax	Net Cash Flows
0	-$1,521,841	0	0	$1,521,841		-$1,521,841					-$1,521,841
1 (2021)	0	-$369,474	$64,422	$ 1,491,404	$2,438,400	$2,133,348	2%	-$ 30,437	$2,102,912	-$315,437	$1,817,912
2 (2022)	0	-$375,016	$65,388	$ 1,431,748	$2,482,291	$2,172,664	4%	-$ 59,656	$2,113,008	-$316,951	$1,855,713
3 (2023)	0	-$380,641	$66,369	$ 1,374,478	$2,526,972	$2,212,701	4%	-$ 57,270	$2,155,431	-$323,315	$1,889,386
4 (2024)	0	-$386,351	$67,365	$ 1,319,499	$2,572,458	$2,253,472	4%	-$ 54,979	$2,198,493	-$329,774	$1,923,698
5 (2025)	0	-$392,146	$68,375	$ 1,266,719	$2,618,762	$2,294,992	4%	-$ 52,780	$2,242,212	-$336,332	$1,958,660
6 (2026)	0	-$398,028	$69,401	$ 1,216,050	$2,665,900	$2,337,273	4%	-$ 50,669	$2,286,604	-$342,991	$1,994,282
7 (2027)	0	-$403,998	$70,442	$ 1,167,408	$2,713,886	$2,380,330	4%	-$ 48,642	$2,331,688	-$349,753	$2,030,576
8 (2028)	0	-$410,058	$71,498	$ 1,120,712	$2,762,736	$2,424,176	4%	-$ 46,696	$2,377,480	-$356,622	$2,067,554
9 (2029)	0	-$416,209	$72,571	$ 1,075,883	$2,812,465	$2,468,827	4%	-$ 44,828	$2,423,999	-$363,600	$2,105,227
10 (2030)	0	-$422,452	$73,659	$ 1,032,848	$2,863,090	$2,514,297	4%	-$ 43,035	$2,471,261	-$370,689	$2,143,608
Total	-$1,521,841	-$3,954,373	$ 689,491		$ 26,456,961	$ 21,670,238		-$ 488,993	$ 22,703,086	-$3,405,463	$18,264,775

Appendix E

DEEP ENERGY RETROFIT BUSINESS CASE EVALUATION CASE STUDY

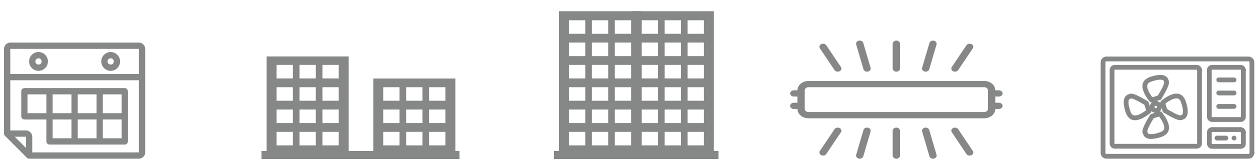
Introduction

This appendix outlines a sample deep energy retrofit business case evaluation for a real multi-family building in the GTHA. This example illustrates the impacts of monetary non-energy benefits (NEBs), Life Cycle Cost Analysis, different financing options, and varying levels of energy savings on the business case. An overview of the project's scope, costs, benefits and multiple views of the financials are provided, as the business case varies significantly depending on how the project is financed, how the measures perform, and how the cash flows are evaluated. When using a holistic financial analysis lens that evaluates life cycle costs and monetary NEBs, the business case for the site is compelling.

Project Background Information

Original Building Information

The residential walk-up apartment complex in Toronto, Ontario is comprised of three- and four-storey buildings and a total of 175 residential units.



Year constructed
1973

Building form
Residential walk-up apartment complex consisting of 3- and 4-storey buildings

Total Units
175 suites, mostly 3-bedroom

Heating
Electric resistance baseboard heaters with non-programmable thermostats

Cooling
No central air-conditioning. Individual AC units installed and maintained by residents

Recommended Deep Retrofit Measures

An investment grade energy audit for this site recommended window replacement, ultra-low-flow toilets and water fixtures, HVAC, and lighting upgrades. The project targeted a 40 per cent reduction in annual energy use with an estimated budget of $5.5 million.

Business Case Analysis

A more robust business case using Life Cycle Cost Analysis

Business case evaluation for a deep energy retrofit should include Life Cycle Cost Analysis (LCCA), including monetary energy and non-energy benefits (NEBs). LCCA can be presented using various metrics, most frequently Net Present Value (NPV). A key consideration in the analysis is the appropriate time horizon, based on the expected life of the retrofit measures, the period of time over which the project will be financed, and/or the remaining useful life of the building itself.

Financials

The business case evaluation compares the effects when different annual energy savings are realized at 100 per cent versus 75 per cent of expected savings. The NPV time horizon used for this analysis is 20 years, which is the assumed useful life for the project. Each NPV calculation is based on a five per cent discount rate.

Table 1: Business Case Summary Comparison – Conventional versus Upgraded Evaluation

Business Case Evaluation Approach	Expected Savings Scenario	Self-Financed	Loan	Energy Savings Performance Agreement[i]
Base Net Present Value (NPV)*	Full Savings	-$2,475,666	-$2,404,384	-$2,511,085
	75% savings	-$3,221,350	-$3,150,068	-$2,872,914
NPV w/Non-Energy Benefit (NEB) Life Cycle Cost Analysis (LCCA)**	Full Savings	$1,463,389	$1,534,671	$1,427,970
	75% savings	$717,706	$788,988	$1,066,141

* Utility savings are the only monetary benefit evaluated under this approach. Additional life cycle costs and benefits are not considered over the useful life of this illustrative retrofit example.

** **Lifetime avoided capital improvement costs** and **increased revenue from reduced vacancy due to comfort improvements** over the useful life of this illustrative retrofit example (e.g. 20 years) are included as part of a more robust NPV analysis.

Legend

- Best NPV
- Bad NPV
- Ok NPV
- Worst NPV

This comparison reveals a compelling business case using an LCCA approach

While the recommended project budget of $5.5 million was a significant investment, consultation with property staff revealed that $4 million in energy-related capital repairs and replacements were needed over the next three years simply to maintain a state of good repair at this site. Therefore, the incremental cost over a business-as-usual approach was estimated at $1.5 million. Furthermore, the improvements to indoor comfort from HVAC and window upgrades were expected to reduce turnover by 33 per cent, equivalent to one suite or an assumed rental income increase of $24,000 per year.

[i] What is an Energy Savings Performance Agreement (ESPA)™? An ESPA is a service performance agreement—not a loan. An ESPA doesn't require upfront payment for energy efficiency measures and technologies. Energy savings are shared until the investment is repaid, plus a small return.

This comparison shows how financing can be a business case benefit, not a hurdle, due to freed up operating cash flows

As long as savings are maintained, loans can improve the business case by eliminating the upfront retrofit costs and helping to free up operating funds. However, when projects underperform, innovative financing solutions with variable repayment linked to energy usage, like an Energy Savings Performance Agreement (ESPA), can remove a lot of the financial risk for property owners. This is compared to a loan that requires regular fixed payments regardless of savings or other benefits. Avoidance of fixed payments can therefore help property owners advance a retrofit project despite the uncertainty of an energy retrofit's future performance.

Table 2: Increased rental income evaluation parameters

Parameter	Value
Total suites retrofitted	175 suites (100%)
Average pre-retrofit vacancy rate	1.80%
Average pre-retrofit number of vacancies	3 suites
Anticipated reduction in average number of vacancies after the retrofit	1 suite
Average rent per suite per month	$2,000
Average rent per suite per year	$24,000

Financing details

Financing Options	Details
Self-Financed	100% of the project paid upfront by the property owner
Loan	100% of the project financed using a loan at 5% interest rate over 20 years
ESPA	• $1.5 million financed under an ESPA over 10 years • Assumes a 90% share of the savings taken to pay towards the ESPA for 10 years • Remainder of $4 million paid by the property owner

Choosing how to pay for the retrofit

Investing in a retrofit can be accomplished in many ways. The recommended options for this project are: self-financing, a loan, or an ESPA.

	Self-Financed	Loan	ESPA
PROS	• Zero cost of capital	• Simple, streamlined application process • Potentially fast approval • Allows operational cash flow to be used elsewhere	• Flexibility allows for this financing approach to pay for some or all of a project. • A non-debt financing mechanism, with repayment equal to, or less than, the energy savings only over course of term. After the term all savings belong to property. • Performance risk on the financier and project managers. In fact, a greater financial benefit if project underperforms and energy savings fall short of projections
CONS	• Entire upfront cost provided by property owner, reducing operational cash flows • Performance risk entirely on the property owner	• Performance risk entirely on the property owner	• A longer approvals process than a loan due to in depth engineering analysis and verification requirements • ESPA terms are typically fixed to projects that achieve paybacks within 10 years. Therefore, any components of a project that are outside of that term length must be financed by other means.

Retrofit Information

Description of Energy Savings Measures	Impact Type	Estimated Annual Utility Savings: Elec. kwh	Gas m³	Gas Net ekwh	Water m³	Annual Cost Savings $	Cost of Retrofit $	Available Incentives $	Net Cost of Retrofit $	Annual GHG Savings (tonnes CO_2eq)
Install a central ductless heat pump system	HVAC	730,200	-		-	$ 87,050	$ 3,960,700	-$146,050	3,814,650	97.8
Decommission gas make-up and install in-suite electric energy recovery ventilators	HVAC	-26,604	35,318	372,177	-	$ 9,536	$ 656,250	$0	$ 656,250	67
Replace existing windows with high performance triple glaze	Envelope	187,370	-		-	$ 22,350	$ 711,000	-$34,550	$ 676,450	25.2
Retrofit common area lighting	Lighting	98,300	-		-	$ 11,700	$ 91,700	-$12,600	$ 79,100	13.2
Retrofit in-suite lighting	Lighting	35,450	-		-	$ 4,250	$ 135,500	-$3,550	$ 131,950	4.8
Install high efficiency toilets & low-flow showerheads and aerators	Cold & Hot Water	-	16,780	176,828	12,760	$ 55,000	$ 84,800	-$350	$ 84,450	31.9
Replace top-loading washers with front-loading washers	Cold & Hot Water	-	9,700	102,219	1,030	$ 6,700	$ 500	-	$ 500	18
Install a co detection system to operate the garage exhaust fans	Other systems	1,300	-		-	$ 150	$ 11,300	-$250	$ 11,050	0.2
Training & resident awareness	Resident Behaviour	31,300	1,350	14,226.30	650.00	$ 6,650	$ 4,000		$ 4,000	6.8
TOTAL SAVINGS		1,110,524	63,148	665,450	14,440	$ 203,386	$ 5,655,750	-$ 197,350	$ 5,458,400	264.9
ANNUAL BASELINES		3,136,570	135,837	1,431,450	65,918	$ 660,738				
Percent Reduction		35.4%	46.5%	46.5%	21.9%	30.8%	**Annual GHG Emission Reduction of CO_2**			**39.1%**
TOTAL ENERGY SAVINGS		**38.9%**								

Annual Cash Flows

SCENARIO: SELF-FINANCED WITH 100% OF EXPECTED ENERGY SAVINGS ACHIEVED

NPV (LCCA with NEBs) $1,463,389
NPV (without NEBs) -$2,475,666

Year	Retrofit Investments	Utility Savings (includes estimated annual escalation @ 2% per year)	Extra Rental Income Per Year (From reduction in vacancy - includes annual inflation @ 2%)	Avoided Capital Improvement Costs	Total Operational Savings And Revenue	Net Cash Flow (w/NEBs)	Net Cash Flow (without NEBs)
0	-$5,458,400					-$5,458,400	-$5,458,400
1	$0	$203,386	$24,000	$1,000,000	$1,227,386	$1,227,386	$203,386
2	$0	$207,453	$24,480	$1,000,000	$1,231,933	$1,231,933	$207,453
3	$0	$211,603	$24,970	$2,000,000	$2,236,572	$2,236,572	$211,603
4	$0	$215,835	$25,469	$0	$241,304	$241,304	$215,835
5	$0	$220,151	$25,978	$0	$246,130	$246,130	$220,151
6	$0	$224,554	$26,498	$0	$251,052	$251,052	$224,554
7	$0	$229,045	$27,028	$0	$256,073	$256,073	$229,045
8	$0	$233,626	$27,568	$0	$261,195	$261,195	$233,626
9	$0	$238,299	$28,120	$0	$266,419	$266,419	$238,299
10	$0	$243,065	$28,682	$0	$271,747	$271,747	$243,065
11	$0	$247,926	$29,256	$0	$277,182	$277,182	$247,926
12	$0	$252,885	$29,841	$0	$282,726	$282,726	$252,885
13	$0	$257,942	$30,438	$0	$288,380	$288,380	$257,942
14	$0	$263,101	$31,047	$0	$294,148	$294,148	$263,101
15	$0	$268,363	$31,667	$0	$300,031	$300,031	$268,363
16	$0	$273,730	$32,301	$0	$306,031	$306,031	$273,730
17	$0	$279,205	$32,947	$0	$312,152	$312,152	$279,205
18	$0	$284,789	$33,606	$0	$318,395	$318,395	$284,789
19	$0	$290,485	$34,278	$0	$324,763	$324,763	$290,485
20	$0	$296,295	$34,963	$0	$331,258	$331,258	$296,295
TOTAL	**-$5,458,400**	**$4,941,739**	**$583,137**	**$4,000,000**	**$9,524,876**	**$4,066,476**	**-$516,661**

SCENARIO: SELF-FINANCED WITH 75% OF EXPECTED ENERGY SAVINGS ACHIEVED

NPV (LCCA with NEBs) $717,706
NPV (without NEBs) -$3,221,350

Year	Retrofit Investments	Utility Savings (includes estimated annual escalation @ 2% per year)	Extra Rental Income Per Year (Assumed increase due to reduction in turnover)	Avoided Capital Improvement Costs	Total Operational Savings And Revenue	Net Cash Flow (w/NEBs)	Net Cash Flow (without NEBs)
0	-$5,458,400					-$5,458,400	-$5,458,400
1	$0	$152,539	$24,000	$1,000,000	$1,176,539	$1,176,539	$152,539
2	$0	$155,590	$24,480	$1,000,000	$1,180,070	$1,180,070	$155,590
3	$0	$158,702	$24,970	$2,000,000	$2,183,672	$2,183,672	$158,702
4	$0	$161,876	$25,469	$0	$187,345	$187,345	$161,876
5	$0	$165,113	$25,978	$0	$191,092	$191,092	$165,113
6	$0	$168,416	$26,498	$0	$194,914	$194,914	$168,416
7	$0	$171,784	$27,028	$0	$198,812	$198,812	$171,784
8	$0	$175,220	$27,568	$0	$202,788	$202,788	$175,220
9	$0	$178,724	$28,120	$0	$206,844	$206,844	$178,724
10	$0	$182,299	$28,682	$0	$210,981	$210,981	$182,299
11	$0	$185,945	$29,256	$0	$215,200	$215,200	$185,945
12	$0	$189,663	$29,841	$0	$219,504	$219,504	$189,663
13	$0	$193,457	$30,438	$0	$223,895	$223,895	$193,457
14	$0	$197,326	$31,047	$0	$228,372	$228,372	$197,326
15	$0	$201,272	$31,667	$0	$232,940	$232,940	$201,272
16	$0	$205,298	$32,301	$0	$237,599	$237,599	$205,298
17	$0	$209,404	$32,947	$0	$242,351	$242,351	$209,404
18	$0	$213,592	$33,606	$0	$247,198	$247,198	$213,592
19	$0	$217,864	$34,278	$0	$252,142	$252,142	$217,864
20	$0	$222,221	$34,963	$0	$257,184	$257,184	$222,221
TOTAL	**-$5,458,400**	**$3,706,304**	**$583,137**	**$4,000,000**	**$8,289,441**	**$2,831,041**	**-$1,752,096**

SCENARIO: LOAN WITH 100% OF EXPECTED ENERGY SAVINGS ACHIEVED

NPV (LCCA with NEBs) $1,534,671
NPV (without NEBs) -$2,404,384

Year	Loan Principal	Cost Of financing (interest on the loan)	Utility Savings (includes estimated annual escalation @ 2% per year)	Extra Rental Income Per Year (Assumed increase due to reduction in turnover)	Avoided Capital Improvement Costs	Total Operational Savings And Revenue	Net Cash Flow (w/NEBs)	Net Cash Flow (without NEBs)
1	-$163,059	-$269,217	$203,386	$24,000	$1,000,000	$1,227,386	$795,109	-$228,891
2	-$171,402	-$260,874	$207,453	$24,480	$1,000,000	$1,231,933	$799,657	-$224,823
3	-$180,171	-$252,105	$211,603	$24,970	$2,000,000	$2,236,572	$1,804,296	-$220,674
4	-$189,389	-$242,887	$215,835	$25,469	$0	$241,304	-$190,973	-$216,442
5	-$199,078	-$233,198	$220,151	$25,978	$0	$246,130	-$186,147	-$212,125
6	-$209,264	-$223,013	$224,554	$26,498	$0	$251,052	-$181,224	-$207,722
7	-$219,970	-$212,306	$229,045	$27,028	$0	$256,073	-$176,203	-$203,231
8	-$231,224	-$201,052	$233,626	$27,568	$0	$261,195	-$171,082	-$198,650
9	-$243,054	-$189,222	$238,299	$28,120	$0	$266,419	-$165,858	-$193,977
10	-$255,489	-$176,787	$243,065	$28,682	$0	$271,747	-$160,529	-$189,211
11	-$268,560	-$163,716	$247,926	$29,256	$0	$277,182	-$155,094	-$184,350
12	-$282,300	-$149,976	$252,885	$29,841	$0	$282,726	-$149,551	-$179,392
13	-$296,743	-$135,533	$257,942	$30,438	$0	$288,380	-$143,896	-$174,334
14	-$311,925	-$120,351	$263,101	$31,047	$0	$294,148	-$138,129	-$169,175
15	-$327,884	-$104,392	$268,363	$31,667	$0	$300,031	-$132,246	-$163,913
16	-$344,659	-$87,617	$273,730	$32,301	$0	$306,031	-$126,245	-$158,546
17	-$362,293	-$69,984	$279,205	$32,947	$0	$312,152	-$120,124	-$153,071
18	-$380,828	-$51,448	$284,789	$33,606	$0	$318,395	-$113,881	-$147,487
19	-$400,312	-$31,964	$290,485	$34,278	$0	$324,763	-$107,513	-$141,791
20	-$420,793	-$11,483	$296,295	$34,963	$0	$331,258	-$101,018	-$135,982
TOTAL	**-$5,458,400**	-$3,187,126	**$4,941,739**	**$583,137**	**$4,000,000**	**$9,524,876**	**$879,350**	**-$3,703,787**

SCENARIO: LOAN WITH 75% OF EXPECTED ENERGY SAVINGS ACHIEVED

NPV (LCCA with NEBs) $788,988
NPV (without NEBs) -$3,150,068

Year	Loan Principal	Cost Of financing (interest on the loan)	Utility Savings (includes estimated annual escalation @ 2% per year)	Extra Rental Income Per Year (assumed increase due to reduction in turnover)	Avoided Capital Improvement Costs	Total Operational Savings And Revenue	Net Cash Flow (w/NEBs)	Net Cash Flow (without NEBs)
1	-$163,059	-$269,217	$152,539	$24,000	$1,000,000	$1,176,539	$744,263	-$279,737
2	-$171,402	-$260,874	$155,590	$24,480	$1,000,000	$1,180,070	$747,794	-$276,686
3	-$180,171	-$252,105	$158,702	$24,970	$2,000,000	$2,183,672	$1,751,395	-$273,574
4	-$189,389	-$242,887	$161,876	$25,469	$0	$187,345	-$244,931	-$270,400
5	-$199,078	-$233,198	$165,113	$25,978	$0	$191,092	-$241,184	-$267,163
6	-$209,264	-$223,013	$168,416	$26,498	$0	$194,914	-$237,363	-$263,861
7	-$219,970	-$212,306	$171,784	$27,028	$0	$198,812	-$233,464	-$260,492
8	-$231,224	-$201,052	$175,220	$27,568	$0	$202,788	-$229,488	-$257,057
9	-$243,054	-$189,222	$178,724	$28,120	$0	$206,844	-$225,432	-$253,552
10	-$255,489	-$176,787	$182,299	$28,682	$0	$210,981	-$221,295	-$249,978
11	-$268,560	-$163,716	$185,945	$29,256	$0	$215,200	-$217,076	-$246,332
12	-$282,300	-$149,976	$189,663	$29,841	$0	$219,504	-$212,772	-$242,613
13	-$296,743	-$135,533	$193,457	$30,438	$0	$223,895	-$208,382	-$238,820
14	-$311,925	-$120,351	$197,326	$31,047	$0	$228,372	-$203,904	-$234,950
15	-$327,884	-$104,392	$201,272	$31,667	$0	$232,940	-$199,336	-$231,004
16	-$344,659	-$87,617	$205,298	$32,301	$0	$237,599	-$194,678	-$226,978
17	-$362,293	-$69,984	$209,404	$32,947	$0	$242,351	-$189,926	-$222,872
18	-$380,828	-$51,448	$213,592	$33,606	$0	$247,198	-$185,079	-$218,684
19	-$400,312	-$31,964	$217,864	$34,278	$0	$252,142	-$180,135	-$214,413
20	-$420,793	-$11,483	$222,221	$34,963	$0	$257,184	-$175,092	-$210,055
TOTAL	**-$5,458,400**	-$3,187,126	**$3,706,304**	**$583,137**	**$4,000,000**	**$8,289,441**	**-$356,085**	**-$4,939,222**

SCENARIO: ESPA WITH 100% OF EXPECTED ENERGY SAVINGS ACHIEVED

NPV (LCCA with NEBs) $1,427,970
NPV (without NEBs) -$2,511,085

Year	Retrofit Investments	Utility Savings (includes estimated annual escalation @ 2% per year)	Espa Savings Share	Extra Rental Income Per Year (assumed increase due to reduction in turnover)	Avoided Capital Improvement Costs	Total Operational Savings And Revenue	Net Cash Flow (w/NEBs)	Net Cash Flow (without NEBs)
0	-$3,958,400						-$3,958,400	-$3,958,400
1	$0	$203,386	-$183,047	$24,000	$1,000,000	$1,227,386	$1,044,339	$20,339
2	$0	$207,453	-$186,708	$24,480	$1,000,000	$1,231,933	$1,045,225	$20,745
3	$0	$211,603	-$190,442	$24,970	$2,000,000	$2,236,572	$2,046,130	$21,160
4	$0	$215,835	-$194,251	$25,469	$0	$241,304	$47,052	$21,583
5	$0	$220,151	-$198,136	$25,978	$0	$246,130	$47,994	$22,015
6	$0	$224,554	-$202,099	$26,498	$0	$251,052	$48,953	$22,455
7	$0	$229,045	-$206,141	$27,028	$0	$256,073	$49,932	$22,905
8	$0	$233,626	-$210,264	$27,568	$0	$261,195	$50,931	$23,363
9	$0	$238,299	-$214,469	$28,120	$0	$266,419	$51,950	$23,830
10	$0	$243,065	-$218,758	$28,682	$0	$271,747	$52,989	$24,306
11	$0	$247,926	-	$29,256	$0	$277,182	$277,182	$247,926
12	$0	$252,885	-	$29,841	$0	$282,726	$282,726	$252,885
13	$0	$257,942	-	$30,438	$0	$288,380	$288,380	$257,942
14	$0	$263,101	-	$31,047	$0	$294,148	$294,148	$263,101
15	$0	$268,363	-	$31,667	$0	$300,031	$300,031	$268,363
16	$0	$273,730	-	$32,301	$0	$306,031	$306,031	$273,730
17	$0	$279,205	-	$32,947	$0	$312,152	$312,152	$279,205
18	$0	$284,789	-	$33,606	$0	$318,395	$318,395	$284,789
19	$0	$290,485	-	$34,278	$0	$324,763	$324,763	$290,485
20	$0	$296,295	-	$34,963	$0	$331,258	$331,258	$296,295
TOTAL	**-$3,958,400**	**$4,941,739**	**-$2,004,316**	**$583,137**	**$4,000,000**	**$9,524,876**	**$3,562,160**	**-$1,020,977**

SCENARIO: ESPA WITH 75% OF EXPECTED ENERGY SAVINGS ACHIEVED

NPV (LCCA with NEBs) $1,066,141

NPV (without NEBs) -$2,872,914

Year	Retrofit Investments	Utility Savings (includes estimated annual escalation @ 2% per year)	Espa Savings Share	Extra Rental Income Per Year (assumed increase due to reduction in turnover)	Avoided Capital Improvement Costs	Total Operational Savings And Revenue	Net Cash Flow (w/NEBs)	Net Cash Flow (without NEBs)
0	-$3,958,400						-$3,958,400	-$3,958,400
1	$0	$152,539	-$137,285	$24,000	$1,000,000	$1,176,539	$1,039,254	$15,254
2	$0	$155,590	-$140,031	$24,480	$1,000,000	$1,180,070	$1,040,039	$15,559
3	$0	$158,702	-$142,832	$24,970	$2,000,000	$2,183,672	$2,040,840	$15,870
4	$0	$161,876	-$145,688	$25,469	$0	$187,345	$41,657	$16,188
5	$0	$165,113	-$148,602	$25,978	$0	$191,092	$42,490	$16,511
6	$0	$168,416	-$151,574	$26,498	$0	$194,914	$43,340	$16,842
7	$0	$171,784	-$154,606	$27,028	$0	$198,812	$44,206	$17,178
8	$0	$175,220	-$157,698	$27,568	$0	$202,788	$45,090	$17,522
9	$0	$178,724	-$160,852	$28,120	$0	$206,844	$45,992	$17,872
10	$0	$182,299	-$164,069	$28,682	$0	$210,981	$46,912	$18,230
11	$0	$185,945		$29,256	$0	$215,200	$215,200	$185,945
12	$0	$189,663		$29,841	$0	$219,504	$219,504	$189,663
13	$0	$193,457		$30,438	$0	$223,895	$223,895	$193,457
14	$0	$197,326		$31,047	$0	$228,372	$228,372	$197,326
15	$0	$201,272		$31,667	$0	$232,940	$232,940	$201,272
16	$0	$205,298		$32,301	$0	$237,599	$237,599	$205,298
17	$0	$209,404		$32,947	$0	$242,351	$242,351	$209,404
18	$0	$213,592		$33,606	$0	$247,198	$247,198	$213,592
19	$0	$217,864		$34,278	$0	$252,142	$252,142	$217,864
20	$0	$222,221		$34,963	$0	$257,184	$257,184	$222,221
TOTAL	**-$3,958,400**	**$3,706,304**	**-$1,503,237**	**$583,137**	**$4,000,000**	**$8,289,441**	**$2,827,804**	**-$1,755,332**

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