

Investigating Deep Retrofits for Toronto's Financial District Office Towers

Author Alita Jones

Abstract In response to a perceived shift towards green building practices and an increased focus on energy efficiency in commercial office facilities management, in this report I examine the barriers and drivers related to deep retrofits for the purpose of developing recommendations for increasing the energy efficiency goals of future retrofit projects. Centered on the Financial District in Toronto, Ontario, I integrate the existing literature, interviews, and local case studies to indicate the current environment for whole building energy efficiency reductions. Recognizing deep retrofits as relatively new to the commercial real estate market, my ideas and recommendations include: corporate social responsibility reporting to build tenant demand; an easily accessible national energy labelling system; improving tools for benchmarking and industry knowledge; and providing innovative financial incentives.

In this paper, I investigate and assess the current business environment for commercial office tower deep retrofits in Toronto's Financial District. The decision to research this topic stems from a perceived shift in the built environment towards green building practices, and an increased focus on energy efficiency in commercial office facilities management. Although there are many instances of sustainable practices and commercial retrofits around the world, this study was restricted to Toronto's Financial District as a means to provide research specifically relevant to the Canadian building market.

By looking at deep retrofits, I examine the factors related to tower renewal, and explore the drivers and barriers for retrofit projects that have an articulated and substantial energy use reduction goal. In addition, three retrofit projects from Toronto's Financial District have been examined to illustrate the current direction of retrofit projects and how they fit within the criteria for energy use reduction as defined here. Trends were gathered from literary sources, personal interviews, and case studies, then analyzed with the goal of forming an integrated assessment of the primary drivers and barriers for deep retrofits. The data related to the case studies are focused on the aspects of the retrofit, without providing specific financial details related to payback.

The objective of the paper is to analyze trends and expert opinions regarding energy reduction drivers and barriers related to retrofits in the commercial real estate market, and to understand what the current environment is for pursuing

deep retrofits for commercial towers in Toronto's Financial District. From this analysis, the goal of the research is to identify best practices or recommendations for increasing energy efficiency goals for future tower retrofit projects.

Literature Review

In reviewing the literature, the initial purpose was to establish a definition for a "deep" retrofit, and secondly to examine the current range of opinions on the drivers and barriers to whole building energy use reductions. As this is a relatively new topic of research, the majority of the literature is associated with government and independent research groups who have published white papers and conference proceedings. A secondary source of information comes from case studies of recent Toronto commercial tower retrofits, originating from the property owners and associated consultants. Finally, information from the City of Toronto and real estate management companies with a strong presence in Toronto were reviewed to get a broader sense of the current commercial property environment in Toronto's Financial District.

Four sources in particular proved to be excellent resources of information on the topic of deep retrofits for commercial towers: Sustainable Development Technology Canada (2009), Smith and Lane (2011), B+H Architects (2012), and GRESB Report (2012). All four papers were developed by highly reputable organizations, and contain substantial content regarding specific data for Canada. Presenting a broad overview on energy efficiency and the Canadian commercial real estate market, these papers provided the literary baseline for this paper. The findings build on the existing literature by introducing current professional opinions from a broad base of practice, together with location-specific case studies, to indicate the current environment for deep retrofits in Toronto's commercial market.

Methodology

The methods of research for this paper are literature review, semi-structured interviews with regional experts, and case studies. These methods are used to present a "holistic" picture of the retrofit practices in the Toronto's financial commercial tower market.

Much of the current research and analysis involves a diverse range of specialties. The primary sources of information include the green building councils in the United States and Canada, the Tower Renewal Office of Toronto, and related North American government energy sites. These articles, presentations, and case studies establish the academic background for the study and a broader assessment of retrofit trends.

The majority of white papers and research presentations are based on data from the U.S. While some reports included data for Canada, the best source of regional information for Toronto was local professional organizations including the

Building Owners and Managers Association (BOMA) and REALpac. It should be noted that the literature review was focused on energy reduction through the retrofit of existing buildings, and not on the use of or outcomes related specifically to sustainable certification programs.

To provide specific regional data, 11 local experts from various building-related professions were interviewed. Prospective interview candidates were primarily identified through the Greater Toronto Area chapters of the International Facility Management Association and the Canadian Green Building Council, or through their connection to the case study properties. The interviews were semi-structured. Each interviewee was informed of the research objective and asked for their opinion on the primary drivers and barriers for deep retrofits for commercial towers. By interviewing experts from a variety of backgrounds, the research aims to encompass a broad perspective permitting the identification and assessment of trends or conflicts in the interview data.

To add a third dimension to the analysis, three Toronto Financial District commercial tower retrofit case studies have been reviewed, using both property specific interviews and publicly available data. Both the TD Centre and First Canadian Place represent large commercial properties that have undergone high profile and substantial retrofit projects completed (or near completion) in 2013. The State Street Financial building demonstrates a unique retrofit project which indicates the potential for deep retrofits on property revitalization. These case studies provide a snap shot of current retrofit practices and highlight the impacts of deep retrofit drivers and barriers in real application.

Discussion and Analysis

Defining a Deep Retrofit

Many facilities undergo substantial retrofit projects at some point. While every building is different, and there are many reasons for undertaking a retrofit, most retrofits are undertaken for one or more of the following reasons: property renewal for tenant retention, upgrading or replacement of failing systems, or increasing the facility's asset value (Neate, 2013). A reduction in energy use is a common result of modernization retrofits, and new equipment and systems may be selected with energy efficiency as a key consideration. A deep retrofit is characterized by the inclusion of energy reduction as a primary goal for the project and is measured by the level of verified whole building energy savings achieved compared to the pre-retrofit baseline (Liu, et al., 2011).

The U.S. Department of Energy (DOE) estimates that buildings are responsible for 40% of national energy use and 38% of greenhouse gas emissions (Vanderpool, 2010). Furthermore, of the 40% of energy use from buildings, 17%–18% of that amount is specifically attributed to commercial buildings. Canadian statistics demonstrate similar trends: Sustainable Development Technology Canada (SDTC, 2009) reported that energy consumption in Canada increased by 27% between 1990 and 2005. It has also been estimated that commercial buildings account for

14% of end-use energy consumption in Canada. As a result, the SDTC, along with a number of reports for the U.S., target energy reduction in commercial buildings as a key strategy for reducing overall energy consumption over the next two decades. In response, deep retrofits have been explored by a number of agencies as an important strategy for reducing end-use energy consumption in existing commercial buildings.

There is currently no universally or even broadly accepted definition of a deep retrofit. Liu, et al. (2011) define a deep retrofit as one achieving a 45% energy savings, Smith and Bell (2011) describe a deep retrofit as a retrofit that results in a 30%–50% energy savings, and Vanderpool (2010) uses a 25%–50% energy reduction as the deep retrofit goal. While overall definitions for deep retrofits ranged from 25% to 75% reductions, the majority of literary sources focus on the 30%–50% range for energy reductions. For the purposes of this paper, a deep retrofit is defined as a project that uses integrated building strategies to achieve a 30% or greater reduction in whole building energy use reduction compared to the pre-retrofit baseline. The overall retrofit project should include defined goals, the benchmarking of baseline energy use, and verified measurement of the energy use reduction on completion.

One of the defining aspects of a deep retrofit is the consideration of the whole building during project planning to maximize energy savings. Whole building retrofits generate the best overall results, potentially allowing increases in insulation, upgrades to windows and façade materials, and new control systems to reduce the loads on HVAC systems and decrease lighting needs (Liu, et al., 2011). The combination of strategies and the ability to leverage benefits between systems is the primary benefit of proceeding with an integrated energy reduction plan. Relatively easy changes with fast paybacks can be used to offset the higher costs associated with replacing critical equipment or upgrading major assemblies (Lockwood, 2009).

A deep retrofit is considered to work best when planned in tandem with a critical replacement point in a building's lifecycle. At this point the building owner can take advantage of planned capital upgrades or major system replacements to get the best value from the retrofit (Liu, et al., 2011). Opportunities for deep retrofits should also be considered in the event of major occupancy changes, regulatory required upgrades, or sustainable certification. However, the focus of a deep retrofit may differ from that of a certification strategy, where some reduction of energy use is typically required, but the whole building energy reduction may be much lower than 30% from the baseline. Kok, Miller, and Morris (2012) noted that most respondents to a survey on LEED Existing Building retrofit projects indicated that they implemented “low hanging fruit,” such as lighting, HVAC, and water fixtures, with less than 10% addressing insulation or windows. Though this type of strategy addresses the needs of the certification program, it does not use the whole building approach to achieve the more substantial energy reductions associated with deep retrofits.

Commercial Office Towers in the Toronto Financial District

Commercial buildings have been identified as substantial contributors to end-use energy consumption; it follows that cities with a significant inventory of

Exhibit 1 | Energy Intensity by Building Age

The number directly under each column denotes the number of buildings in each age group that exists in Canada in 2009. The source is SDTC (2009).

commercial office tower properties could play a substantial role in the reduction of greenhouse gases and energy use. B+H Architects (2012) identified over 20,000 commercial office buildings above 12 stories in Hong Kong, New York City, and Toronto. They reported that the majority of these buildings were built in the 1960s and 1970s, and many are now approaching a critical component replacement point in their lifecycle. This is supported by data from the SDTC that shows 52% of commercial buildings in Canada were constructed between 1960 and 1989 (SDTC, 2009), with the highest energy use intensity being found in buildings constructed between 1960 and 1969, as shown in Exhibit 1.

A sample of 60 commercial office properties from the downtown Financial District of Toronto gives a targeted picture of construction dates, as shown in Exhibit 2 (A full listing of the buildings sampled is in Appendix A.) As was seen with the national numbers shown in Exhibit 1, the majority of the Financial District towers in the sample were built after 1970.

REALpac (2010) reported similar energy consumption results to those of the STDC. Their results are from a survey of 261 office buildings, with 46% of the sample being located in the Greater Toronto Area. REALpac researched and published commercial office building energy intensity benchmarks as part of their initiative “20x15,” a joint project with the CaGBC promoting a 20% reduction in energy use (against 2010 as a benchmark) by the year 2015. When the project was being developed in 2009, the feedback from property owners and managers was that 20% reduction was an unrealistic target (St. Michael, 2013). The 2010 benchmarking information included area, occupancy, operating hours, and vacancy rates and provided a basis for comparison because the actual regional energy use was normalized for energy intensity and weather (REALpac, 2010). As shown in Exhibit 3 the normalized energy intensity was found to be highest for buildings

Exhibit 2 | Toronto Financial District Building Sample by Construction Date

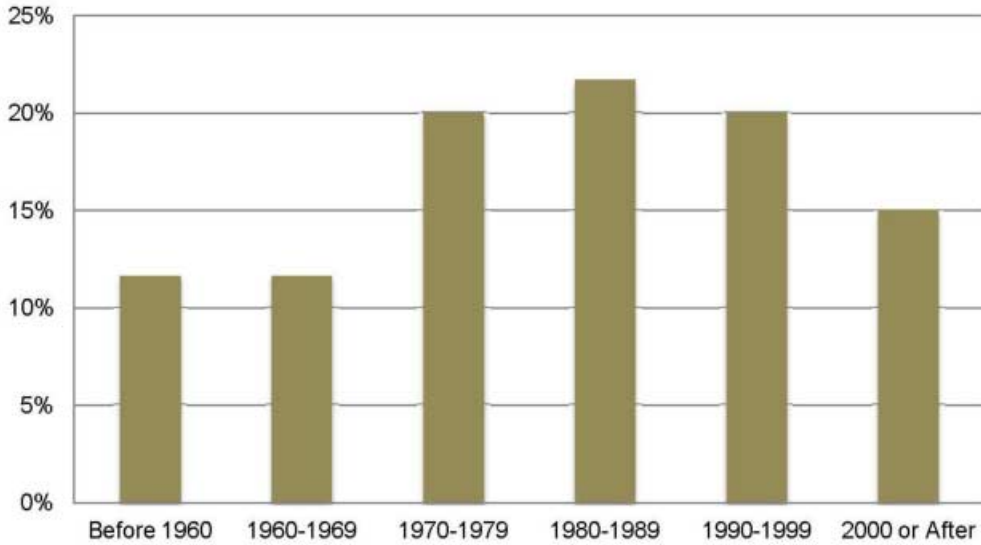
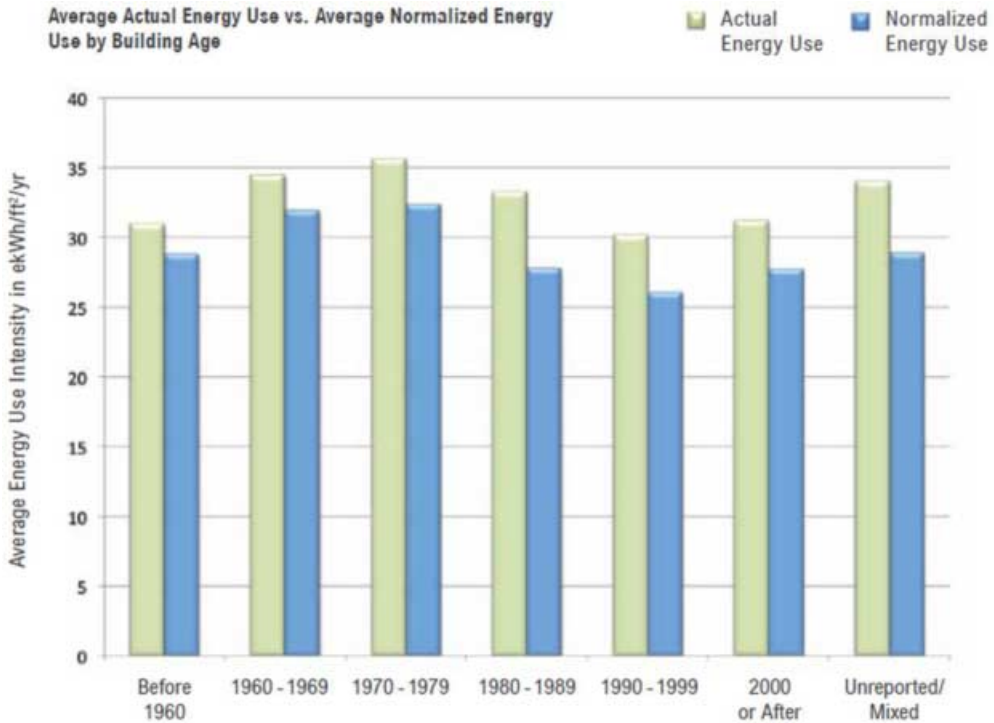


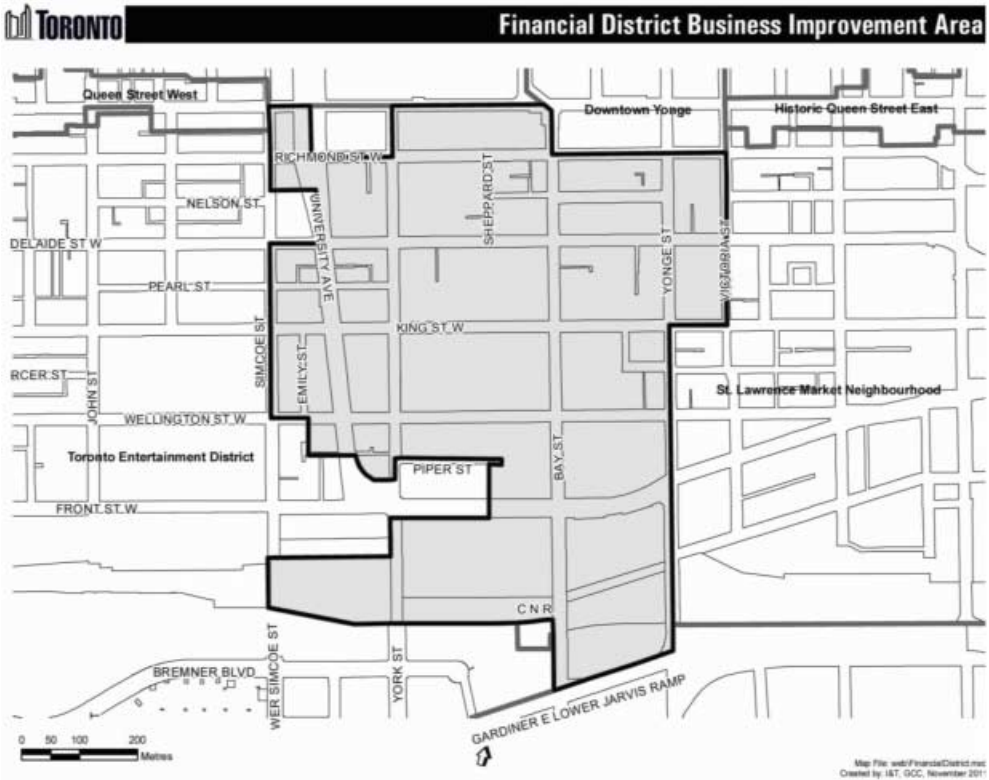
Exhibit 3 | Average Actual & Normalized Energy Use by Building Age



The source is REALpac (2010).



Exhibit 4 | Toronto Financial District Map



Map retrieved from http://www1.toronto.ca/static_files/economic_development_and_culture/docs/BIA_Maps/financialdistrict.pdf.

constructed between 1960 and 1979. The same data set determined the Canadian current national annual normalized energy intensity to be 28.7 ekWh/ft²/yr, which is 13% lower than the average normalized energy intensity for 1970s buildings.

The growing number of commercial office tower properties in the Greater Toronto Area that are reaching a typical major renewal age makes the region a potential Canadian hub for achieving energy reductions through deep retrofits. Commercial office buildings in the Toronto region are responsible for consuming 37% of the region’s electricity, 17% of the natural gas, and generate approximately 20% of the total carbon emissions (Geller, 2011). The greatest density of these buildings is located in the downtown Financial District (Exhibit 4).

The “Toronto Skyline” represents the downtown prime commercial real estate market, with many of the office towers defined as Class AAA (Johansson, 2012). These Class AAA towers provide high material quality common spaces and access to transit or services, and command a rental rate threshold of \$25 per square foot,

with many charging \$30+ per square foot. As reported by real estate specialist company Jones Lang LaSalle, the Skyline market in 2012 consisted of 18 buildings, including landmark properties such as First Canadian Place, TD Centre, Scotia Plaza, and Royal Bank Plaza. The recent construction of new commercial towers has added competition to the Skyline market, with 2.2 million square feet of commercial space completed between 2009 and 2011, and another 1.6 million square feet to be completed by 2015.

On average, the new Toronto commercial towers have a 15% lower operating and maintenance cost compared to a Financial District benchmark (Johansson, 2012). In addition, sustainable certification has become standard for new construction, with many of the buildings featuring LEED or BOMA BEST certification, state-of-the-art technology, and enhanced occupant comforts such as increased daylighting. Aging assemblies and systems, along with competition from new Class AAA tower construction, are generating pressure on mature commercial towers in the Financial District to undergo facility revitalization for tenant retention and maintenance of property value.

Drivers for Deep Retrofits

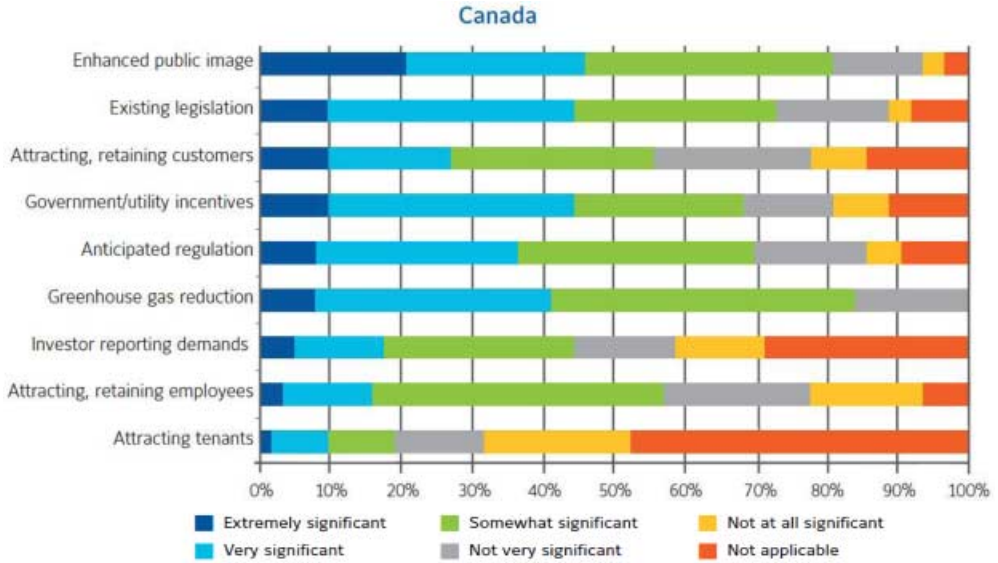
Significant research and analysis have been devoted to the identification of the drivers most likely to result in energy use reduction. While there is no consensus on the key driver(s), a commercial properties survey report by Smith and Lane (2011) indicated that 80% of Canadian respondents considered cost savings to be the primary driver to reduce energy use. Respondents also placed a high value on enhanced public image and existing legislation when deciding to implement energy reduction projects. The key Canadian influences on company decisions resulting in energy efficiency decisions from the IBE survey are shown in Exhibit 5.

Other research has indicated that many Canadian commercial property managers consider reduced operational cost savings and increased asset value through reduced operational costs to be primary drivers for deep retrofits (Smith and Lane, 2011). Other primary drivers such as brand equity and tenant retention are not items that directly translate into accounting statements, although they do impact the overall financial value of a project.

When asked to give their thoughts on drivers for deep retrofits, the first response from research interviewees trended to two key considerations: tenant retention (meeting tenant demands and decreasing competition from new construction) and organizational values (particularly senior leadership on sustainability strategies). Tenants with strong corporate social responsibility (CSR) requirements, such as the Royal Bank of Canada (RBC), are demanding green building office space (Ouellette, 2013).

The 2009 survey from CoreNet Global and Jones Lang LaSalle, as referenced in a study for REALpac by Jantzi Sustainalytics, indicated that 70% of 231 commercial facility executives considered sustainability to be a “critical business issue today” (MacMahon, 2010). The Jantzi study noted that although 18

Exhibit 5 | Significant Influencers on Organizational Energy Efficiency Decisions



The source is Smith and Lane (2011).

Canadian real estate companies participated in the benchmarking for the study, only four had published sustainability reports: Brookfield Properties, Oxford Properties, First Capital Realty, and SITQ.

Enhanced public image or brand equity as a primary driver was also recognized by a number of the interviewed experts, who noted that property management companies and real estate investment trusts (REITs) not only have recognized the value of sustainability to their brand marketing, but tend to be competitors in their operational strategies. Demonstrating industry leadership or operational firsts adds value to the brand and differentiates a company from its competition.

The fourth driver trend that emerged from the expert interviews is the increase in asset value through reduced operational costs. Love (2012) on behalf of the Energy Services Association of Canada indicated that major energy efficiency retrofits have an annual average return on investment (ROI) of approximately 22%, with a less than 10% rating on the risk index. Retrofits also have the potential to increase profits by 35% from reductions in operating costs, reduced recruiting costs, increased productivity, and brand equity benefits. Some of the potential for increased asset value comes from capital rate gains, while other financial benefits may be less directly linked. As an example, the retrofit project at First Canadian Place allowed the building management to hold the rent rate at under \$30/square foot (McQueen, 2013). A number of studies from the United States and Canada support the potential financial benefits for deep retrofits, although the financial benefits are often placed on hold or passed over due to project barriers, such as project size or complexity (Katz, 2013).

The combination of aging facilities and increased competition from new construction is potentially creating an ideal environment in the Toronto Financial District for the implementation of deep retrofits. The conditions of the commercial real estate market in this district correspond to three categories of drivers for retrofit projects: (1) physical drivers including lifecycle replacement, reduced risks associated with failing assemblies or systems, and the need for increased energy efficiency (B+H Architects, 2012); (2) financial drivers including tenant retention, property value, office classification, and brand equity; and (3) environmental drivers such as tenant demands, CSR reporting, and investment, occupant productivity, or regulatory changes. These three categories of drivers do not specifically lend themselves to pursuing energy use reductions of 30% or greater from the baseline as a target goal of the retrofit project, although they can contribute during the initial evaluation and decision-making process to the inclusion of projects in the retrofit that may result in significant energy use reductions.

Given the importance of environmental drivers, strategies to enhance their effectiveness are crucial in exploiting the potential of Toronto's Financial District to become a leader in commercial tower energy use reduction. Currently, CSR reporting and investment are key drivers in energy reduction programs, and the research indicates that CSR programs run by managers and major tenants of the towers are having an impact on energy conservation programs. As well, CSR requirements are a driver for tenants, who are demanding sustainable office space. For example, the Toronto Dominion (TD) Bank has a commitment to become carbon neutral and, while their current strategy includes using carbon offsets to achieve this goal, there is a shifting focus towards increased use of reduction strategies (Love, 2013). At the TD Centre (a Cadillac Fairview property) building management has incentivized goals at a corporate level, which are annualized per property, including energy use targets, energy reduction planning, and energy management programs (Hoffman, 2013a).

Similarly, Oxford Properties is working to align its sustainability objectives to support the increasing CSR requirements of their tenants (Oxford Properties, 2013). In addition to annual energy reduction targets and internal sustainability strategies, Oxford is working towards the implementation of green leases for all new office or retail tenants and establishing joint landlord-tenant engagement teams across their portfolio by the end of 2013.

Civic programs can also promote energy reduction. The "Race to Reduce" was started by CivicAction in 2011 as a challenge to reduce total building energy use by 10% over four years (Geller, 2011). It is a program that capitalizes on public image as a driver that reaches both landlords and tenants.

The literature and interviewees acknowledge the importance of regulatory or voluntary schemes that require or encourage standardized energy usage and CSR information to be made available to tenants, building owners, and the public. In Canada, CSR and energy reporting are relatively new activities within the real estate industry (Neate, 2013). Management companies are evolving in their integration of sustainable practices in the real estate investment market. In the

GRESB (2012) report, the majority of respondents who were collecting and reporting energy use data reported on less than 50% of their portfolio, and only 8% of respondents were able to obtain data on tenant energy use. Furthermore, only 32% had developed a sustainability performance plan with defined energy use reduction targets. These statistics indicate that CSR reporting may not be fully capturing energy reduction strategies, but note a promising trend as sustainability reporting on energy use numbers for 2012 had increased from previous years.

The GRESB (2012) report also recognized the importance of organizational values, noting that 70% of respondents surveyed considered sustainability to be the responsibility of senior management. According to the report, regular and frequent updates to the executives are an essential aid to accurate and timely decision making on sustainability. However, 12% of respondents only provided annual updates and another 17% provided no updates at all. For a property company or REIT to fully realize performance and operational financial benefits, there needs to be a sustainability vision and corporate strategy with targets and performance goals.

There is support in the literature, and among a number of the interviewees, for standardized commercial building energy use labelling. Five of the interviewees felt that building labelling of energy use could capitalize on concerns about brand equity and public image. In addition, the creation of a publicly accessible benchmarking and labelling standard would allow for office property comparison, increase transparency, and permit facility managers to see how their buildings perform against a defined benchmark or other neighboring properties (Theaker, 2013). This strategy could also act as a driver by giving tenants a metric by which to assess office lease options or apply to internal CSR goals and potentially become part of the standard due diligence when considering lease contracts.

An easily accessible national database for commercial buildings would represent significant movement towards the goal of increased transparency and benchmarking and would give building owners an opportunity to self-manage (Stoate, 2013). Currently, a number of individual professional organizations have started their own databases, with various levels of participation and accessibility. Cooperation between these professional groups to create a single body of knowledge would encourage and support the commercial real estate industry to pursue national benchmarking. Increased access to case studies, best practices, and lessons learned from all sectors of the industry would also improve peer-to-peer networking while building knowledge for owners and tenants. Finally, the introduction of a federal program of mandatory labelling would allow for consistency and equality across national real estate portfolios, making it easier for all stakeholders to evaluate properties.

Barriers to Deep Retrofits

As discussed in the previous section, the barriers to deep retrofits can be classified as financial, physical (including operations), and environmental. Although each retrofit project is unique with specific concerns and restraints, an analysis of the Toronto commercial property market indicates that competition for capital funds

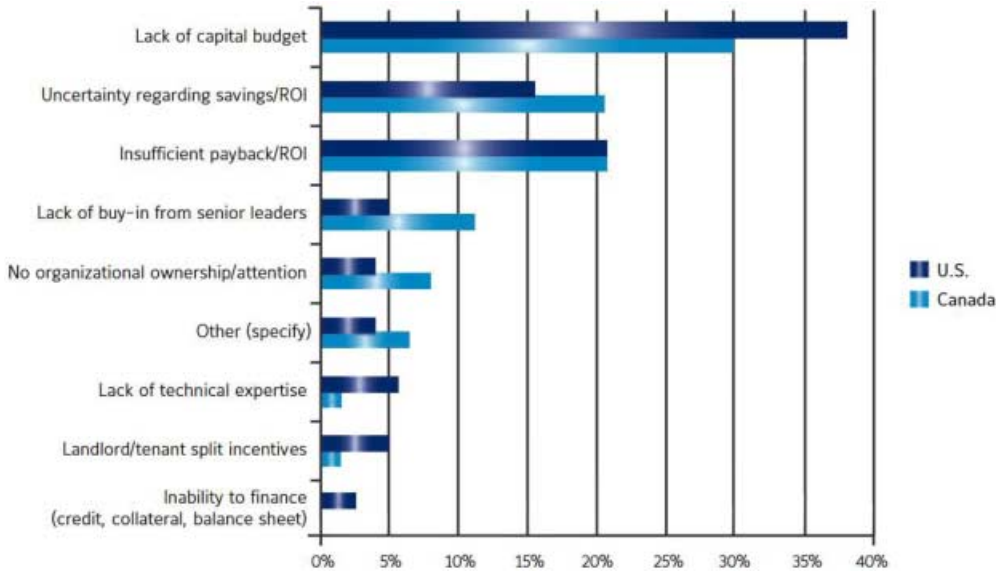
and expectations for ROI, operational challenges, and executive buy-in are the four primary barriers associated with deep retrofits. These barriers must be addressed in order to meet the business needs of the occupants, management, and investors and to promote the goal of a 30% energy use reduction through whole building retrofits.

The low cost of energy was noted by a number of interviewees as being a fundamental issue in creating a weak fiscal connection with energy reductions. Government subsidies and the pricing model for energy in Canada makes energy relatively cheap (Theaker, 2013), and, with a typical lease structure in the commercial market, the energy use for common spaces and base systems only represents 15% of the overall operating costs (Hoffman, 2013a). The effect of the low cost of energy was clearly seen in the U.S. when, in 2008, an energy price spike increased the appeal of energy reduction to the U.S. commercial market (White, 2010). Uncertainty in the energy market also makes it difficult to produce accurate cost analysis over a longer period of time. Without a stable model for energy pricing, and increases to the overall cost of energy, energy will continue to be a secondary consideration for building retrofits (Lockwood, 2009).

Finances currently present one of the most significant barriers to deep retrofits. The traditional business model, which evaluates project viability on simple payback and competitive ROI calculations, does not readily support the slower returns and large initial costs associated with deep retrofits. Love (2012) reports that the key indicators for decision making on energy reduction retrofits shows capital availability, payback or ROI, project ownership, and split incentives as the top four barriers to deep retrofits. Smith and Lane (2011) report that key findings specific to Canada in 2010 survey indicate that “20% of respondents identified uncertainty around the savings or economics of projects as the top barriers limited by difficulty in finding projects with reliable results and acceptable levels of risk,” and 18% indicated a lack of buy in or internal champions for more energy efficiency projects. As illustrated in Exhibit 6, 30% of Canadian companies surveyed list the lack of capital budget as the primary barrier to deep retrofits (Smith and Lane, 2011). B+H Architects (2012) found that fewer than 20% of building owners used banks to finance retrofits, with most green retrofits funded by operational revenues. In another study evaluating the financial value of deep retrofits, competition for capital funds and low ROI were determined to be primary barriers to pursuing 30% or greater whole building energy use reduction as a key goal (Smith and Lane, 2011). These latter studies confirm the interviewees’ experience, which is that the key financial barriers for deep retrofits in the current environment are competition for capital and low ROI, not lack of capital.

Although the lowest cost way to borrow is to re-mortgage and use the equity, the traditional business case may not support using borrowed equity for retrofits when it could be invested in a higher value project, such as buying a new building. Specific to Canadian real estate investment market, there is a new trend since the 2008 recession for REITs to focus on acquiring U.S. properties for investment or resale purposes as a way to maximize on investment (Theaker, 2013).

Other financial barriers such as split incentives, uncertainty in returns, leasing terms, and low energy costs act as disincentives when assessing the business case

Exhibit 6 | Top Barriers to Decisions on Energy Efficiency

The source is Smith and Lane (2011).

for deep retrofits. Commercial office towers function as a valuable asset for the owner or management company. Their first obligation in decision making is to generate value for invested shareholders (Katz, 2013). The effect of split incentive was also noted by Kok, Miller, and Morris (2012), who observed that LEED-certified buildings that were energy efficient may have more energy savings than reported, but did not count those savings as they were accrued by the tenants.

Competition for capital is directly linked to the second key financial barrier: lack of ROI or payback. Expectations for ROI are determined internally to meet the requirements of the individual companies. Although these values can vary substantially, Lockwood (2009) found that 50% of commercial buildings require a simple payback of three years or better. A 10%–15% energy use reduction is more common for typical retrofit projects, and such an investment is more likely to achieve a payback in less than five years (Love, 2013). Therefore, capital projects or acquisitions that offer higher and faster ROI will often be cherry-picked over more complicated deep retrofits with a slower return (Sweatman and Managan, 2010). How the value of a deep retrofit project is assessed and the parameters for the business case are strongly related to the corporate vision and values of the management company (Smith and Lane, 2011).

Real estate investment is a business equation with the balance resting on how business wants to spend its capital resources. Preference is usually given to projects with a high ROI (Ouellette, 2013). Most deep retrofit projects have a 5–10 year payback, making capital investments in a new building more attractive for REITs and other investors. As well, investing in a new building is more

familiar for property management companies, and there is less uncertainty about planning and outcomes. Because financial drivers and barriers are so integral to the decision-making process for deep retrofits, it is necessary to examine in greater detail the market conditions and business factors that impact the financial viability of deep retrofits for commercial office towers in Toronto's Financial District.

Michael Barker, President of Hope Beckwith Group, suggested that one must look at the asset class of the building, assess the options of borrowing versus equity, and then determine the impact on obtaining rents (Barker, 2013). If the property is older, with a high vacancy rate, and is located in a desirable urban area, a deep retrofit project makes sense as an option to raise the asset class and attract new tenants. As the common gross effective rent is usually a combination of the lease cost and cost of use, reducing operating cost while maintaining gross rent will provide an increased profit for the building owner.

In the current economic climate there is a high level of debt capital loans available from banks and lending institutions. However, as much as 50%–75% of the loan rate may be based on the lease values, making it more difficult for a building with high vacancy to obtain favorable external financing (Barker, 2013). Upgrades to the building classification favor larger retrofit projects: an average urban district Class A tower is approximately \$400–\$500 per square foot in construction (hard), soft, and land costs or \$250–\$300 per square foot in hard costs. In comparison, deep retrofits are estimated to cost \$50–\$100 less than a new build. A successful financial case can be made for a deep retrofit in this scenario, particularly if there are no tenants or a low tenancy rate. If the building has tenants they must be relocated, or the cost of retrofit will increase due to such factors as premiums for late night work, and possible rent reductions or concessions for the duration of the project.

Another consideration when looking at the commercial office tower market is the nature of the ownership (Stoate, 2013). Common legal ownership arrangements include owner/operator, REITs, and property management companies. Each arrangement has its own specific economics, and usually an obligation to provide a reasonable return on investment to shareholders. However, all ownership arrangements benefit from a reduction of net operating costs: the reduction fundamentally increases the asset cap rate (which is expressed as a percentage of net operating income divided by the purchase price), and therefore increases the profitability of the building asset for the owner. A better cap rate translates into better loan terms and tends to extend the simple payback period that will still meet lender terms (Wisdom, 2012). A successful deep retrofit, where the estimated operating cost savings are achieved, will increase the owner's equity and improve the value of the building for refinance or sale.

The potential to increase property class, tenant attraction, and equity value are all additional financial benefits to deep retrofits. Not only are these potential outcomes beneficial to assessing the value of targeting energy cost reductions, but they also assist in addressing competition for capital and lower ROI. While most retrofits maintain or add to the physical value of the building, a deep retrofit adds to the value of the building and reduces the gross operating costs, leading to an improved

stabilized baseline value (Wisdom, 2012). When assessing the cost of a deep retrofit against competing projects with a faster payback, the doubled value associated with energy use cost reductions may assist in presenting the financial case to executive management. The move from simple payback and discounted cash flow to a total value model of analysis can provide the needed motivation for decision makers (New Buildings Institute, 2013).

While deep retrofits can show a positive ROI, it is often difficult to attain the commitment to the funding levels needed for whole building renewal and increased energy reduction goals (Tower Renewal Office, 2011). To maintain cash flow and reduce the burden on capital or operating budgets, external funding can assist in a building owner's ability to manage the initial costs of a deep retrofit. In examining financial models for deep retrofits, the Clinton Climate Initiative found that many financiers were uncertain of how to approach energy efficiency projects as an investment (Henderson, 2011). Lenders need security of repayment, standardization, and scalable investment opportunities. Uncertainty related to retrofit outcomes and future energy prices increase the risk associated with funding these types of projects.

In both the literature and interviews, two financing models are promoted as the means for funding deep retrofit projects, managing risk, and ensuring security of repayment: Property-Assessed Clean Energy (PACE) bonds and energy performance contracting. PACE funding is based on a municipality (or potentially a utility) providing the loan for retrofit projects with an energy reduction target above a specific level (Henderson, 2011). The loans are repaid over a longer term, typically 20 years, via an assessment on the building property tax or the utility bill. Under the terms of this kind of contract, the energy use cost savings pay for the loan and the payments transfer with the sale of the asset. As a condition of this type of financing, the PACE loan becomes senior to all other existing liens.

Under the pilot projects in the U.S., the benefits of PACE funding include providing security for the investments by removing the initial cost barriers (Henderson, 2011). As well, where the property tax assessments qualify as a pass-through expense, concerns about split incentives were reduced. Split incentive refers to the circumstance where the building owner bears the cost of the retrofit but the tenant gains the majority of the benefit associated with lower operating costs. By qualifying the tax assessment as a pass-through expense, the building owner can regain the costs through the common gross effective rent and the tenant still gains from reduced space metered utility charges.

In the U.S., PACE funding models have been piloted by utilities in Connecticut and California (Smith and Bell, 2011). The Tower Renewal Corporation (TRC) in Toronto is looking at this option for deep retrofits for residential tower properties as it would allow building owners to invest in their buildings without borrowing against their mortgages or reducing equity (Tower Renewal Office, 2011).

However, for this model to be used in Toronto, changes would be required to Ontario Regulation 594/06, which governs the creation of priority liens and property tax bill additions, and assigns the municipal assessment tax with priority

lien status (Tower Renewal Office, 2011). The bank or mortgage holder has priority charge on the asset and will not welcome external encumbrances of relatively low value that could jeopardize the value of the building asset (Barker, 2013).

The second financial model, energy performance contract, centers on an energy service company (ESCO) or private contracting company carrying the design, financing, and implementation of the deep retrofit (White, 2010). The performance contract is repaid over a set period of time (typically 10 years) from energy use cost savings. The company that implements the improvements guarantees the savings on energy consumption and operations performance, which greatly reduces the risk for the building owner. ESCO acts as the team manager who collaborates with the owner, carries the most majority of risk, and provides capital and resources (Love, 2013). ESCO also provides the expertise and processes to deliver successful project outcomes. An additional advantage is that the model gives the building owner a single point of contact; if something goes wrong, the building owner does not have to chase after multiple contractors or spend time trying to identify the source of concerns. In Canada, energy performance contracts have primarily been implemented for MUSH (municipal/university/school/hospital) projects (Love, 2013). The contract model transfers the financial burden, the risk, and the technical expertise requirements to ESCO, which has been very attractive for institutional and government clients.

In buildings that operate on a triple net lease contract model, long-term anchor tenants could be the contracting agent to ESCO, using the guaranteed savings to lower lease costs and obtain additional financial gains (White, 2010). In an anchor tenant financing scenario, the building owner also benefits from building upgrades, which modernizes the facility and improves the asset value. The contract term can also be extended, so that guaranteed energy savings can be used to finance non-energy deferred priority maintenance projects.

Energy performance contracts have been in Canadian use since 1993, with over 90% of the market being represented by the eight founding ESCOs, which make up the Energy Services Association of Canada (Love, 2012). To date, very few commercial office projects in Canada have been completed with energy performance contracts, although the Toronto Atmospheric Fund (TAF) is now providing energy performance contracts for the smaller commercial market (Stoate, 2013). Tim Stoate, the Vice President of Impact Investing at TAF, emphasizes the high level of expertise that is required to successfully enter into this type of contract, which is usually detailed and extensive due to the transfer of risk to the contracting party. TAF only contracts with clients who have a very strong financial position. As a result, TAF does not place a lien against the property mortgage, which negates the issue of encumbrance on the primary mortgage holder.

Although the literature review on barriers for deep retrofits does not indicate that physical or operational barriers are primary disincentives, interview responses often referenced them as the primary limiting factor to retrofit activities. In particular, disruption to tenants becomes a key consideration when assessing the

financial and environmental barriers. Simply put, according to the interviewees, the primary barrier to a deep retrofit is operational in nature.

A comprehensive whole building retrofit will not happen if the project requires vacancy because it is too difficult to move tenants and the risk of losing a tenant is too high. As retrofits usually occur while the building is occupied, there is a need for minimal tenant disruption. Activities deemed too disruptive to tenants, either due to noise or reduced access, cannot be pursued without strategies for tenant cooperation. In the case of the First Canadian Place retrofit, the glazing was not replaced as it was deemed too disruptive to the tenants, thereby limiting the opportunity for increased daylighting (McQueen, 2013). The TD Centre retrofit had labor crews removing perimeter office furniture and replacing it exactly each night as part of their glazing replacement plan (Knifton, 2011).

Both the interviews and the literature acknowledge the effect of physical barriers on a retrofit project. In addition to size, each building is uniquely structured and clad and presents new challenges for each retrofit project (B+H Architects, 2012). However, the physical concerns are not the primary barriers to deep retrofits, possibly because most retrofit projects are initiated in response to a need to replace or revitalize building systems and assemblies. Most envelop retrofits are driven by end of lifecycle, system failure, and tenant loss (Theaker, 2013). The owner is looking at the potential for lost revenue as a reason to initiate the retrofit and energy savings are a secondary bonus.

There are also post-retrofit challenges: the tenants need to understand the “how and why” of new operations, while building operators need training to use new technologies correctly (Lockwood, 2009). Many buildings with advanced technology have poor energy performance because the operators often use overrides to make the systems manageable.

Lockwood (2009) reports that lack of corporate or executive buy-in is the fourth largest barrier referenced by Canadian respondents. To overcome many of the perceived financial barriers, the executive management must fully recognize the potential benefits of significant operational savings. Business environmental issues related to low awareness, lack of knowledge on financing options, and traditional short-term investment criteria are contributing factors to reduced management support (Sweatman and Managan, 2010). Having strong policies and strategies for corporate sustainability, with clear reporting and assessment tools, is vital to driving energy efficiency performance (GRESB, 2012).

The impact of corporate buy-in is addressed by many of the interviewees, with 60% identifying corporate culture or executive support as the largest barrier (and potential driver) after competition for capital funds. The current executive inclination is to pursue projects with the fastest completion time and highest returns, with limited interest in pursuing energy reductions (Stoate, 2013). The reasons to pursue a retrofit are often not based on technical considerations but rather on the values of the company, where the value of a project is related to financial projections, social status, and competition (Theaker, 2013). In addition, the building manager may not be allocated extra time and resources for major

retrofits, if facility management is under-resourced then a deep retrofit means additional work and stress.

A building management company looking at a whole building retrofit must have the whole company behind the project and corporate commitment and executive buy-in is an essential component to the project's success (St. Michael, 2013). There is a difference between belief and commitment, with a full building retrofit requiring a leap-of-faith and an analysis of the full project in light of the corporate vision and goals. If the executive management fully supports the goals of a deep retrofit, then the primary drivers for deep retrofits will be more likely to bridge the operational, financial, and environmental barriers.

Toronto Financial District Retrofit Case Studies

Case Study 1: TD Centre

The Toronto-Dominion (TD) Centre is a Class AAA collection of six striking modern black office towers. Gathered on a seven-acre site, the TD Centre also includes the TD Pavilion, multiple courtyards, and an extensive underground retail concourse, which is part of the Toronto PATH system (Cadillac Fairview, 2012). The original three towers were designed by architect Mies van der Rohe, including the 56 story TD Bank Tower (66 Wellington St. West), which opened in 1967, 46 story Royal Trust Tower (77 King St. West Tower), which opened in 1969, and the Canadian Pacific Building (100 Wellington St. West), which opened in 1973. The other buildings were added over the next two decades, ending with the 95 Wellington Street tower, which was constructed in 1986 but purchased as part of TD Centre in 1997. The original towers are defined by sleek black steel and glass façades and clean modern interior common areas (Exhibit 7). They are unique structures that were designated as heritage buildings under the Ontario Heritage Act in 2003 (B+H Architects, 2012). This designation not only recognizes the importance of the buildings to the architectural fabric of Toronto's Financial District, but also restricts changes that would impact the historical preservation of the towers.

In 2010, a \$110,000,000 capital revitalization project was initiated by owner Cadillac Fairview Corporation for the Royal Trust Tower and TD Bank Tower (Cadillac Fairview, 2010). An envelope and systems retrofit project is part of an overall revitalization plan, designed to refresh the original architecture, enhance the public spaces, and provide upgrades to the retail levels. Physical aspects (B+H Architects, 2012) of the project include: (1) replacement of 5,676 windows (now double-paned with low e-glazing); (2) repainting of the steel façade; (3) elevator replacement; (4) new waterproofing under the plaza; (5) upgrades to controls; (6) improved fan efficiency; (7) full renewal of the lobby areas; (8) replacement of the lighting systems, (9) installation of roller blinds; and (10) changes to the perimeter induction units. Energy management consultants, Duke Solutions Inc., forecasts savings of \$5,000,000 annually through energy cost reductions garnered from the upgrades to elevators, HVAC systems, and lighting systems (TowerWise,

Exhibit 7 | TD Centre



2012). The Duke energy management section of the project has a project cost of \$33,000,000, with a payback period of 6.5 years.

In tandem with the physical changes, both buildings have been LEED Existing Building (LEED EB) Gold Certified and BOMA BEST Level 3 certifications

(Cadillac Fairview, 2010). Further sustainable strategies are addressed by the TD Centre's "Green at Work" program, which targets annual reductions of energy consumption for a total of 15% by 2014 from the 2008 baseline, enrollment in the "Race to Reduce" challenge, and a custom occupant engagement program developed by HOK to help the tenants partake in energy reduction programs. The central component of the engagement program is the TDC Green Portal, which allows tenants to see how the buildings are performing in real time, learn about annual energy and cost savings, and access data specific to their own office space. The overall revitalization plan follows upon previous Cadillac Fairview initiatives, such as the early adoption of deep lake cooling in 2004, the largest project of its kind when implemented, which allowed for a 90% reduction in the energy required for running chiller systems. In their public documentation on sustainability, Cadillac Fairview cites the drivers for the 2010 retrofits as tenant expectations, community responsibility, and current industry practices, with the results building on the TD Centre brand for uncompromising success.

David Hoffman, TD Centre's Building Manager, described the primary drivers for the 2010 retrofit project as tenant demand and tenant retention planning, in part due to competition from the new Class AAA properties opening in the Financial District (Hoffman, 2013a). Energy reduction was not a primary decision driver for the project but it was one of the considerations. With the loss of a major tenant, opening up 17 floors in the Royal Trust Tower, there was an additional opportunity to replace existing perimeter floor level induction heating systems with more efficient ceiling-based systems. However, the induction replacement is only being completed on floors that are completely vacant, otherwise it would be too disruptive to the tenants and major space upgrades are not performed mid-lease.

Hoffman (2013b) notes that over the past 3–4 years, sustainability has become part of the corporate culture, both internally and for tenants. As part of this trend, the management policy for TD Centre drives sustainable initiatives by mandating that environmental considerations must be part of all business cases, setting annual energy reduction targets, and implementing sustainability targets as part of the management's incentive program. Using 2008 operations as the benchmark, there is a mandate to reduce energy use by 3% every year, with an expected 20% reduction overall by 2015. TD Centre is on target to meet the mandate and is currently exceeding its targets year to year.

The first TDC Sustainability Report (2013) indicates that energy was reduced from the 2008 baseline by 14% in 2011, with energy savings close to \$1.8 million; the TDC Green Portal shows an 18% reduction was achieved by early 2013 (Race To Reduce, 2012). A key initiative for TD Centre to reduce energy consumption is the tenant engagement program. Every tenant space now has its own submeter providing tenants with a tool to monitor their specific energy use through the TDC Green Portal dashboard. This allows the tenants to better understand the impacts of turning off lights or installing more energy efficient equipment within individual offices. The program also helps tenants meet their internal CSR requirements and increases tenant buy-in for ongoing building initiatives.

With regard to barriers, Hoffman (2013a) indicates that energy reduction goals have to meet the needs of the business. For example, the recharge rate for

operational costs (including utilities) is generated from metered loads and a portion of the common areas. If the building management paid for energy reduction projects, the tenant would benefit through reduced operations charges, and the building management would have to recoup the costs through additional charge-backs to the tenants. As noted earlier, the split incentive created by the operator/tenant lease contracts can make it difficult to justify increased energy reduction targets. Another potential issue is the inherent difficulty with implementing a clean energy management plan, which requires extensive long-term planning and a highly dedicated interdisciplinary team. In the TD Centre retrofit project, the facility management team was able to engage the assistance of the corporate development team due to the size of the project; however, not every management team would have that level of project support.

While the TD Centre retrofit does not meet the 30% energy use reduction criteria of a deep retrofit, it is likely to be close to 25% less than the 2008 baseline by the end of 2014 (Hoffman, 2013a). As one of the largest retrofit projects of its kind in Canada, the TD Centre leads by example in tenant engagement and the inclusion of energy efficiency targets for management. Going forward, Hoffman suggests that increased reporting could be a beneficial driver for encouraging both owners and landlords, potentially mandating CRS by property instead of aggregated at the corporate portfolio level. Increased visibility and data sharing through a public forum such as real-time sustainability dashboards will help tenants drive the demand for energy-efficient office space.

Case Study 2: First Canadian Place

First Canadian Place (FCP), owned by Brookfield Properties Corporation, is the tallest standing office tower in Canada (B+H Architects, 2012). Established in 1975, the 3,468,610 square foot Class AAA building stands 72 stories. It is a modern white clad landmark in Toronto's Financial District. The original construction was one of the first to include structural tube steel and advanced HVAC systems. In 2009, Brookfield initiated a retrofit project for FCP with the primary purpose of replacing the 45,000 marble façade panels with 5,600 fritted glass panels (Exhibit 8). The goal of the retrofit was to rejuvenate and reinforce the status of the iconic building, redefining it as a premier business location in Canada (B+H Architects, 2012).

Starting from the top, a uniquely designed elevated exterior platform system was used to remove and replace the façade panels. With 80 workers, it averaged 3 days per floor to replace the panels using an elevated platform to work their way down each side of the building. It is estimated that 1.3 million man hours were saved by using advanced building technologies, allowing the complete retrofit to be completed in 1.5 years from initial construction. Along with the enormous task of replacing the facade panels (B+H Architects, 2012), the retrofit project included: (1) new heat recovery chillers; (2) recovery of heat from existing cooling systems and domestic hot water; (3) washroom exhaust heat recovery and low flow fixtures; (4) new high efficiency condensing boilers; (5) retrofit and recalibration of the perimeter induction systems; (6) improved systems controls;

Exhibit 8 | First Canadian Place



(7) variable frequency drives for HVAC system and pumps; and (8) complete renovation of the lobbies and retail areas including water features.

As part of their sustainable initiatives for the retrofit, FCP targeted LEED EB Gold, receiving certification in 2012, and Honorable Mention for Innovative Technology in the Zerofootprint Awards (B+H Architects, 2012). The new glass panels were locally sourced and all of the original marble was either reused in other areas of the building or recycled through local construction projects.

Mechanical and electrical upgrades had a \$17,000,000 project cost and estimated annual savings of \$113,000 with a 9.7 year payback (TowerWise, 2012). In addition to the energy savings estimated from systems upgrades, Brookfield enrolled the property in a demand response charge reduction program with the Ontario Power Generation (OPG), which allows the energy provider to increase the office floor temperature from 24°C to 26°C and reduce lighting when peak energy demands are too high (B+H Architects, 2012). It is estimated that Brookfield will save an overall 20% in annual energy consumption or \$1,800,000 per year through the retrofit, commissioning, and tenant energy management initiatives (Geller, 2011).

Along with their anchor tenant, BMO Financial Group, Brookfield has committed FCP to the “Race to Reduce,” targeting a 10% reduction in whole building energy use by 2014. Key benefits expected to arise from the retrofit project and subsequent initiatives include increased productivity, renewed brand equity, and reduced operational costs.

As a director on the leasing side of Brookfield Corporate Real Estate, interviewee Rosalind McQueen was not part of the decision-making team for the FCP retrofit but she confirms that the successful results of the retrofit project impacts the relationship with existing and perspective tenants (McQueen, 2013).

One of the primary drivers for the façade replacement was the deteriorating condition of the existing marble panels (McQueen, 2013). Two marble panels had come loose from the building and fallen to the ground, creating a substantial risk for the property. Following this occurrence, a very high operational cost was associated for assessing weakness in the façade. Of the 45,000 panels, 1 in 8 was found to be in need of replacement. Where older panels had been replaced with new marble it created a “patchwork” appearance and the associated costs of testing and replacement were not being charged back to the tenants. The retrofit costs were financed internally through the operational budget, in part from savings on annual panel testing and replacement, and these costs were not passed on to tenants.

At the time the decision was made to replace the façade, there were 10 vacant floors, which allowed for additional retrofit activities such as washroom and controls upgrades in those spaces (McQueen, 2013). The decision to pursue LEED certification and some of the retrofit goals were related to the new standards for Class AAA buildings, driven by tenant CSR requirements and competition from new office towers. McQueen confirms that tenants now have an expectation that office space of this rating have LEED certification and have documented sustainable initiatives. One of the immediate benefits of the operational cost reductions was the ability for Brookfield to hold the additional rent rate at just \$29.40 per square foot from 2012. Having a rent under \$30 for a bank tower has very beneficial optics for tenants, and indicates a commitment for creating the best value in the “newest” new building in the Financial District.

The noise and disruption from the façade replacement was challenging for the tenants (McQueen, 2013). As the retrofit was implemented from the top down,

the vacant 58th floor was placed into service as a designated “quiet floor” that all tenants could use as a guaranteed quiet work or meeting space at no additional charge. Operational disruption was a barrier to more comprehensive retrofit activities; for example, the vision glazing was not replaced as that was deemed too difficult for the tenants. Similar to the TD Centre project, intrusive changes were not made to occupied office spaces both to minimize disruption and because upgrades are not typically implemented mid-lease.

While reduced energy consumption was a consideration as part of the retrofit planning, McQueen did not think it was a major driver. From a lease management perspective most tenants do not ask about energy use (McQueen, 2013). In her experience, price, views, and durability are the key decision-making properties that determine office space selection, with tenants taking a checklist from new building stock to compare against existing office space.

As a single whole building project, the projected 20% reduction in energy consumption does not meet the deep retrofit criteria. Additional energy savings from ongoing tenant engagement programs may eventually bring the energy use down 30% from the 2009 baseline and office renovations will continue as spaces turnover occupancy. However, the project was primarily intended to address structural safety, revitalize the building, and promote tenant retention. The project did excel at many sustainable strategies, particularly related to innovative construction practices, and clearly demonstrates the growing importance of sustainability to tenant retention and attraction.

Case Study 3: State Street Financial

Originally constructed in 1959 as the headquarters for Revenue Canada, the 30 Adelaide Street East building was innovative for its time with a full curtain wall façade, an open access atrium, and two tower connection bridges (Curtner, 2013). After sitting vacant for two years, Dundee Realty and ING Realty Partners purchased the building in the 1999 at \$30 per square foot for redevelopment (DREAM, 2011). The complete renovation of the building, including replacement of the façade and mechanical systems, was completed in 28 months from purchase. The now Class A commercial office building was fully leased by completion of the renovation, and the building showed a gross internal rate of return of 30% or 1.8 times the original investment value. The redesign of the 17 story commercial tower was designed by Quadrangle Architects Ltd, and the retrofit was awarded the NAIOP Office Project of the Year.

In discussion of the State Street Financial retrofit, Brian Curtner, Quadrangle Principal and Co-founder, characterized the original building as needing replacement for all mechanical and electrical systems (Curtner, 2013), the once innovative curtain wall façade was thermally broken, and the floor plates were narrow with odd connections (not appropriate for commercial office layouts). Given a limited budget, the best option at the time was to strip the building back to structural elements and renew it as commercial office space. By removing the constant volume/constant temperature induction systems, the design team was able to reduce the HVAC footprint, gaining a whole extra floor and additional

parking space. New heat pump systems allowed for the reclamation of valuable core space while modernizing the heating systems.

Had there been tenants in the building it would have been difficult to implement the depth of changes they achieved, particularly replacing the electrical systems (Curtner, 2013). The combination of reclaimed floor space, high-efficiency operating systems, low purchase price, and early sign-on of a strong anchor tenant provided the elements for a good financial case on the retrofit.

The project was completed before LEED and other sustainable programs were adopted in Canada, but the owner and tenant worked with the design team to make decisions that supported energy efficiency, resulting in recognition and a grant from Natural Resources Canada (Curtner, 2013). Although the property was vacant for an extended period prior to retrofit and there is no baseline to use for measuring the operation energy use change, it appears likely that a 30% reduction was achieved with this project. Decisions were based on total value analysis to provide the best financial case from multiple perspectives. By considering the whole building, the design team was able to gain valuable leasable space while modernizing the operational systems and minimizing future operating costs.

Conclusion

Studies from government agencies in both Canada and the U.S. identify energy reduction in commercial buildings as a key strategy regarding overall energy consumption during the next two decades. With energy consumption rising 27% between 1990, and commercial buildings accounting for 14% of end-use energy consumption in Canada, deep retrofits present an opportunity to maximize energy savings in the built environment. Characterized by the inclusion of energy reduction as a primary goal for the project, measured by the level of verified whole building energy savings achieved compared to the pre-retrofit baseline, a deep retrofit uses whole building consideration to achieve 30% or greater reductions in gross building energy use. As the best retrofit energy and cost savings are achieved when combined with major system replacement projects, or critical upgrades, the aging Toronto Financial District office towers present an opportunity for deep retrofits to be integrated with future revitalization planning.

In addition to the large number of buildings reaching a lifecycle renewal point, a boom in commercial office tower construction has placed new pressure on existing towers. With over 3.5 million square feet of new office space opened or in development (between 2009 and 2015), mature properties are beginning to use revitalization retrofits to maintain property value and retain tenants. Indicators from the literature show that physical drivers such as aging systems and an increased need for energy efficiency do not inherently lend themselves to pursuing energy use reduction targets of 30% or greater, but they do contribute to the initial decision-making process during retrofit planning. The State Street Financial case study illustrates how integrated energy efficiency decisions can benefit both the operations and the financial outcomes of a commercial office tower retrofit.

However, the TD Centre and First Canadian Place case studies confirm the views of interviewees that, in a low energy cost environment, energy use reductions are a secondary consideration when initiating a commercial tower retrofit project. The low cost of energy makes it difficult to make a financial connection specific to energy reductions. Until energy prices increase, it is likely that energy use reduction will remain a secondary consideration during retrofit decision making.

Although the literature review and interviewees analysis shows that even in the current low energy cost environment, deep retrofit projects can generate a positive financial case and increased asset value, the risk of disrupting existing tenants, competition for capital funds, and business expectations for high ROI keep energy use reduction targets from becoming a primary decision-making factor during retrofit planning. Building executive buy-in, through education and tenant demand, will make it more likely for deep retrofit drivers to overcome the operational, financial, and environmental barriers.

The research indicates that in Canada, the drivers that most likely influence energy use reduction decisions are tenant retention, organizational values, public image, and increased asset value. The increasing importance of CSR reporting to both building management and tenants is driving awareness of sustainability and energy efficiency. Although CSR reporting is a relatively new in practice, increases in corporate engagement and evolving sustainability policies are having a strong impact on the industry, with real estate management companies, such as Oxford Properties and Cadillac Fairview, integrating sustainability planning and energy reduction with annual targets and incentive programs.

By combining competition between commercial tower owners with increased CSR demands, programs such as “Race to Reduce” are showing positive results in bringing whole building energy use reduction to the forefront of retrofit and operational planning. The focus of Race to Reduce is on bringing tenants and owners together to reduce overall building energy consumption. This model of cooperation may offer the best results for deep retrofits as well. The importance of tenant engagement is demonstrated in the strategies being developed by the TD Centre as part of their revitalization program, where working with the tenants of the building is a key part of the ongoing efforts to reduce energy consumption against a 2008 baseline.

Another tool that could build on CSR and corporate image to drive deep retrofits is the establishment of publicly accessible energy use labelling for a building. By increasing transparency, and giving both tenants and facility managers a method of evaluating buildings against a benchmark, a national labelling program would provide a metric that could be used for assessing lease options or supporting CSR goals. Professional organizations could further support benchmarking efforts by cooperating to create a national database for commercial buildings. An easily accessible single body of knowledge would help building owners and managers increase their knowledge through case studies, best practices, and improved networking.

Innovative financing for deep retrofits, including PACE financing and energy performance contracts, can offer potential solutions to the issue of raising capital

funds, and create a framework for ensuring guaranteed energy reduction results. While neither model offers a panacea for all financial barriers, they do offer property management companies tools for minimizing the risk and internal expertise requirements associated with deep retrofits. Similarly, the relatively new field of project planning for integrated whole building energy reductions will likely lead to greater energy reduction at a lower cost in the commercial real estate industry as experience and expertise in this area develops.

Finally, both the literature and the interviewees agree that it is not sufficient to just make physical changes to a commercial building. Even buildings that are built or retrofitted to be energy efficient will not achieve expected energy reductions unless tenants and building managers use and maintain buildings properly. The need for extensive tenant and building management education and ongoing resources points to the importance of facility management as a component in an integrated whole building energy reduction strategy.

Toronto's Financial District is an ideal setting to assess the current business environment for deep retrofits. Aging assemblies and systems, along with competition from new Class AAA tower construction, are generating pressure on mature commercial towers in the Financial District to undergo facility revitalization for tenant retention and maintenance of property value. In the current low cost energy environment, energy reduction alone does not generate a sufficient financial incentive to support implementing deep retrofits. So long as energy costs remain low, factors such as growing tenant demand, accessible benchmarking data, and increased transparency through CSR reporting will help build executive support for pursuing greater energy use reduction targets, while revitalizing the Financial District's commercial towers.

Appendix A

Sample Building Inventory

The included list is a sample of 60 commercial towers in Toronto's Financial District, generated from real estate listings and Toronto's public library archives. The list is not inclusive of every commercial tower in the area, but provides a fair representation of the district building population.

Toronto Financial Core Commercial Towers (Sample)					
Building Name	Address	Street Name	Construction Date/ Major Renovation Date	Number of Stores	Original Date
Canada Permanent Trust Building	320 Bay St	Bay	1928	19	
Sterling Tower	372 Bay St	Bay	1928	21	
Victory Building	80 Richmond St W	Richmond	1930	20	
Commerce Court North	25 King St W	King	1931	34	
Bank of Nova Scotia	44 King St W	King	1951	27	
Yolles & Rotenberg Building	111 Richmond Street W	Richmond	1954	16	
	4 King St W	King	1959	20	
Simpsons Tower	401 Bay St	Bay	1964	33	
Bell Telephone Building	76 Adelaide St W	Adelaide	1965	16	
Montreal Trust Tower	11 King St W	King	1965	18	
Richmond-Adelaide Centre	120 Adelaide St W	Adelaide	1966	26	
TD Bank Tower	66 Wellington St W	Wellington	1967	56	
Simpson Tower	401 Bay St	Bay	1968	33	
Royal Trust Tower	77 King St W	King	1969	46	
	155 University Ave	University	1971	18	
York Centre	145 King St W	King	1972	27	
The Thomson Building	65 Queen St W	Queen	1972	28	
	141 Adelaide St W	Adelaide	1973	18	
Munich Re Centre	390 Bay St	Bay	1973	32	
Commerce Court	243 Bay St	Bay	1973	57	
Canadian Pacific Building	100 Wellington St W	Wellington	1973	33	
Royal Bank Plaza North	200 Bay St	Bay	1976	26	
First Canadian Place	100 King St W	King	1976	72	
Markel Place	55 University Ave	University	1977	18	
Oxford Tower	130 Adelaide St W	Adelaide	1979	33	
Royal Bank Plaza South	200 Bay St	Bay	1979	40	
National Bank Building	150 York St	York	1982	20	
Exchange Tower	130 King St W	King	1983	30	
Sun Life Centre	200 King St W	King	1984	24	
Standard Life Centre	121 King St W	King	1984	26	
Sun Life Centre	150 King St W	King	1984	28	
TD South Tower	79 Wellington St W	Wellington	1985	39	
Waterpark Place	20 Bay St	Bay	1986	24	1963
	1 University Ave	University	1986	19	
	1 University Ave	University	1986	19	
	95 Wellington St W	Wellington	1986	23	
Scotia Plaza	40 King St W	King	1988	68	
Prudential House	55 York St	York	1989	16	1929
Canada Trust Building	110 York St	York	1989	19	1965
Waterpark Place II	10 Bay St	Bay	1990	17	
TD Canada Trust Tower	161 Bay St	Bay	1990	53	
HSBC Building	70 York St	York	1990	17	
Dundee Place	1 Adelaide St E	Adelaide	1991	31	
Brookfield Place	181 Bay St	Bay	1991	49	1937
Ernst & Yonge Tower	222 Bay St	Bay	1991	32	
Metro Centre-Wellington Tower	200 Wellington St W	Wellington	1991	15	
University Place	123 Front St W	Front	1993	20	
Bay-Wellington Building	220 Bay St	Bay	1995	15	1950
Simcoe Place Park	200 Front St W	Front	1995	33	
Richmond-Adelaide Centre	100 Adelaide St W	Adelaide	1997	16	1928
Canada Life Building	330 University Ave	University	1997	15	1929
DBRS Tower	181 University Ave	University	2001	23	
State Street Financial	30 Adelaide St E	Adelaide	2002	16	1960
Maritime Life Tower	2 Queen St E	Queen	2002	20	1910
The Silver	1 King St W	King	2005	51	
Bay Adelaide West	333 Bay St	Bay	2009	51	
RBC Dexia	155 Wellington St W	Wellington	2009	42	
Telus Tower	25 York St	York	2009	32	
PwC Tower	18 York St	York	2011	26	
Bremner Tower	20 York St	York	2013	30	
Case Study Buildings					

Appendix B

Glossary

Actual Net Effective Rent: Common net effective rent together with the present value of lease takeover costs, mandatory tenant space take-up costs, early termination and space put costs, the cost of limits on recoverable costs, the costs of holding space for expansion, moving, or other tenant relocation costs. (REALpac/AIC, 2001, pp. -ANER-1-101-2001).

BOMA: Building Owners and Managers Association.

Building Class A: Top class of building that competes for premier office tenants at rents above average for the area. The buildings have a very high standard of finishes, systems, and exceptional accessibility. Buildings have a prominent market presence (BOMA, 2011).

Building Class AAA (bank): Another term for Building Class A commercial space, defined in Toronto as buildings that command a rental rate of over \$25 per net square foot (Johansson, 2012).

CaGBC: Canada Green Building Council.

Capital Cost Pass-Through: A lease provision that allows owners to pass on to tenants the cost of capital improvements that lower total operating costs. Lease terms should ensure that pass-through costs comply with a sustainable certification or rating program (White, 2010).

Capitalization (Cap) Rate: The capitalization rate is the value of a commercial building based on the expected earnings expressed as a percentage value. An investment in equipment that improves energy efficiency and increases the building's cash flow will both pay back the original investment and increase the value of the building (TowerWise).

Common Gross Effective Rent: Calculated by combining the common net effective rent with the building's quoted realty taxes and operating costs, but excludes direct billed or separately metered hydro consumption (REALpac/AIC, 2001, pp. -CGER-1.01-2001).

Common Net Effective Rent: The true rent related to a certain lease transaction, based on the present value using the common discount rate, of all rent receivable by a landlord over the initial fixed term, less the present value of all tenant inducements, free rent periods and commissions payable, with such remainder present value amortized over the fixed initial lease term (REALpac/AIC, 2001, pp. -CNER-1.01-2001).

Corporate Social Responsibility (CSR): Voluntary activities undertaken by a company to operate in an economic, social, and environmentally responsible manner (Government of Canada, 2013).

ekWh: The combined energy consumption of natural gas, oil, and electricity expressed in kWh (Enermodal Engineering, 2011).

Energy Services Company (ESCO): Energy Service Company finances an energy efficiency retrofit and recovers invested capital based on retrofit performance and energy savings (Sweatman and Managan, 2010).

ENERGY STAR: A national energy performance rating system (ENERGY STAR, 2013).

HVAC: Heating, ventilation, and air conditioning.

Increased Building Value Using Net Operating Income (NOI): An investment in capital equipment that improves the NOI improves the value of the building. Divide NOI/Cap Rate to see increased value (TowerWise).

Internal Rate of Return (IRR): The interest rate that brings the value of the investment back to zero; rate of return greater than the value indicates a positive return on investment (TowerWise).

LEED: Leadership in Energy and Environmental Design is a third party certification program for the measurement of building performance through design, construction, and operations (Canada Green Building Council, 2013).

Lifecycle Costing: Comprehensive measure of the expected cost and expected repair and replacement costs over an extended period of time (TowerWise).

Net Present Value (NPV): The value of an organization will increase by the amount equal to the present value today of future cash flows. A positive NPV indicates an increase in the value of the organization (TowerWise).

Net Rent: The rent, excluding a tenant's share of real estate taxes, operating cost, and other costs directly related to the tenant's occupancy of the space (REALpac/AIC, 2001, pp. -NR-1.01-2001).

REIT: Real estate investment trust.

Simple Payback: The time it takes to return back to the organization the funds invested through the savings generated (ignores time value of money and therefore biased against investments where the highest returns are in 8–10 year time frame) (TowerWise).

Triple Net Lease: A lease contract where the tenant is required to pay all taxes, insurance, maintenance, and utility costs on top of a monthly rent rate (White, 2010).

Appendix C

List of Interviewees

Barker, Michael. Hope Beckwith Group: President. Interview February 4, 2014.

Curtner, Brian. Quadrangle Architects: Principle. Interview February 20, 2013.

Hoffman, David. Cadillac Fairview: General Manager, TD Centre. Interview Feb 15, 2013.

Katz, David. Sustainable Resources Management Inc.: President. Interview February 20, 2013.

Love, Peter. Love Energy Consultants: President. Interview February 27, 2013.

McQueen, Roslind. Brookfield Properties: Director, Office Leasing. Interview Feb 15, 2013.

Neate, Darryl. Oxford Properties: Director, Sustainability. March 20, 2013.

Ouellette, Chris. Royal Bank of Canada: Senior Manager, Sustainable Business, Corporate Environmental Affairs Group. Interview February 13, 2013.

St. Michael, Julia. REALpac: Manager, Research & Environmental Programs. Interview February 4, 2012.

Stoate, Tim. Toronto Atmospheric Fund: Vice President, Impact Investing. Interview March 13, 2013.

Theaker, Ian. Pinchin Environmental: Senior Sustainability Consultant, Sustainability & Building Sciences. Canadian Green Building Council—Greater Toronto Area: Board Member of Education. Interview February 13, 2013.

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Alita Jones, Conestoga College, Kitchener, ON, CAN, N2G 4M4 or swampjones@gmail.com.

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