White Paper

Sustainable Real Estate

Translating Climate and Energy Performance into Real Estate Value

april 2026

AN INITIATIVE BY

DĒCARBONE+

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Executive summary

A Value Paradox

The real estate sector is currently facing a paradox: sustainable buildings clearly demonstrate superior operational performance and resilience, yet the market still struggles to fully capture this value within valuation, financing, and investment mechanisms.

This disconnect creates a structural impasse. Building owners and operators are willing to invest in energy performance and asset modernization. However, in the absence of appropriate analytical frameworks, these improvements are not properly recognized or valued. This lack of recognition sends a negative market signal: owners delay investments out of concern that expenditures will increase without a corresponding reduction in perceived risk. Conversely, the risks associated with lower-performing assets — whether energy-related, climatic, or regulatory — remain significantly underestimated.

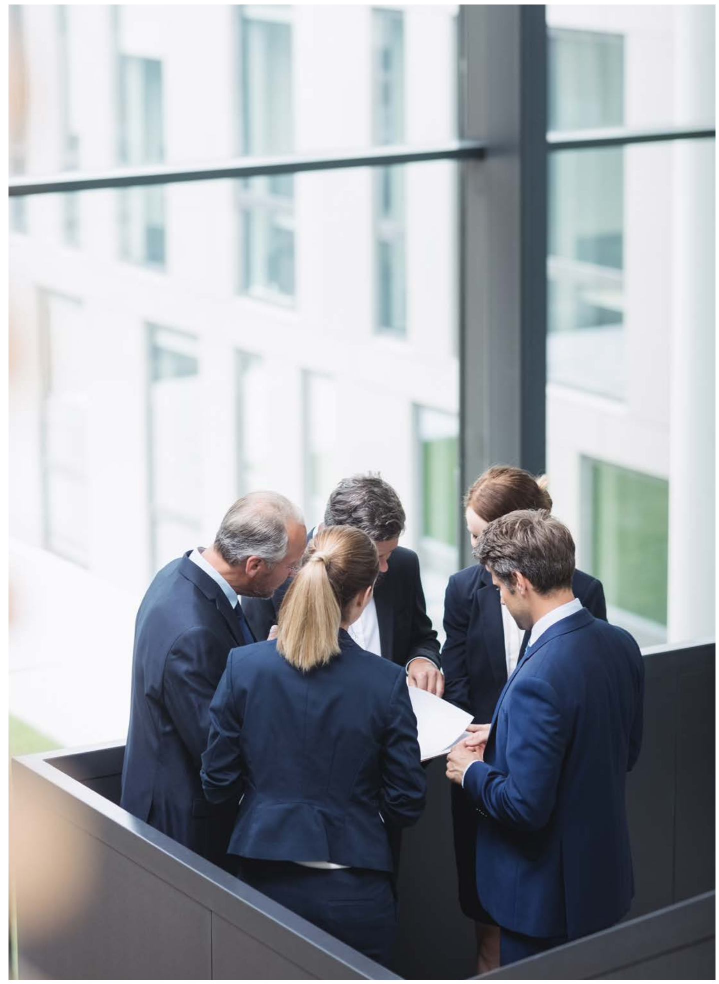
A Collaborative and Rigorous Approach

This observation lies at the heart of the present white paper initiative: identifying the conditions required to better recognize, structure, and capture the value associated with sustainable performance. Our work is based on rigorous academic research and an extensive consultation process involving hundreds of stakeholders across the ecosystem: financial institutions, investors, appraisers, asset managers, and technical experts.

One major conclusion emerges from this work: the market currently relies on fragmented data and on practices that fail to effectively integrate evolving risk dynamics. In the absence of coherent indicators and harmonized assessment matrices, the true value of high-performing assets remains difficult to demonstrate, just as the real financial impact of "brown" assets remains insufficiently quantified.

From Risk Theory to Financial Reality

Through detailed analyses and practical demonstrations, our work shows that factors still only partially integrated into current market practices can materially influence asset value, with valuation impacts ranging from +5 % to –11 %. Buildings capable of proactively managing these risks demonstrate stronger long-term resilience and value-preservation potential.
This transformation, however, cannot occur without collective mobilization. The integration of sustainability opportunities does not depend solely on analytical tools; it also requires the adoption of new practices by market participants. While the willingness to act clearly exists, isolated initiatives alone will not be sufficient.



A Call to Action for the Industry

This white paper represents the foundation of a necessary transformation. Its ambition is to foster a common language and to establish a reference framework for the decades ahead. The objective is not to achieve immediate mathematical precision, but rather to build a robust foundation that can be progressively strengthened by improved data quality and market maturity.
More than a report, this publication is a call to action. Leadership for this transformation rests with the industry itself. We invite market participants to continue this work collectively. Together, we will not only improve the management of emerging risks, but also unlock the significant economic opportunities associated with the sustainable transformation of Quebec's real estate portfolio.

Glossary

Understanding Sustainable Real Estate

To facilitate the reading of this white paper, here are the key concepts, abbreviations, and financial indicators used in our models.

Sustainable real estate : For the purposes of this white paper, building sustainability refers to a set of criteria for assessing, in a measurable and evolving manner, a real estate asset's capacity to preserve its value and functionality over time. It encompasses, at a minimum: energy efficiency, climate resilience, operating-cost discipline, the ability to anticipate and meet applicable regulatory requirements, and financial performance stability over the holding period.

Regulatory Bodies and Frameworks

AMF (Autorité des marchés financiers) : Quebec's financial markets regulator, mandated to protect investors and ensure the orderly functioning of the markets.

OSFI (Office of the Superintendent of Financial Institutions) : The federal authority that supervises banks and insurers in Canada. Its Guideline B-15 now requires the integration of climate-related risks into financial risk management.

ISSB (International Sustainability Standards Board) : An international body that develops global disclosure standards so that companies report climate-related risks in a consistent manner.

Bill 41 : Quebec legislation aimed at improving the energy efficiency of buildings through the mandatory disclosure of performance data.

Performance and Management Indicators

KPI (Key Performance Indicator) : A quantitative metric (e.g., kWh/m^2) used to track the effectiveness of a decarbonization strategy.

RAF (Risk Appetite Framework) : A strategic tool through which an organization defines the level of climate or financial risk it is willing to accept before triggering action (e.g., divesting an asset overly exposed to flooding).

ESG (Environnement, Social and Governance) : The three pillars used to assess the sustainability and ethical impact of an investment.

HVAC (Heating, Ventilation, and Air Conditioning : The set of mechanical systems that ensure thermal comfort. HVAC is the principal technical lever for reducing energy costs.

Real Estate Finance and Profitability

EGI (Effective Gross Income) : Total income actually collected by a building (rents, parking, ancillary services), net of losses associated with vacant space.

NOI (Net Operating Income) : The true profit of the building. NOI equals EGI less all operating expenses (energy, taxes, maintenance).

Formula: NOI = (Gross Rent - Vacancy and Credit Losses)- Operating Expenses

Cap Rate (Capitalization Rate) : The annual yield (in %) required by an investor. When an asset's risk profile rises, the cap rate increases, which in turn drives the market value down.

bps (basis point) : A unit of measure for interest rates. 100 bps = 1 %. A 35 bps decrease represents a 0.35 % reduction in the cost of a loan.

SLB (Sustainability-Linked Bond / Loan) : A loan or bond whose interest rate varies based on the achievement of environmental targets (e.g., a 20 % reduction in GHG emissions).

Investment and Value Analysis

Simple pPayback Period : The time required (in years) for energy savings to repay the initial cost of the works.

ROI (Return on Investment) : A ratio measuring the gain earned relative to the amount invested.

IRR (Internal Rate of Return) : An indicator that measures the overall profitability of a project across its entire life cycle, including annual revenues and the terminal resale value.

Brown Discount : The reduction in a building's sale price arising from poor energy performance or climate vulnerability.

Green Premium : The additional rent or market value that a high-performing, certified building can command in the market.

A Word from the President

The idea behind this white paper arose from a simple yet difficult-to-ignore observation: despite more than twenty years of effort to improve the environmental performance of the building stock, the way we capture and recognize the value of sustainable development in real estate remains limited and, at times, poorly understood. And yet the climate, energy, and economic stakes facing our industry now require us to rethink certain long-standing practices.

In early 2024, several conversations led me to consider the relevance of launching a structuring initiative on this question. The first exchanges took place with Léa Berlinguet of Hydro-Québec, and then with Sébastien Leboeuf, then at Otera, a subsidiary of La Caisse. These discussions quickly brought a fundamental issue to the surface: to genuinely accelerate the transition of the real estate sector, we must also be able to better recognize and integrate the value of decarbonization and sustainable-performance initiatives into financial and real estate decisions.

Early on, it became clear that the project could not be built from a single point of view. References were still few, practices were scattered, and approaches varied from one stakeholder to another. It became evident that we needed to bring together a wide range of stakeholders from across the real estate ecosystem in order to share perspectives, test ideas, and identify credible avenues for action.

In this endeavour, the contribution of HEC Montréal proved decisive. Their involvement allowed us to structure the work on a rigorous and neutral basis, grounded in solid academic and methodological references. This contribution laid the foundations of the project and offered a credible framework from which the content of the white paper could be developed.

The initiative truly took off in late autumn 2024 with the arrival of Louis-Philip Bolduc, who agreed to take on the role of project lead. His work enabled the project to be structured as an ambitious collaborative initiative.

The true strength of this white paper lies not solely in the content we have produced. It lies above all in the collective demonstration it represents. It is rare to see an initiative capable of bringing together stakeholders from finance, real estate appraisal, development, and property management, as well as dozens of building and academic professionals who have spent years building expertise in sustainability.

I take great pride in seeing this project take shape today. This white paper seeks to launch a movement and to enhance our understanding of the role we can play — and, above all, of a new approach — in how we apprehend risk and capture value in real estate. It is a first stone in this transition that we must undertake together.

Philippe Hudon, Président Décarbone+

Introduction

Why This White Paper — and Why Now ?

The real estate sector is undergoing a profound transformation. Historically structured around relatively stable parameters — location, rental performance, quality of fit-outs, and economic cycles — the industry must now increasingly contend with a defining variable: the climate and energy transition. This transition is no longer solely a matter of public policy or environmental commitments. It is increasingly shaping financing conditions, insurability, valuation methodologies, and ultimately the liquidity of real estate assets.

It is within this context that this white paper initiative was launched. The original objective was to explore the relationship between sustainable building performance and financial value creation. To achieve this, an extensive consultation process was undertaken.

Hundreds of stakeholders from across the real estate and building sectors participated in the initiative, including institutional investors, developers, asset managers, financial institutions, insurers, appraisers, technical experts, and public-sector representatives. Although these participants engage with the same underlying assets, they rarely share the same analytical frameworks. The workshops provided a forum to compare perspectives, challenge existing practices, and identify shared areas of uncertainty.

As discussions progressed, one central observation became increasingly evident: there is a significant shortage of structured and comparable data.

For more than two decades, considerable effort has been devoted to improving the energy and environmental performance of buildings. Standards have tightened, certifications have multiplied, and technologies have advanced considerably. Yet despite these developments, the systematic and comparable measurement of the financial impacts of these improvements remains limited.

The data exists, but it remains fragmented. Each stakeholder relies on proprietary systems, indicators, and evaluation tools. No shared methodological backbone currently exists to aggregate information and generate robust conclusions. As a result, the true financial value of sustainable performance remains difficult to demonstrate consistently and reproducibly.

This fragmentation creates information asymmetries and widens the gap between organizations equipped with sophisticated analytical tools and those without such resources. It complicates the integration of climate risk into credit models, limits appraisers' ability to fully reflect sustainable performance in asset valuations, and disproportionately disadvantages smaller market participants.

In a context where financial institutions are progressively integrating climate risk into their practices, where insurers already rely on climate models, and where institutional investors are strengthening disclosure requirements, the absence of a common framework has become a structural issue.

Sustainable real estate is no longer a reputational issue. It has become a matter of insurability, financing, risk management, competitiveness, and long-term liquidity.

1 BSIF (fédéral) – Ligne directrice B-15 (Gestion des risques climatiques); AMF (Québec) – Ligne directrice sur la gestion des risques liés aux changements climatiques.
2 BSIF/AMF – Exercice normalisé d'analyse de scénarios climatiques (ENASC/SCSE).
3 Par exemple, CDPQ (La Caisse) – Rapport d'investissement durable

That said, it would be unrealistic to claim that sustainable performance can be reduced to a single certification, or that it can be quantified with perfect precision. Resilience remains insufficiently integrated into decision-making models, the data are still partial, and tools will continue to evolve. The objective is not to overstate the precision of the figures, but rather to lay the foundations of a common language and a shared methodological framework.

From this perspective, the intent of this paper is not to provide a detailed analysis of the technical measures or technologies to be deployed within buildings. Rather, it is a strategic analytical tool focused on the sensitivity of the real estate business model. By varying key financial and operational parameters, we illustrate how the intrinsic value of an asset reacts to climate and regulatory pressures, thereby providing a clear view of the direct impact of these variables on the profitability and long-term viability of capital.

This white paper directly responds to this need.

The initiative constitutes a point of convergence for the market. It begins to build a common methodological backbone, proposes a simple matrix that can be integrated into existing decision-making models, and encourages the pooling of data. It also identifies the key stakeholders called upon to play an active role in the evolution of practices — managers, developers, appraisers, financial institutions, and insurers.

This is not about imposing a single model or claiming immediate standardization. Rather, it is about creating the conditions for greater comparability, stronger coherence, and the progressive integration of sustainable performance into financial decisions.

What comes next?

The content of this white paper is not meant to remain theoretical. It is designed to be taken up by the market.

The recommendations set out herein will need to be adapted, tested, and implemented by the various stakeholders. Some organizations will be able to integrate the proposed matrices into their investment or credit processes. Others may contribute to enriching existing databases or to developing mechanisms for sharing information.

Ultimately, the ambition is twofold: to improve the quality and consistency of the data available on the sustainable performance of buildings, and to gradually advance financing and risk management practices.

The real estate transition cannot be decreed. It is built collectively, through common tools, shared data, and a renewed understanding of risks and opportunities.

This white paper is intended as a starting point — a reference framework — and an invitation to structure, together, the next stage in the evolution of the real estate sector.

01

Understanding the Risks and Opportunities of Building Decarbonization

The analyses and data presented in this first part draw on a comprehensive literature review conducted by the HEC Montréal research team. This synthesis brings together the most recent academic studies and market reports at the international level, allowing us to establish a rigorous picture of global trends before placing them in the context of Quebec's specific market realities.

1.1 The Real Estate Sector Facing New Realities

Real estate assets are at the heart of profound transformations that extend far beyond purely technical or regulatory matters. The rapid evolution of public policy, building standards, financial practices, and tenant expectations is redefining the traditional drivers of real estate value. Increasingly, the strategic question of energy — both consumption and production — is being added to this picture. Finally, the growing demands of financial institutions and insurers, who are progressively integrating climate risks (both transition and physical) into their valuation, financing, and underwriting practices, represent an additional parameter that must be factored into real estate projects.

In this context, the very notion of real estate performance is evolving. **A building can no longer be assessed solely on the basis of its location or its immediate rental yield.** It must now demonstrate measurable, verifiable, and evolving performance, encompassing energy efficiency, climate resilience, operating-cost discipline, regulatory anticipation, and financial stability. Such performance no longer aims only at short-term optimization, but at securing and preserving value over time. In other words, sustainability is becoming a structural determinant of value and of its long-term durability.

17 %

In 2023, the residential sector accounted for 17 % of Quebec's energy use and the commercial sector for 13 %. [3].

7,9 %

Combined, the residential, commercial, and institutional sectors emitted 6.2 Mt CO_2eq in 2023, representing 7.9 % of Quebec's total emissions [4].

Beyond these emerging risks and opportunities, the real estate sector now occupies a strategic position in the climate and energy transition, both because of its environmental footprint and its central role in the economy. In Quebec, buildings account for a significant share of greenhouse gas (GHG) emissions and an even more substantial share of total energy consumption. This reality makes the built environment an unavoidable lever for meeting climate objectives.

Location, rental yield, and the quality of fit-outs — long considered sufficient to explain an asset's performance — no longer suffice, on their own, to capture either its potential or its risks.

3 Whitmore, J., Pineau, P.-O., 2026. État de l'énergie au Québec 2026, Chaire de gestion du secteur de l'énergie - HEC Montréal, rapport préparé pour le gouvernement du Québec. (link)

4 Gouvernement du Québec, Inventaire québécois des émissions de gaz à effet de serre en 2023 et leur évolution depuis 1990, Ministère de l'Environnement, de la Lutte contre les changements climatiques, de la Faune et des Parcs, 2025. (link)

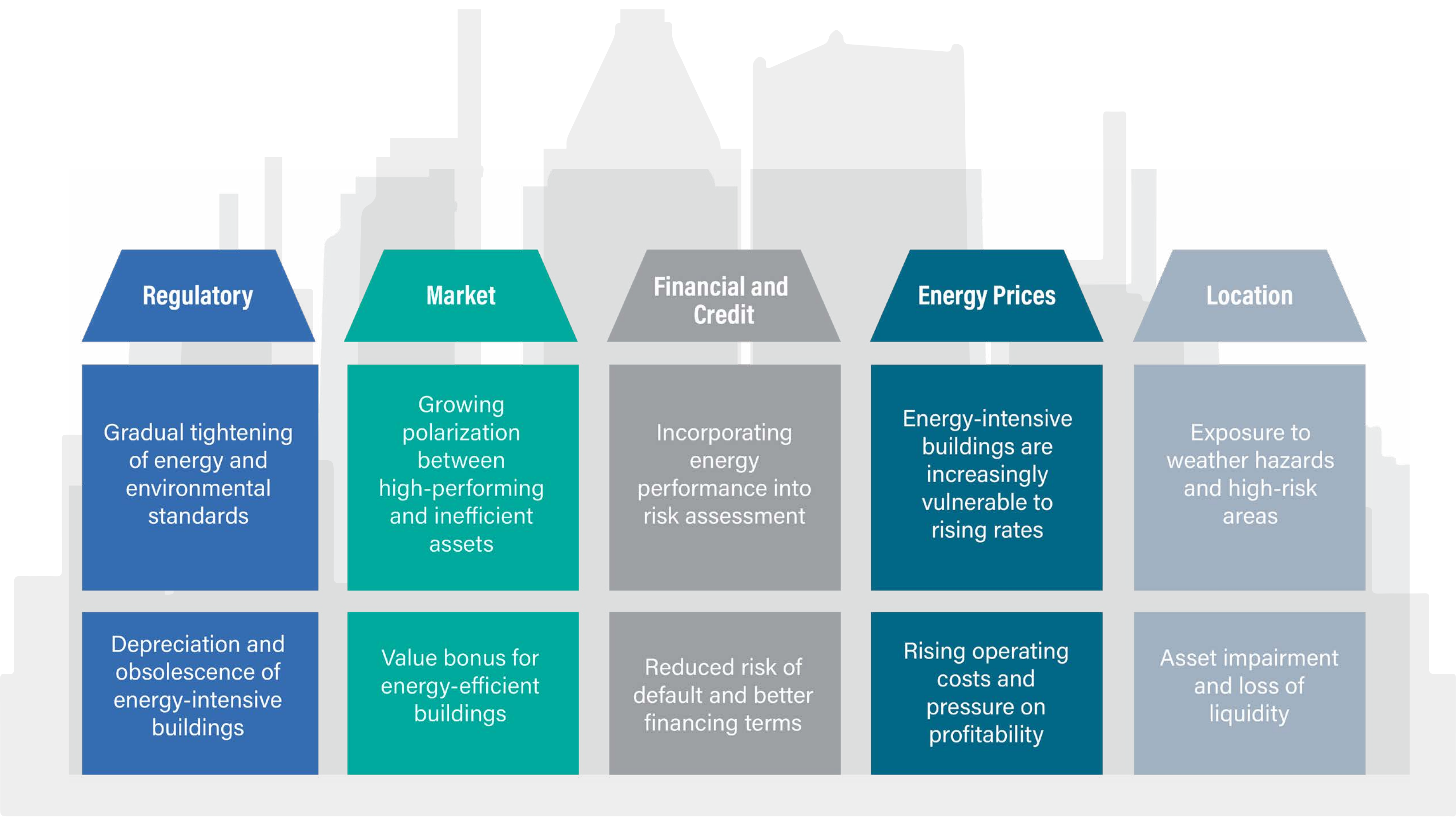
A building's ability to meet growing requirements with respect to energy performance, climate resilience, and regulatory compliance is becoming a structural factor in its attractiveness, valuation, and financial stability.

In this context of an evolving value chain, the climate transition is no longer a peripheral issue for the real estate sector.

The climate transition is establishing itself as a central determinant of risk and capital management, on a par with market, credit, and liquidity risks.

The risks associated with the new realities of real estate are not confined to a single category. They unfold across regulatory, financial, market, energy, and physical dimensions, the effects of which are beginning to be measured empirically.

Figure 1 - Synthesis of the main risks and observed effects.



Source : Pôle IDEOS - HEC Montréal. See "Appendix — Summary of main findings by type of risk" for a detailed view.

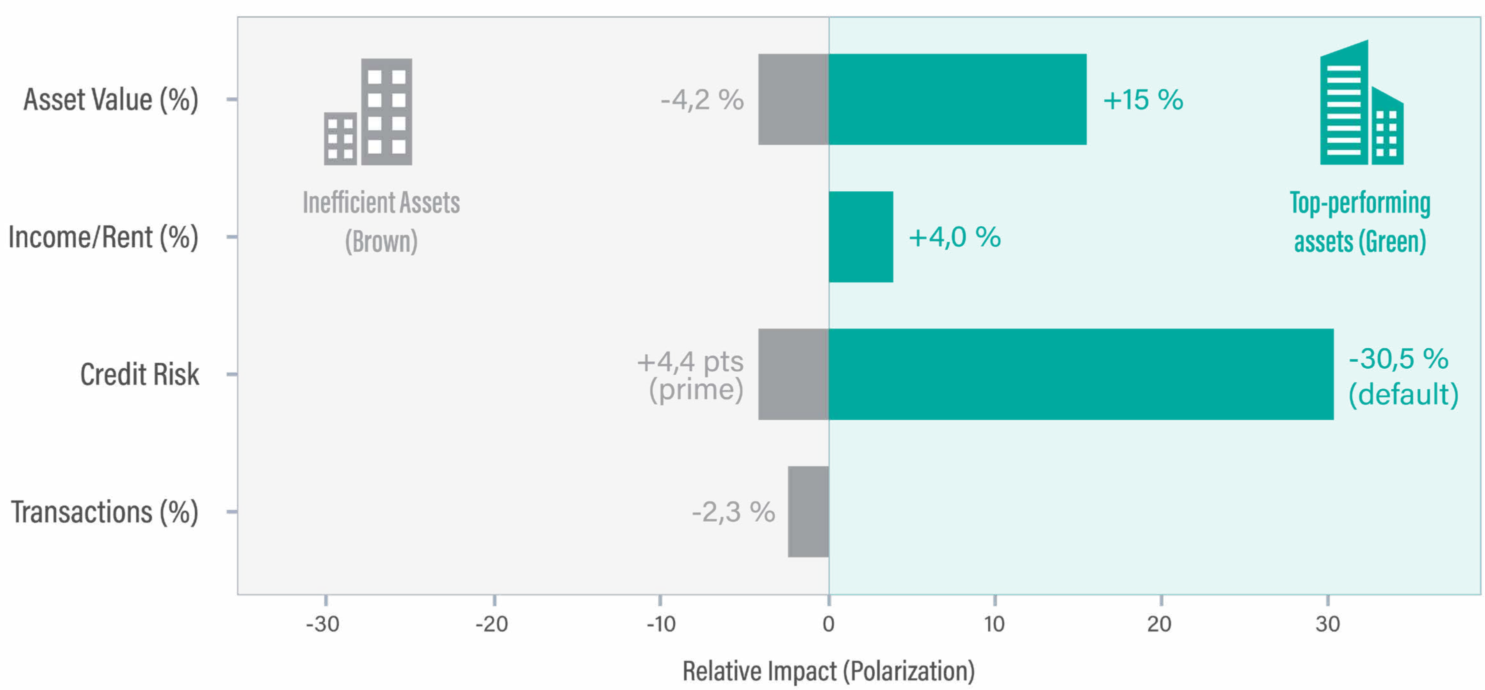
1.2 Financial Risks Associated with Low-Performance or Carbon-Intensive Buildings

One of the major findings emerging from recent analyses is the rise of financial risks tied to buildings with low energy performance or high carbon intensity — often referred to as "brown" buildings. These assets are increasingly exposed to a combination of risks that directly affect their value and liquidity.

The growing polarization of the real estate market between high-performing and inefficient assets is already translating, in several jurisdictions, into value discounts (up to -4.2 % in areas exposed to climate risk[5]), reduced liquidity (-2.3 % in transactions[6]), and less favourable financing conditions for the lowest-performing buildings. Conversely, high-performing assets benefit from a value premium of up to +15 % to +16 % and rents that are 3 % to 5 % higher[7]. Financial institutions are progressively incorporating environmental, climate, and energy-consumption criteria into their risk-assessment models. This translates, among other things, into a reduction in default risk of -27 % to -34 % for high-performing assets[8], and into credit risk premiums of up to

5 Hennighausen et al. (2023) - See "Appendix 1 – Summary of Key Findings by Risk Type."
6 Hennighausen et al. (2023) - See "Appendix 1 – Summary of Key Findings by Risk Type."
7 Eichholtz et al. (2010) - See "Appendix 1 – Summary of Key Findings by Risk Type."
8 Guin et al. (2022) ; An & Pivo (2020) ; Billio et al. (2022) - Voir « Annexe 1 - Récapitulatif des principaux résultats par type de risque »

Figure 2 : Asymmetry in real estate values: the performance gap between proactive assets and exposed assets.



+4.4 percentage points for loans located in highly exposed areas[9].

Over time, **some buildings risk becoming stranded assets** — that is, assets whose value is durably impaired due to regulatory, economic, or physical constraints, potentially to the point where leasing, sale, or economically viable operation is no longer feasible.

9 Javadi & Masum (2021) - See "Appendix 1 – Summary of Key Findings by Risk Type."

The most energy-intensive buildings risk seeing their book value diverge from their real economic value, as future risks are progressively integrated into investment decisions.

Figure 3 - Financial trajectory of an energy-intensive building in a transition context.

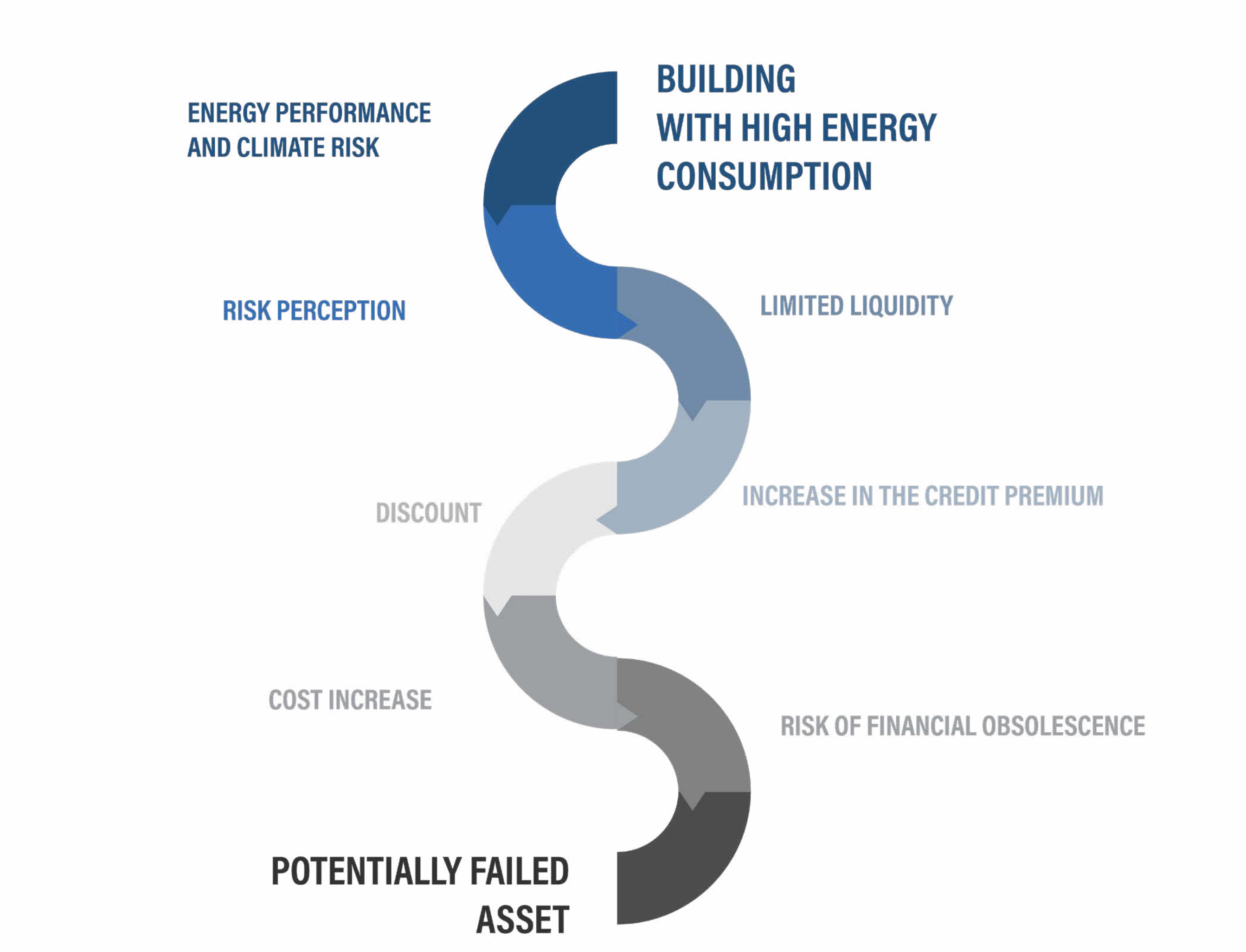
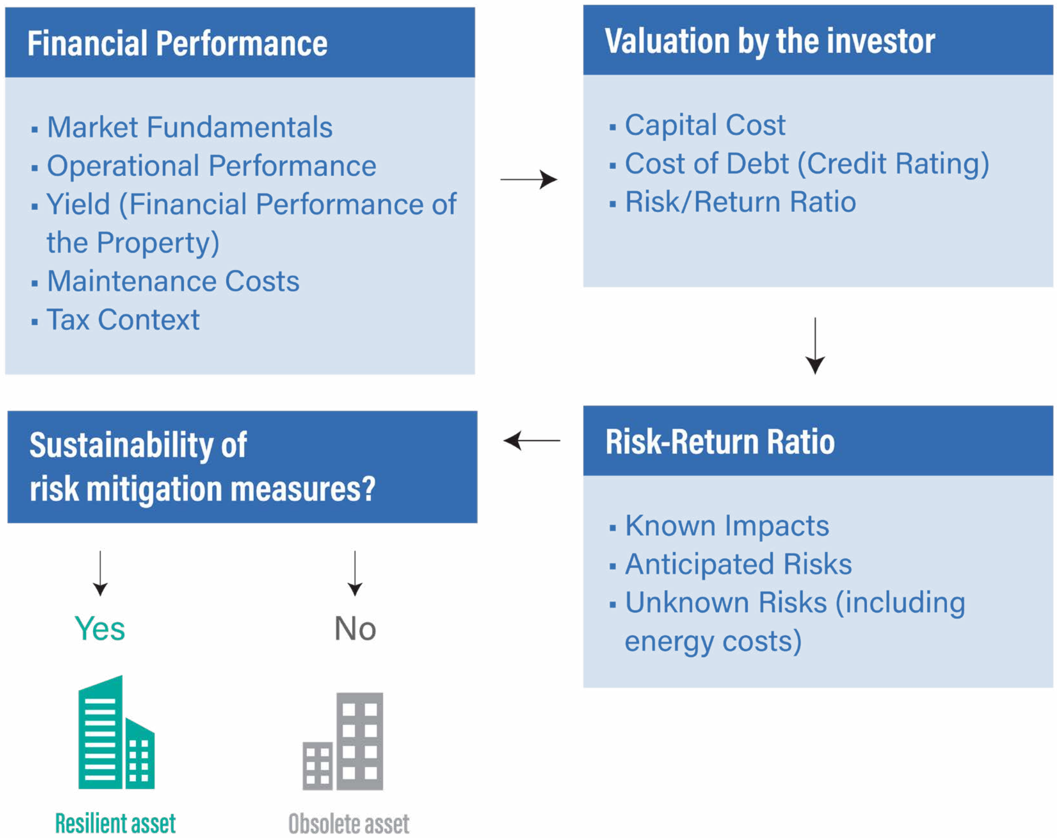


Figure 4: The Risk Transmission Chain: From Real Estate Fundamentals to Asset Viability



1.3 Operational Risks: Obsolescence, Attractiveness, and Income Continuity

Beyond strictly financial risks, weak environmental performance generates mounting operational risks that directly affect the continuity of income. The accelerated obsolescence of underperforming buildings is becoming a major concern in a context where tenant expectations — particularly those of institutional tenants — are evolving rapidly.

In parallel, energy performance and climate resilience are becoming increasingly decisive selection criteria for many occupants — particularly those subject to ESG[11] requirements or disclosure obligations. In certain segments, a minimum performance level is gradually becoming an implicit standard, below which assets become difficult to market.[12]

+8 % to +17 %
occupancy rates for energy-efficient buildings[10]

10 Devine & Kok, 2015 ; Fuerst & McAllister, 2020 - Voir « Annexe 1 - Récapitulatif des principaux résultats par type de risque »
11 ESG stands for Environmental, Social, and Governance: a set of non-financial factors used by investors, lenders, insurers, customers, and regulators to assess risks (e.g., physical climate and transition risks) and the quality of governance and practices (e.g., policies, controls, and accountability).
12 Par exemple, ACVM/AMF – Avis 51-358 (2019) (link)

Moreover, assets with weak performance or pronounced climate vulnerability face growing instability in their charges, which can be broken down into several categories:

Variability of operating expenses (OPEX) : Energy-intensive buildings are directly exposed to volatility in energy prices. Poor thermal efficiency turns any tariff increase into immediate pressure on the asset margins.

Insurability disruption : Independent of energy consumption, physical risks (flooding, sewer back-ups) drive insurance premiums higher and, in some cases, reduce the coverage available, thereby increasing the residual risk borne by the owner.

Reduced predictability of cash flows : The uncertainty associated with loss frequency and with the evolution of carbon taxes or energy regulations complicates medium- and long-term planning. An unforeseen expense (e.g., a sudden compliance upgrade or a high insurance deductible following a loss) destabilizes the expected net return and may force unplanned capital trade-offs.

Potential impact on credit risk assessment, as higher operating costs directly affect debt-service capacity.

In short, these operational risks are not isolated: they act as decisive factors that bear directly on the pillars of real estate valuation. Deteriorating operational performance translates into lower Net Operating Income (NOI) through higher charges and vacancy, while the rising risk profile of the asset increases the cap rate applied by the market. These transmission mechanisms between operational risk and financial value are modelled in detail in Section 2.8.

An asset’s capacity to generate sustainable revenues is closely tied to its energy performance and its climate resilience.

1.4 Regulatory and Compliance Risks

Among the risks identified, regulatory risks rank among the most structuring and the most difficult to anticipate. Unlike other categories of risk, they depend largely on the evolution of legislative frameworks, standards, and public policies, the pace and trajectory of which remain difficult to forecast with precision.

In Quebec, as elsewhere, the general trend is nonetheless clear: **requirements regarding energy performance, disclosure, and emissions reductions are gradually tightening[13].** To this are added the prudential and disclosure obligations imposed on financial institutions, notably OSFI Guideline B-15, which requires the integration of physical and transition climate risks into risk-management frameworks, the performance of scenario analyses, and the disclosure of climate-risk exposures. The gradual adoption of the Canadian sustainability disclosure standards (aligned with the ISSB) further reinforces this requirement. These obligations lead institutions to model their sectoral and geographic exposure with greater precision, which in turn indirectly affects the requirements imposed on the real estate assets they finance.

13 For example, Building Code: Update to Chapter I.1, Building Energy Efficiency (link).

Table 1 : Physical risk — increasing frequency and severity of weather-related events.

Source of risk	Potential impact or loss
Credit risk: damage to collateral underlying bank loans	**Credit impact:** higher loan-to-value ratio and loss given default (LGD) due to reduced collateral value, leading to higher capital requirements
Market risk: physical damage and elevated perceived risk that can undermine the market value of investments	**Price declines:** market-value losses (investment losses or operating losses)
Insurance risk: claim values consistently exceeding insurers projections	**Insurance loss:** higher insurance losses and reinsurance costs
Operational risk: physical damage to premises; interruption of essential functions or services (e.g., a bank branch, an insurance claims department)	**Operational loss:** losses due to physical damage or interruptions; potential reputational impact

Source: Office of the Superintendent of Financial Institutions, Climate Risk Management (link)

1.5 Impacts on Real Estate Valuation and Returns

The transformations now under way have direct repercussions on real estate valuation mechanisms. **Environmental performance is gradually emerging as a key criterion in how investors, lenders, and insurers perceive risk**, which is reflected in adjustments to capitalization rates, expected returns, and capital allocation decisions.

Assets perceived as riskier on account of weak energy performance or heightened climate exposure tend to see their value become more volatile. Conversely, buildings better positioned environmentally enjoy greater income stability and a more favourable risk profile — factors that help sustain long-term valuation.

This growing differentiation makes an approach based essentially on the analysis of past transactions increasingly inadequate. **In a market undergoing structural transition, where risk parameters are evolving rapidly, historical data no longer provide a sufficient guide for estimating future value.** Continuing to project the future from a past that no longer reflects coming conditions amounts to building a strategic blind spot into the appraisal of real estate.

In a market in transition, a valuation based solely on historical data risks ignoring future compliance costs and climate vulnerabilities. While the discount rate incorporates a general risk premium, it does not necessarily capture the accelerated depreciation tied to the regulatory or physical obsolescence of a specific asset. For an investor, the absence of forward-looking analysis amounts to ignoring future, near-certain expenses (transition capital expenditures) — leading to an overestimation of the current value of an underperforming asset.

Sustainability risks and opportunities are specific to each site. Their assessment requires a grid of factors, access to building-specific data (design, performance, energy consumption, compliance), and the integration of geolocated climate-risk data (zoning regulations, flooding, wildfire, storms, landslides, and so on).

Operationalizing climate-risk analysis to integrate these factors into the financial appraisal of a real estate investment ultimately requires a clear, coherent, and evolving governance structure, as well as efficient processes and appraisal mechanisms.

Value premium

+15-16 %

on the observed sale value of green buildings.[14]

Rent and yield premium

+3-5 %

on rents

+3-4 %

on return[15]

Residential

+2-10 %

on resale value.[16]

Without specific data, geolocated analysis, and appropriate governance, climate risks remain invisible in financial models — **until the moment they materialize.**

14 Eichholtz et al., 2010 - See "Appendix 1 - Summary of Key Findings by Risk Type"
15 Eichholtz et al., 2019 - See "Appendix 1 - Summary of Key Findings by Risk Type"
16 Bloom et al., 2011; Kahn & Kok, 2014; De Ayala et al., 2016 - See "Appendix 1 - Summary of Key Findings by Risk Type"

VOICES FROM THE FIELD

Insurability risk is becoming a strong indicator

"The first shock may not be the resale value. It will be insurance. Once an asset becomes difficult to insure, the whole financial structure begins to waver."

The brown discount has begun, but is incomplete

"We are already seeing a gap between high-performing assets and the others. It is not yet systemic in Quebec, but the direction of travel is clear."

1.6 Opportunities Associated with "Green" Buildings

While the current and future impacts of climate change give rise to new risks, they also open significant opportunities for real estate assets able to adapt. Buildings with low environmental risk — often called green — stand out by their ability to preserve their value, functionality, and compliance in a rapidly changing environment.

This financial durability rests on a rigorous analysis of the profitability of interventions. Energy optimization generates direct savings on operating expenses, thereby shortening the simple payback period. When such measures are combined with subsidies, the recovery period may fall below the asset's overall return — immediately improving its financial performance. Beyond the direct gain, these investments constitute an essential defensive strategy: they protect the asset against energy-cost volatility, evolving tenant expectations, and tightening regulation.

Figure 5 : Les opportunités de l'immobilier « vert »

These assets generally combine higher energy efficiency, tighter operating-cost discipline, anticipation of regulatory developments, and stronger resilience to climate hazards. Together, this combination reduces the uncertainty perceived by the financial sector and improves access to capital.

Sustainability thus emerges not only as a risk-mitigation strategy, but also as a lever for value creation, reinforcing the competitiveness and attractiveness of assets across their entire life cycle.

VOICES FROM THE FIELD

Finance as a lever for transformation

"Capital is a powerful signal. If financing conditions genuinely reflect energy performance and resilience, the market will adjust quickly."

1.7 Climate Resilience as a New Determinant of Value

Assets located in areas exposed to flooding, heat waves, or other climate hazards see their economic attractiveness diminish, their insurance costs rise, and their value become more uncertain. Heat waves, for example, can overload air-conditioning systems, cause outages during peak periods, or accelerate equipment degradation, particularly in heavily glazed buildings or those poorly adapted to urban heat islands. Conversely, buildings that integrate passive strategies (vegetation, shading, reflective materials, natural ventilation) or that benefit from surrounding cool islands display better operational continuity and lower exposure to unforeseen costs.

These performance gaps in the face of climate hazards translate directly into differences in operating costs, rental vacancy, and the perception of risk by insurers and lenders. In some cases, insurability itself may become a critical issue.[17]

In this context, **resilience is no longer merely a technical attribute, but a key factor of financial stability.** It influences the insurability of assets, their access to financing, and their capacity to maintain operational continuity — i.e., to remain functional, usable, and comfortable for their intended use, despite climate shocks. Ultimately, it conditions their ability to preserve enduring value over time.

17 Hennighausen et al. (2023) - See "Appendix 1 - Summary of Key Findings by Risk Type"
The impact of climate vulnerability on real estate markets is now quantifiable. The cited study shows a direct correlation between risk exposure and transaction performance: insurance premiums are 14.3% higher in high-risk areas, which automatically leads to a 4.2% drop in sales prices and a slowdown in market liquidity (with transactions down 2.3%).

VOICES FROM THE FIELD

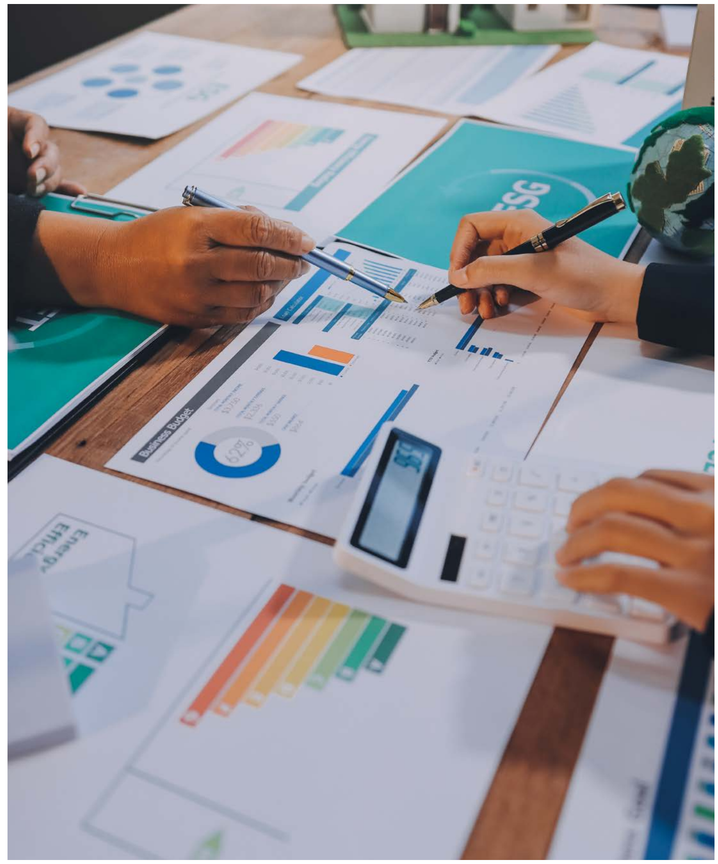
Resilience is essential, even if imperfect

"We can no longer build as though the climate were stable. Designing a building today without taking physical risks into account means accepting structural vulnerability."

1.8 The Challenge of Standardization and Shared Understanding

Despite the accumulation of findings and analyses, the effective integration of sustainability into real estate decisions remains hindered by a lack of standardization in indicators, valuation methods, and analytical frameworks. Several reference systems exist (environmental certifications, energy scores, disclosure frameworks, taxonomies), but they are neither used systematically nor harmonized with one another. Industry stakeholders still have access to little data that is truly comparable on the actual energy performance of buildings, their exposure to physical risks, and their translation into financial variables.

In the absence of robust historical time series, financial analysis practices tend to favour past transactional data rather than the integration of projections involving a degree of climate uncertainty. Yet this methodological prudence, though rigorous, can paradoxically limit the predictive reach of valuations: setting aside an emerging risk on the grounds that it is not yet perfectly normalized can create a gap between the estimated value and the reality of future risks. The challenge is not to substitute proven methods with unvalidated data, but to complement the analysis with prudent and transparent estimates that reflect a more comprehensive view of long-term value.



VOICES FROM THE FIELD

Without a common framework, investment is on hold

"We are moving forward by trial and error. There are intentions, but no shared framework. Until we have a common language and comparable data, sustainability will remain peripheral to investment decisions."

Data, but not useful data

"It is not that there is no data. The issue is that the data is neither comparable, nor accessible, nor integrated into financial models. For an investor, that makes it difficult to treat as a credible decision-making factor."

Sustainability remains hard to translate into finance

"If we want sustainability to be taken seriously, it has to be translated into measurable risk: cash flow, cap rate, insurability, liquidity. Otherwise, it remains a good intention."

This preference for the historically measurable over the probably future creates a growing gap between valuation models and the reality of risk.

This situation complicates risk assessment, limits the ability to compare assets, and feeds sometimes contradictory perceptions of the real benefits of sustainability. The consultations conducted with stakeholders point in particular to the difficulty of translating climate issues into financial variables recognized by valuation, credit, and insurance models.

Without a common language and shared tools, sustainability risks remaining an abstract concept, difficult to translate into concrete financial decisions.

1.9 Toward a Common Definition of a Green or Low-Risk Building

In a context where environmental, climate, regulatory, and financial risks intersect, the definition of a green building cannot be reduced to a certification or to a point-in-time measure of energy performance.

The definition of a green building should rather reflect the ability of a real estate asset to maintain its value, its functionality, and its compliance in an environment marked by rapid and at times unpredictable transitions.

Although the reduction of greenhouse gas (GHG) emissions is the environmental driver of the transition, this variable is not used here as a direct financial indicator. It is treated instead as a transition risk (carbon taxation, regulatory compliance) integrated into our definition of a green building. Financial value, for its part, flows from the reduction of risk and its translation into concrete operational savings. This approach provides protection against the full range of vulnerability variables identified above: it limits the volatility of energy costs, secures rental attractiveness, ensures regulatory compliance, and stabilizes asset valuation. By mitigating these financial and operational risks, the green building protects its net profitability across the entire holding period, as demonstrated in Part 2.

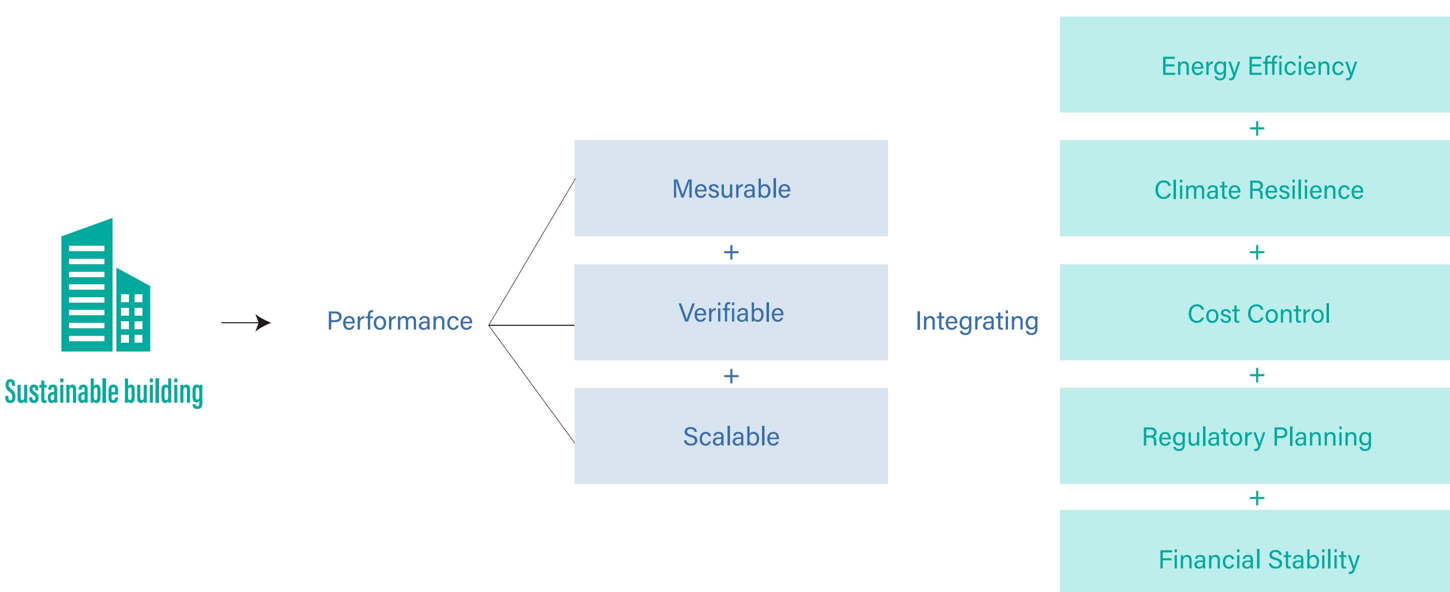
As mentioned at the beginning of this section, **a sustainable building is therefore characterized by measurable, verifiable, and evolving performance, encompassing energy efficiency, climate resilience, operating-cost discipline, regulatory anticipation, and financial stability**. This approach makes it possible to assess the risk profile of assets in a consistent and comparable manner, while offering a common framework to public decision-makers, investors, owners, and financial institutions.

VOICES FROM THE FIELD

A simple, dynamic, and inclusive classification system

"If the tools become too complex or too expensive, we risk creating a two-tiered transition. The taxonomy must be rigorous, but accessible."

Figure 6 : Characteristics of Sustainable Buildings



In summary

01 | Understanding the Risks and Opportunities of Building Decarbonization

The findings set out in this first part reveal an undeniable reality: **the financial stakes of the real estate sector are in flux**. Risk and opportunity matrices are evolving to integrate new factors, among which environmental and climate impacts occupy an ever-greater place. **Inaction exposes stakeholders to heightened financial risks, while anticipation and adaptation generate concrete value opportunities.**

The question, therefore, is no longer whether energy efficiency and the decarbonization of buildings are necessary, but how to implement them in an effective, profitable, and reproducible manner. Part 2 will explore the mechanisms, levers, and concrete examples capable of turning these findings into tangible, value-creating actions.

02

Impact Analysis: Translating Performance and Risks into Financial Terms

2.1 Demonstrating Profitability and the Value of Action

The transition toward sustainable real estate should no longer be viewed as a cost centre, but as a strategy for preserving and optimizing capital. The gap between financial interpretation and technical solutions narrows as soon as decarbonization and climate-resilience measures are translated into standard real estate performance indicators: Net Operating Income (NOI) and Market Value.[18]

2.1.1 Demonstrating Profitability and the Value of Action

The Quebec real estate market is observing a growing correlation between environmental performance and an asset's capacity to generate revenue.

- **The rent premium ("Green Premium")** : The scarcity of certified, high-performing space allows owners to capture a premium on base rent. Our sensitivity analyses — based on the financial models developed for this white paper — show that a $1.00/sq. ft. increase in market rent, achievable by transferring expense savings to base rent, generates an immediate value uplift of $2.45 M (+4.54 %) for a 200,000 sq. ft. asset.[19]

- **Gross- rent optimization** : By reducing energy charges (e.g., electricity), the owner reduces additional rent. This margin allows base rent to be raised without increasing the total burden on the tenant, thereby capturing a larger share of the value created. An energy saving of $1.00/sq. ft. translates into a 4 % to 5 % increase in the building market value.

18 The Net Operating Income (NOI) is the cornerstone of real estate valuation. It represents a property's actual ability to generate cash flow after deducting all expenses.
19 Financial modeling based on Quebec market parameters in 2026, conducted by Boréalis for the White Paper.

These value levers are also confirmed in the multi-residential sector. Our analysis shows that, for a 60-unit reference building, an energy optimization yielding $400 per door per year in expense savings translates into a market-value increase of $615,000 (+6.31 %). This gain far exceeds the investment required for standard efficiency measures.

Table 2 : Factors affecting building vacancy rates

Location	Accessibility, central location, proximity to public transportation
Asset Class	Building quality (A/B/C)
Rental Market Trends	Industry trends
ESG **Tenant ESG Awareness**	Pressure for high-performance buildings
Energy Efficiency	Market comparison (kWh/sq. ft)
Environmental certification	LEED, BOMA, Energy Star
Space quality	Flexibility, comfort, natural light
Tenants' financial capacity	Stability of existing tenants
Average lease term	Revenue security

2.1.2 Protecting Value: Vacancy and Obsolescence Risk

The most significant risk for a real estate asset is not the cost of decarbonization or climate-adaptation work, but the depreciation tied to inaction — often referred to as the Brown Discount.

Normalized vacancy is the parameter most sensitive to a building's obsolescence. The comparative model below illustrates the critical impact of performance on the value of a reference asset (appraised at approximately $54 M).

2.1.3 Return on Investment (ROI) versus Internal Rate of Return (IRR)

For financial actors, the return-on-investment calculation must evolve. **The simple payback period (in years) is an incomplete metric because it does not account for the asset's terminal value or its risk profile.**

- **Moving to IRR :** An investment in energy efficiency (e.g., a $250,000 heat pump) must be analysed over its full life cycle. Although the upfront cost is real, the reduction in operational risk and the protection of the exit cap rate improve the investor's overall return profile.

- **Financing advantage** : Access to preferential financing conditions for sustainable assets (an estimated 0.25 % to 0.35 % reduction on the interest rate) offsets part of the capital cost and improves the debt-service coverage ratio.

Table 3 : Impact of performance scenarios on market value (Class A office building).[20]

Asset scenario	Vacancy assumption	Impact on Market Value	Value differential ($)
« Green » / High performing building	5,0 % (Increased attractiveness)	+ 4,87 %	+ $2,6 M
Reference building	7,5 % (Current market)	-	Baseline
« Brown » / Obsolete building	12,5 % (Loss of competitiveness)	-10,92 %	- $5,9 M

Inaction can lead to a value loss of nearly 11 % — an erosion of capital far more costly than the investments required for energy compliance upgrades.

20 Based on a benchmark property of 200,000 sq. ft. with a gross rental yield of 7.0% and an internal rate of return of 7.5%. Analysis conducted by Boréalis for the White Paper.

2.2 Energy Strategy

If the preceding section established the financial impact of performance, the question remains: which concrete actions deliver these results? **The transition relies on technical choices that transform the risk profile of the building while stabilizing operating expenses.**

2.2.1 Case Study — The Heat Pump as a Value Lever (HVAC)

The optimization of Heating, Ventilation, and Air Conditioning (HVAC) systems is the most direct lever for influencing Net Operating Income (NOI). The addition of a heat pump to recover heat from the cooling loop illustrates the synergy between technical and financial considerations.

- **Investment** : an envelope estimated at $200,000 to $300,000 for a 200,000 sq. ft. building.
- **Energy impact** : a direct saving on the energy bill of 5 % to 15 %.
- **Value protection** : although the investment is significant, its 25-year amortization allows recovery through recoverable charges.
- **Financial outcome** : the impact on market value is close to neutral in the short term, but it protects the building against future energy-price increases that would otherwise erode base rent.

2.2.2 Energy-Source Choices and Carbon Trajectory

The shift from a fossil fuel to electricity is a fundamental energy decision that bears directly on the asset credit profile.

- **Cost / risk trade-off** : While natural gas may appear to offer lower operating costs in the short term, its high carbon intensity exposes the owner to carbon costs and transition risk that could affect access to financing, credit conditions, and liquidity over the medium and long term.
- **Valuation through electrification** : Opting for a clean energy source reduces GHG emissions and thereby improves the loan-to-value ratio and interest-rate conditions. Proactive management here avoids the Brown Discount and supports a rent premium with corporate tenants subject to stringent ESG targets.

2.2.3 Resilience Measures and Stormwater Infrastructure

Technical decisions are not limited to energy; they also encompass resilience to climate hazards.

- **Network upgrades (water and storm sewers)** : An investment in stormwater compliance (estimated at $300,000 to $600,000) is often perceived as a pure cost (compliance with By-law 20-030).
- **The financial angle** : By amortizing this work over 25 years, the impact on recoverable charges remains minimal (less than $0.15/sq. ft.) while securing the insurability of the building. Without this upgrade, the building risks a loss of value tied to the obligation to set aside loss reserves (estimated at 2 % of EGI), a non-recoverable expense that directly erodes market value.

Table 4 : Summary of quick-win levers.

Technical measure	Estimated cost (200k sq. ft.)	Energy impact	Market-value impact
HVAC optimization (heat pump)	$250,000	- 5 % to 8 %	Protection and stability
Conversion to electricity	Variable	Decarbonization	Improved financing access
Stormwater compliance upgrade	$450,000	Resilience	Insurability and regulatory compliance

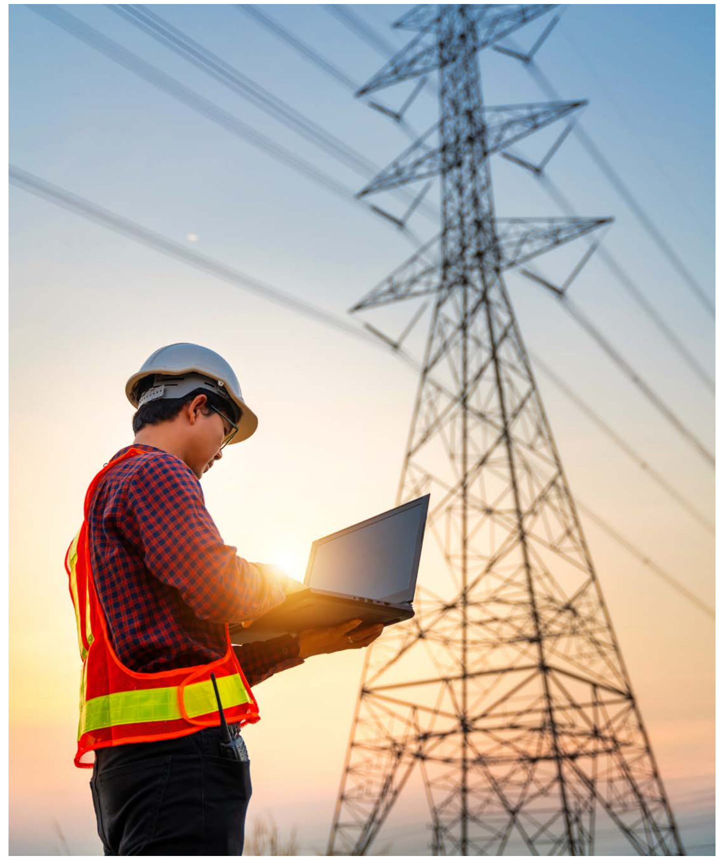
2.3 Energy Security and Capacity Peak Demand Management: A Structuring Emerging Risk

Energy availability — whether considered from the standpoint of consumption or of peak demand management — is becoming a major issue. A project to expand, change use, or develop a property may be delayed, scaled back, or cancelled if the required electrical capacity is unavailable. This increasingly common constraint introduces a new type of real estate risk: the risk of energy non-availability.

Peak demand management therefore becomes strategic:

- Optimization of charges during peak periods;
- Participation in Hydro-Québec demand-management programs;
- Integration of storage solutions or smart load control.

Beyond tariff savings, these strategies strengthen energy security and operational continuity.



2.4 Mastering the Carbon Footprint as a Steering Tool

Even when emissions reductions are not the primary driver of decisions, measurement remains essential. The carbon footprint identifies the main sources of emissions, compares assets against one another, and prioritizes the most relevant interventions.

Beyond its environmental utility, this tool serves concrete financial purposes. It facilitates the anticipation of regulatory risk, supports disclosure efforts, and reinforces the credibility of transition strategies with financial partners.

Used consistently, the carbon footprint becomes a decision-support instrument, complementary to traditional financial indicators.

L'avantage du financement vert

Les prêteurs intègrent graduellement le risque climatique dans leur notation de crédit. Un immeuble « brun » présente un risque de refinancement plus élevé, alors qu'un actif « vert » sécurise.

Réduction de taux : -0,25 % à -0,35 % sur le terme.

Résilience financière : Amélioration de la notation de crédit par la réduction des risques physiques et de transition (vacance, désuétude, volatilité des charges). Cette robustesse de l'actif permet d'optimiser les conditions de financement et les garanties exigées.

Accessibilité : Ouverture vers des produits de financement spécifiques (obligations vertes, prêts liés à la durabilité).

2.5 Financial Incentives and Optimizing the Cost of Capital

Put simply, the financial sector is beginning to apply what might be called a climate performance premium. Just as a strong credit profile reduces the interest rate on a residential mortgage, a high-performing building reduces the cost of capital for an institutional investor.

One of the most concrete levers for supporting the profitability of decarbonization projects lies in the preferential financing conditions offered by financial institutions for sustainable assets.

Analyses conducted by professional appraisers confirm that assets demonstrating superior ESG performance or a clear decarbonization trajectory may obtain more favourable interest rates, with an estimated reduction of between 0.25 % and 0.35 % (25 to 35 basis points).

This differential plays a crucial role in the calculation of debt service and improves the coverage ratio, thereby facilitating access to larger amounts of capital for compliance upgrades.

It is nonetheless important to put this impact into perspective with market dynamics. Historical data (notably from the Altus InSite surveys) indicate that a change in interest rate does not always translate into an equivalent change in the rate of return (IRR). For instance, a 100 bps reduction in the interest rate often shifts the IRR by only 25 bps.

Financial incentives should therefore be viewed as a tool to support cash flow, rather than as the sole driver of an increase in market value.

Table 5: Comparative impact of financing conditions.

Parameter	Standard financing	Green financing	Net benefit
Spread	Reference	-25 à -35 pdb	Reduced cost of dept
Impact on NOI	Neutral	Positive	Improved liquidity
Impact on return	Stable	Low sensitivity (0,25 for 1)	Value protection

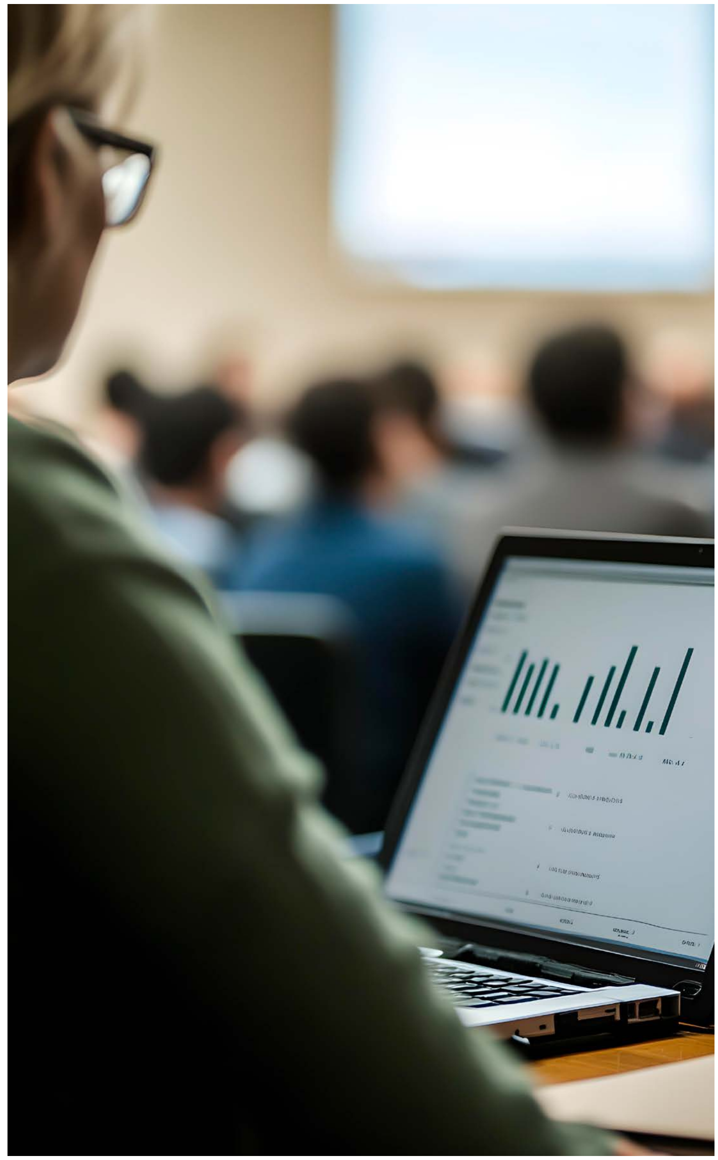
2.6 Energy-Performance Disclosure as a Market Lever

The availability and comparability of data are decisive factors in accelerating the real estate sector transition. Disclosing energy performance reduces information asymmetries, strengthens trust among players, and supports better capital allocation.[21] For this price signal to be fully integrated by investors, however, disclosure must rest on a broad and even-handed framework, ensuring that each asset is assessed against the same performance benchmarks.

By making performance gaps visible, disclosure helps instil a market discipline in which the best-performing assets are valued and the others are incentivized to improve. It is thus a powerful lever for aligning environmental and financial objectives without relying exclusively on regulatory constraint. The effectiveness of this mechanism depends on the adoption of common standards across the entire value chain — a coordination imperative discussed in detail in Part 3.

2.7 Adapting Solutions to the Quebec and Canadian Context

While many international initiatives offer useful lessons, their direct transposition to the Quebec or Canadian context remains limited. The building stock, climatic conditions, regulatory frameworks, and market structures have specificities that must be taken into account. Nevertheless, the underlying mechanisms — such as risk anticipation, the integration of performance into valuation, and the use of data — are broadly transferable. The challenge therefore lies in adapting tools and methodologies rather than in reproducing foreign normative models.



2.8 Impact Analysis: From Risk Theory to Valued Reality

Climate and energy risk analysis cannot remain qualitative if capital is to be mobilized. By converting identified risks into quantifiable financial impacts — based on the rigorous modelling of a 200,000 sq. ft. Class A office building constructed in 1980 (reference value: $54 M)[22] — it is possible to demonstrate how each risk influences the fundamental parameters of valuation: Net Operating Income (NOI) and the rate of return.

21 See Part 3 of this white paper, Table – International Comparison of Regulatory Approaches

22 See Appendix 1—Analysis of the Impact of Risks on Market Value—Detailed Modeling Examples for Two Building Profiles: the table on the following page

2.8.1 Quantitative Synthesis of Impacts on Market Value (Office)

The table 6 on the next page presents the sensitivity of the asset market value across various transition or inaction scenarios. A value decline of nearly 11 % is observed if the building vacancy rises to 12.5 % (a 5-percentage-point gap relative to the market average of 7.5 %).

Table 6 : Sensitivity matrix of market value, by type of risk.

Type of risk	Scenario tested	Value impact (%)	Monetary differential (approx.)
Market	**Obsolescence:** vacancy rising to 12.5 %	-10,92 %	-$5,9 M
	Green building: vacancy reduced to 5.0 %	+4,87 %	+$2,6 M
Energy	**Energy saving of** $1,00 /sq. ft.	+4,54 %	+$2,4 M
Location	**Uninsurability** : reserve of 2 % of EGI	-1,71 %	-$0,9 M
Regulatory	**Stormwater compliance ($600k), amortized**	-0,50 %	-$0,3 M
Financial	**Preferential interest rate** (-35 bps)	Cash-flow impact	Ratio optimization

Base value : $54 M | Cap rate : 7 %

2.8.2 Interpreting the Results for Decision-Makers

Market risk outweighs cost risk

The sensitivity analysis highlights that the most significant threat to capital is not the direct cost of the work, but the market risk tied to obsolescence. In our scenario, a loss of competitiveness translates into a value decline of nearly 11 %. Conversely, the impact of a compliance upgrade (e.g., stormwater management), once amortized and integrated into operating expenses, remains marginal (0.5 % of value).

This divergence underscores that inaction exposes the owner to a form of obsolescence. Rather than a mere construction cost, the upgrade investment should therefore be viewed as insurance against the structural depreciation of the asset on the market.

Energy efficiency as a value lever (NOI).

Every dollar saved on the energy bill (and not transferred as a rent reduction) directly increases the owner's Net Operating Income. Because a building of this type trades at a cap rate of 7.0 %, each dollar of savings is multiplied by the capitalization factor, generating an immediate value increase of $2.4 M.

The critical insurability threshold.

Location risk is not measured solely by the cost of premiums. The uninsurability scenario forces the owner to set aside non-recoverable reserves or to accept the risk of being denied financing. This financial burden cuts 1.71 % off the building's value (assuming a 2 % EGI reserve), a warning signal for asset managers operating in vulnerable areas.

2.8.3 Validating the Thesis in the Multi-Residential Sector

While office buildings are often the first targeted by ESG policies, the multi-residential sector exhibits an even more pronounced financial sensitivity to transition and resilience risks. The analysis of a reference building (60 units, built around 2020) shows that value levers are not only present but amplified by the multiplier effect of the lower cap rate characteristic of this segment.

The principal lesson of this modelling lies in the power of the energy lever. Because the cap rate is lower (3.90 %) than in the commercial sector, each dollar of expense savings translates into proportionally greater value creation than in commercial real estate. Conversely, vulnerability to uninsurability risk is twice that of offices, eroding the asset value by 3.53 %. In this context, preventive investment in resilience ($150,000) may become a sound defensive management decision. This dynamic underscores the need for rigorous cost-benefit analysis: due to the low cap rate, every variation in income or capital expenditure (Capex) is subject to a significant multiplier effect on final market value.

2.8.4 Comparative Summary: Commercial vs. Multifamily

Cross-referencing the data between the two asset types reveals systemic constants for the Quebec market:

The cost-benefit value asymmetry. In both sectors, the simulations suggest that the cost of compliance work (between 0.5 % and 1.5 % of value) is consistently lower than the financial impact of inaction (between 3.5 % and 11 %). This asymmetry calls for a precise evaluation of the profitability of investments, in which the protection of value becomes a benefit in itself.

The insurance-financing correlation. Uninsurability is no longer a marginal operational risk, but a major capital risk. For a multi-residential building, the financial impact of uninsurability is twice as severe as the cost of the investment required to guard against it.

The materialization of the Green Premium. Whether through higher Net Operating Income (NOI) in commercial real estate or through expense compression in residential, climate performance generates a tangible value surplus (between +4.5 % and +6.3 %).

2.8.5 Modelling Conclusion: An Inescapable Financial Reality

Demonstration by the numbers confirms that a tipping point has been crossed. **Decarbonization and resilience are no longer discretionary options for real estate investors but critical elements to be systematically included in risk-return analysis and cost-benefit calculations.**

Rigorous analysis of transition scenarios shows that owners of assets who ignore these indicators expose themselves to emerging risks that must now be measured with heightened attention to avoid an erosion of market value. By contrast, **those who act proactively capture genuine economic value through the stabilization of their vacancy rate, the optimization of their cost structure, and the safeguarding of their insurability.**

This valued reality yields three fundamental lessons:

- **Incomplete analysis is the costliest risk.** Omitting obsolescence factors (market and regulatory) from financial models can destroy more capital than the cost of a planned transition.
- **Data is the key to liquidity.** An owner's ability to document energy performance and physical resilience is becoming the sine qua non for securing financing and insurance.
- **A multi-sectoral strategy is required.** While the levers differ, the end is the same: protecting prospective market value in the face of a changing climate and regulatory environment.

The shift from a theoretical perception of risk toward its progressive integration into asset valuation is well under way. The current challenge is no longer merely to raise the market awareness, but to demonstrate the need for better documentation and standardization of climate and energy information. The goal is to enhance financial analyses so that every investment in sustainability is supported by robust data, allowing its value to be fairly recognized across the entire financial chain.

2.9 Integrating Portfolio Logic: The Risk Appetite Framework

For a fund manager or large owner, decarbonization and climate resilience can no longer be managed asset by asset, but through an aggregated view. The Risk Appetite Framework (RAF) makes it possible to steer the portfolio by setting tolerance thresholds beyond which overall capital value is jeopardized.

The aim is to transform intangible factors into quantifiable parameters — moving from passive return analysis to active management of portfolio resilience.

The RAF rests on pivotal indicators that link technical performance to the protection of overall market value. In light of the modelling presented earlier, three pillars must support this logic:

- **The competitiveness threshold (vacancy).** Since a deterioration in competitiveness or insurability can destroy between 3.5 % (multi-residential) and 11 % (office) of an asset's value, it falls to asset managers and investment committees to monitor portfolio exposure. Professional appraisers, by adjusting their vacancy forecasts, send the obsolescence signal to owners, thereby compelling an investment decision.

- **Energy performance as a credit lever.** Risk appetite can be defined by access to financing conditions. An asset that no longer captures rate premiums (-0.25 % to -0.35 %) degrades the portfolio weighted-average cost of capital.

- **Resilience to losses.** The obligation to set aside loss reserves (estimated at 2 % of EGI for uninsurable assets) directly reduces overall returns, access to financing, and potential income if portions of the building become unusable (a flood-prone basement storage area, for example).

Case Study

Erosion of portfolio value following a non-resilient acquisition

The example below illustrates how an acquisition can appear profitable on its own while weakening the fund's overall risk profile.

Table 7 : Initial portfolio position

Key indicator	Value
Valeur total du portefeuille	$1,2 G
Exposure to flood zones (value of exposed assets)	18 %
Average energy intensity (GJ/m^2)	1,45
Average emissions (tCO^2e/m^2)	0,038
Internal strategic threshold — flood exposure	20 %
Internal strategic threshold — energy intensity	1,50 GJ/m^2

Table 8 : Proposed acquisition

New asset – $120 M Value

Indicator	Value
Partially located in a flood zone	Yes
Energy intensity	1,90 GJ/m^2
Required works	$8 M

Key indicator	Before	After acquisition
Flood exposure	18 %	22 % (threshold breached)
Average energy intensity	1,45 GJ/m^2	1,57 GJ/m^2 (threshold breached)

This example illustrates how an asset can, on a standalone basis, meet minimum financing and insurability criteria while pushing strategic exposure thresholds beyond their portfolio-level limits.

In the case presented, the acquisition would push:

- **flood-zone exposure** from 18 % to 22 %, breaching the internal threshold of 20 %; and
- **the portfolio's average energy intensity** above the strategic target.

The decision therefore no longer rests solely on the immediate profitability of the asset, but on its aggregate effect on the overall risk profile, in pursuit of durable returns.

In such a context, the investor may:

- **adjust the acquisition price** to reflect the additional risk;
- **require corrective work** prior to closing;
- **refuse the transaction** if strategic thresholds are deemed binding;
- or **rebalance by divesting other**, more exposed assets to maintain portfolio equilibrium.

Climate risk thus becomes a negotiable and quantifiable parameter, rather than an intangible factor.

In summary

02 | Impact Analysis: Translating Performance and Risk into Financial Terms

The case is now clear: **mechanisms exist to reduce risk, improve performance, and create value through the decarbonization of the real estate sector**. What remains lacking is not so much knowledge as coordination, prioritization, and alignment of actors.

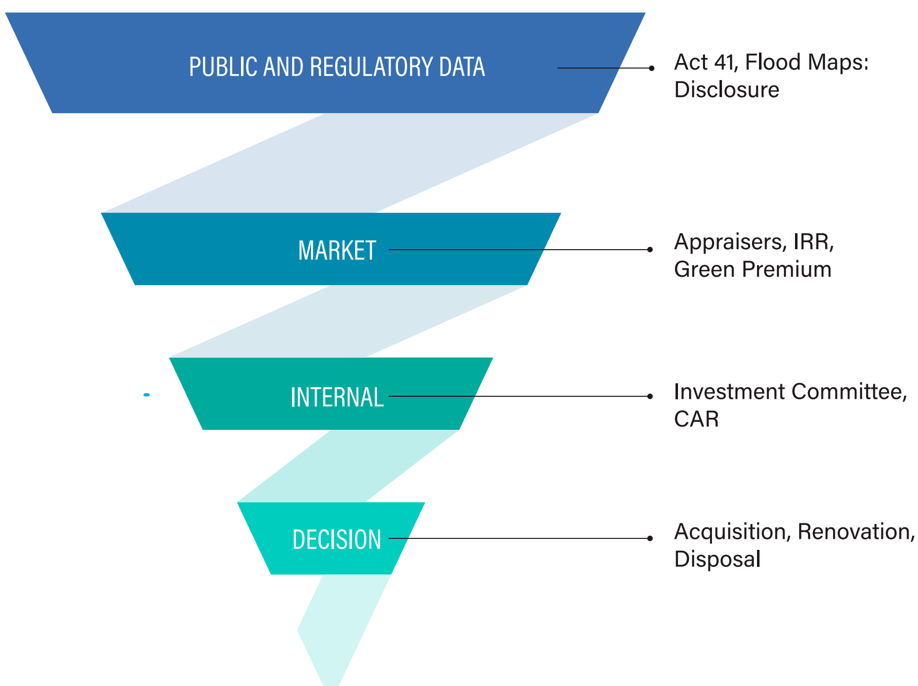
Part 3 sets out concrete, targeted recommendations to translate these levers into coherent actions, calibrated to the responsibilities and capabilities of each segment of the real estate sector.

03

Strategic Recommendations: Operationalizing Sustainability for Real Estate Leaders

The findings set out in the preceding parts make clear that building sustainability can no longer be addressed as a general principle or a normative ambition. It must become a structuring decision-making framework, embedded in governance mechanisms, investment strategies, risk management, and financial models. **The recommendations that follow are intended to turn this ambition into concrete, applicable, and reproducible practices, adapted to the realities of the Quebec and Canadian markets.**

Figure 7 : The decision funnel — from public policy to in-house practice



Public policymakers

3.1 Recommendations to Public Authorities

Regulatory Predictability for a Resilient Market

Public action plays a decisive role in reducing information asymmetries and securing long-term investment. Rather than imposing isolated constraints, the objective is to structure a regulatory environment that channels capital toward resilience.

3.1.1 Guiding Principles for a Structuring Regulatory Framework

The evolution of Quebec regulatory framework would benefit from resting on four strategic pillars:

Emergence of a common language

Fostering shared terminology around real estate sustainability is essential. This language must be compatible with the guidelines of international financial regulators while remaining accessible to all local market actors (managers, appraisers, lenders).

Standardization of data

The deployment of disclosure mechanisms should be gradual and proportionate. Standardized, comparable data is the primary driver of value: it allows the market to quantify risks precisely and to apply, where appropriate, the Brown Discount required to incentivize upgrades.

Predictability and continuity of requirements

For regulation to channel investment rather than impede it, new requirements must follow a clear temporal trajectory. Predictability reduces financial uncertainty and allows transition costs to be incorporated into the natural renovation cycles of buildings, without overturning the fundamentals or direction.

Updating reference tools

Rigorous risk assessment relies on reliable tools and available data. Public support for the ongoing updating of climate-risk maps, energy databases, technical references (e.g., sewer back-up frequency, power outages), and climate-change impact projections is a sine qua non for the sound management of real estate capital.

Internationally, the sustainability of buildings is increasingly being treated as a question of risk management, transparency, and market access, rather than as a voluntary or purely technical undertaking. (See appendix for further details.)

Table 9 : International Comparison of Approaches

Juridsiction	Main lever	Key requirement	Scope
European Union	Financial valuation	Value adjusted for long-term sustainability and future obligations	Financial institutions and appraisers
United Kingdom	Access to rental market	Prohibition on leasing buildings rated F or G	Residential and commercial
France	Energy and climate performance	Progressive ban on leasing the lowest-performing dwellings (G from 2025, F from 2028, E from 2034)	Residential
EU (2024 directive)	Renovation planning	National plans, minimum standards, zero-emission buildings	Whole stock
New York	Emissions caps	Annual emissions limits with financial penalties	Large buildings
Australia	Transparency	Mandatory public disclosure of energy performance	Commercial buildings
Austin	Targeted obligation	Mandatory renovation for highly energy-intensive buildings	Multi-family
Vancouver	Incentives	Regulatory advantages for high-performing projects	New construction

International best practices share several common principles

International best practices are based on a few common principles:

- Anticipating climate risks in the financial value of assets, enabled by access to adequate data and tools.
- Regulatory predictability and clear trajectories.
- Transparency and accessibility of data.
- Differentiated requirements according to use and actual performance.
- A combination of minimum obligations and incentives.

These approaches show that sustainability can be operationally embedded in real estate decisions, not merely through voluntary commitments, but through the progressive structuring of market rules. There is no single model, but rather a range of complementary levers. Some jurisdictions rely primarily on transparency (Australia, Austin), others on minimum performance thresholds (United Kingdom, France), while others embed energy and climate performance directly in financial and valuation mechanisms (European Union, New York). Together, these approaches confirm that a common disclosure framework is often the most structuring entry point, from which more targeted requirements can subsequently be deployed.

3.1.2 Multi-Level Coherence as a Guarantee of Predictability

The proliferation of regulatory initiatives, while it reflects a willingness to act, also carries a risk of fragmentation. For the real estate sector, the uncertainty arising from the layering of municipal (zoning, water management), provincial (Bill 41, energy efficiency), and federal (OSFI / ISSB disclosure standards) requirements constitutes a financial risk factor in its own right — even as the sector is actively integrating climate risk into its portfolio risk analyses.

Aligning energy-performance trajectories with the prudential expectations of credit institutions, coupled with efforts toward climate resilience, is therefore an essential condition for market fluidity. A coordinated and predictable trajectory across the various levels of government channels large-scale investment, rather than holding it back through duplicated compliance costs or contradictory requirements.

3.1.3 Levers for Action and Metropolitan Resilience

The acceleration of the disclosure regulatory framework, notably through the application regulations of Bill 41, marks a turning point. In parallel, the question of municipal infrastructure is becoming an issue of direct market value.

Municipalities are invited to prioritize stormwater network upgrades to safeguard neighbourhood insurability and respond to increases in rainfall intensity. Our financial modelling supports this approach:

- For example, a $600,000 investment in a building stormwater compliance upgrade, amortized over 25 years, affects the asset value by only 0.50 %.

- Conversely, the obsolescence of municipal networks may lead to a loss of insurability, forcing the creation of a reserve of 2 % of EGI — or more, depending on the worsening impacts of climate change. This non-recoverable charge translates into a value drop of 1.71 %.

Finally, the harmonization of fiscal incentives and subsidies, aligned with deep decarbonization targets (favouring high-efficiency HVAC systems and moving away from fossil fuels), would help offset the initial investment required by the most ambitious projects.

Financial Institutions

3.2 Recommendations to the Financial Sector

Converging Valuation, Financing, and Insurance for a Systemic Approach to Real Estate Risk

The real estate market rests on the constant interaction of three fundamental functions: insurance, financing, and valuation. In the face of climate and energy risks, however, these three spheres are currently evolving at different speeds, creating financial blind spots that hinder the transition. Given that a real estate asset typically includes components with useful lives of up to 50 years, it will be difficult to adapt buildings without a financial shock if this rapid market evolution is not accounted for.

3.2.1 A Misalignment of Perception Among Actors

Insurers are often the first to adjust their parameters. Higher premiums, eligibility restrictions, and reduced coverage are direct signals of exposure. At the other end of the chain, lenders are progressively incorporating these signals into their credit analyses. Real estate appraisals, however — which serve as the foundation of collateral value — still rely largely on historical comparables and struggle to reflect prospective market value.

While analysis based on reliable historical data is important to avoid speculative valuations, it should nonetheless include the impact of risks with a high probability of materializing.

This asymmetry creates a critical misalignment: a risk may be recognized by the insurer and integrated by the lender, yet remain invisible in the estimated market value. Greater coherence would allow for more efficient pricing and a reduction in systemic risk.

3.2.2 Levers of Convergence: Standardization and Sensitivity

To reduce this misalignment, harmonization of practices is needed around quantifiable parameters and standardized analytical methods.

- **Favour standardized synthetic indicators.** The proliferation of technical metrics (GJ/m^2, tCO^2e/m^2, flood probabilities) can hinder the readability of analyses. Following the example of the Energy Performance Certificate (EPC) in Belgium, financial institutions would benefit from translating raw data into standardized synthetic indicators (ratings or indices). This simplification supports rapid reading by credit committees, improves comparability across assets, and reduces information asymmetries.

- **Integrate climate-sensitivity analyses.** Without imposing an immediate overhaul of valuation methods, reports could include an impact analysis on valuation across physical, energy, and regulatory risk scenarios. This approach gives lenders a better appreciation of real risk while respecting the current professional framework of appraisers.

3.2.3 Financial Materialization of Risks

Harmonization must translate into concrete adjustments in financial models :

- **Vacancy and revenue signals.** Appraisers should model obsolescence. Applying a 12.5 % vacancy rate for a brown building (versus 7.5 % for the market) leads to a depreciation of 10.9 % — a key signal for adjusting **loan-to-value ratios.**

- **Recognition of resilience.** Energy performance must become a credit lever. Rate reductions (25 to 35 bps) for high-performing assets help secure the pivotal IRR (7.5 %) and cap rate (7.0 %).

- **Managing uninsurability.** If an insurer withdraws coverage, the establishment of a 2 % EGI reserve (which reduces market value by 1.71 %) must be reflected immediately to avoid overvaluation of the asset.

3.2.4 Toward Standardized Forward-Looking Analyses

The gradual integration of harmonized forward-looking analyses is a strategic lever for strengthening the resilience of the Quebec and Canadian real estate market..

To materialize this coherence, financial institutions should systematically require, and appraisers propose, the inclusion of a climate and energy analysis report as an annex to traditional market appraisals. This practice moves sustainability risk out of footnotes and into the heart of the credit file, without altering the fundamental standards of the profession. By standardizing these annexes, the market ensures that every dollar invested in decarbonization and adaptation is recognized, financed, and insured at its fair value, transforming an environmental constraint into a fiduciary management standard.

Integrating climate and energy risks into appraisals requires synthesis tools that allow for the rapid reading of an asset's financial risk profile.

Sample steering tool — The financial-risk dashboard

Using a standardized dashboard (see figure below and Appendix — Sample risk matrix) translates technical vulnerabilities into pivotal financial indicators (financial-risk score). This tool facilitates the dialogue between owner, appraiser, and lender by immediately identifying potential depreciation zones (e.g., uninsurability risk, energy obsolescence).

Asset's financial- risk score dashboard

Scores out of 4, weighted by category

Category	Poids	Score	Interprétation	Score pondéré
1. Energy performance and adaptability	25 %	0,00	Low risk	0,00
2. Physical and climate risk	20 %	0,00	Low risk	0,00
3. Transition risk	8 %	0,00	Low risk	0,00
4. Operational risk	12 %	0,00	Low risk	0,00
5. Financial risk	35 %	0,00	Low risk	0,00
OVERALL SCORE		**0,00**	**Excellent**	

Score legend	Potential impact on asset value
0 to 20 — Low risk	5 % or more
20 to 40 — Moderate risk	0 to 5 %
40 to 60 — High risk	-3 % to 0 %
60 to 80 — Very high risk	-10 % to -3 %
80 and above — Critical risk	-10 % or worse

3.2.5 Institutional Innovation and Tool Interoperability

The effective integration of climate risk does not rest solely on technological innovation, but also on institutional innovation. Today, the lack of interoperability among the appraisal tools used by lenders, insurers, and owners generates information asymmetries and costly duplicated analyses.

The development of public, interoperable databases (risk maps, performance registries), together with the adoption of common appraisal matrices, would streamline data transmission. Such fluidity would allow certified performance information to be immediately interpretable by the entire financial chain. Reducing this data friction is the lever that will enable climate risk to be fully integrated into strategic decisions, rather than remaining confined to an isolated technical metric.

3.3 Recommendations to Real Estate Managers: Defining a Risk Appetite Framework to Operationalize Resilience

3.3.1 Definition and Strategic Role

A Risk Appetite Framework (RAF) is a strategic tool by which an organization defines the level of risk it is willing to assume in pursuit of its financial objectives. Already used to frame credit, market, or liquidity risk, the RAF can be adapted to the climate and energy risks affecting real estate portfolios.

Applied to real estate, this framework translates physical and regulatory risks — often perceived as qualitative — into measurable, comparable, and manageable indicators at the portfolio level. It thereby transforms an environmental issue into a strategic variable embedded in financial governance.

Figure 8 : Simplified framework for integrating climate risk into a real estate portfolio.

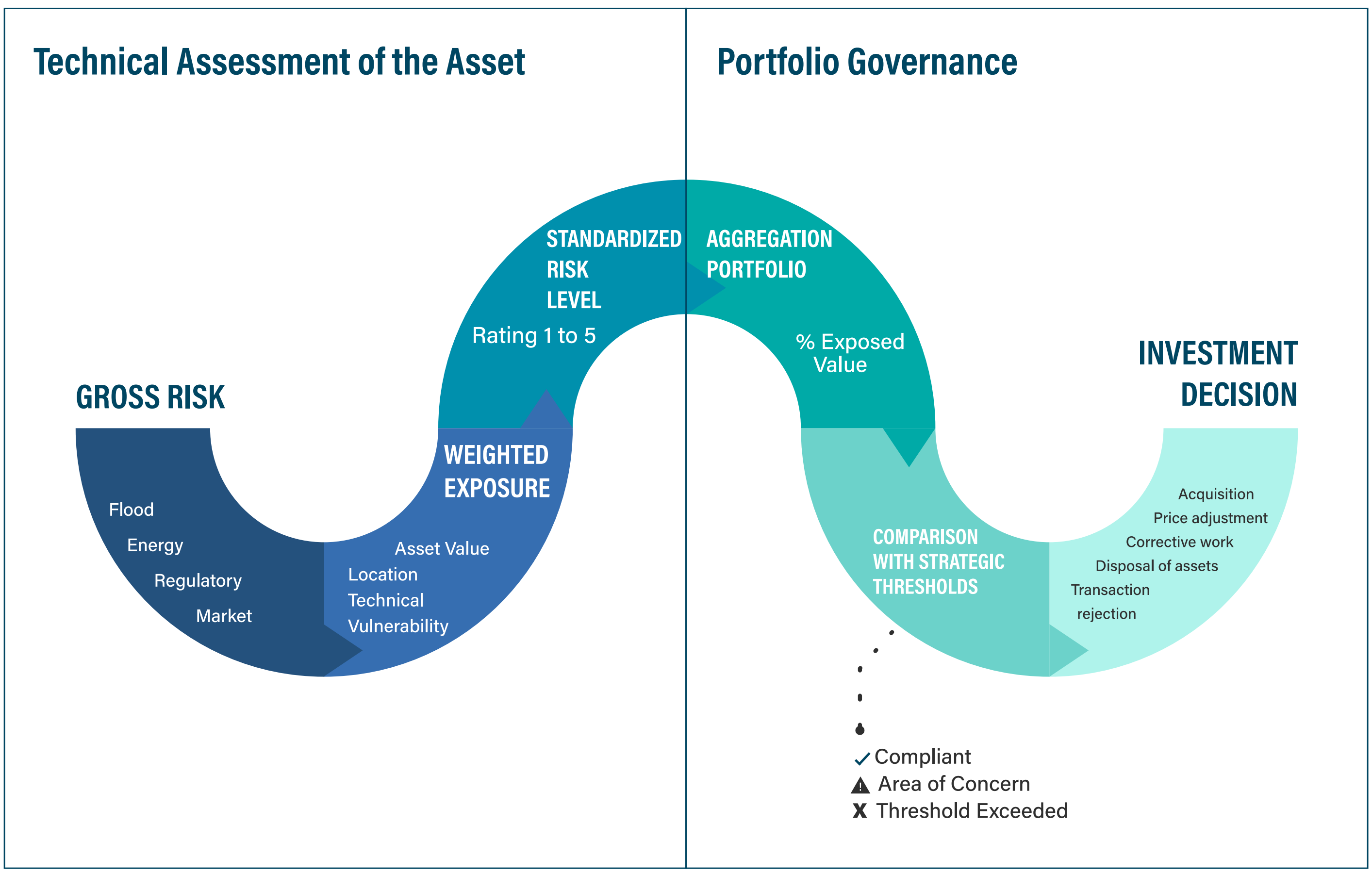


Figure 8 illustrates the path from an identified climate risk (e.g., flooding, high energy intensity) toward an aggregated measure supporting strategic decision-making. The normalization of individual risks enables their comparison and their coherent integration into existing financial governance mechanisms.

Developers and builders

3.3.2 Engaging the Value Chain: Developers and Builders

The integration of sustainability does not begin at the operations stage but at the design phase. The builder holds the initial lever for minimizing future obsolescence and maximizing the asset's exit value.

- **Design for resilience and adaptability.** Buildings must meet not only current standards (Building Code) but also the foreseeable requirements of the coming decades (e.g., 2030–2050 decarbonization targets). Building adaptability margins into the design phase limits subsequent upgrade costs, which are often prohibitive.

- **Demonstrate actual performance through measurable indicators.** To facilitate access to capital and financial valuation, developers must provide tangible evidence of performance (rigorous energy modelling, resilience certifications). A building designed for an optimized energy intensity (targeting the $1.90/sq. ft. threshold or below) immediately secures a liquidity premium on the market.

- **Anticipate convertibility and the life cycle.** The choice of materials and systems (e.g., favouring all-electric or geothermal solutions) reduces future regulatory risk. An asset designed without reliance on fossil fuels avoids, from the outset, the 10.9 % Brown Discount associated with buildings that are difficult to convert.

Real estate managers

3.3.3 Levers for Owners and Asset Managers

The operationalization of a risk appetite framework rests on a transformation of management practices throughout the building life cycle. For owners, this implies moving from reactive maintenance to an active resilience strategy :

- **Adopt a full life-cycle perspective.** Sustainability must be integrated not only at the acquisition stage, but also into operating and decommissioning choices. Each renovation decision should be assessed on its ability to reduce long-term obsolescence rather than on its immediate cost alone.

- **Systematize the collection of reliable data.** Reducing information asymmetries with lenders requires robust internal systems. Rigorous monitoring of energy performance (benchmark: $1.99/sq. ft.) and of actual operating costs is the sine qua non for justifying a value premium with appraisers.

- **Use standardized analytical tools.** Each building must be positioned within a clear risk profile (a 1-to-5 rating). This standardization supports a shared view with financial partners and facilitates access to preferential financing (reductions of 25 to 35 bps).

- **Prioritize structural investments.** Budgetary trade-offs should favour measures that reduce fundamental risks (HVAC efficiency, flood resistance) rather than aesthetic or one-off improvements. A $600,000 investment in stormwater resilience, although it may appear as a cost, is in fact a hedge against a 1.71 % value depreciation tied to uninsurability.

3.3.4 Operationalization: From Signal to Decision (Workflow)

For the Risk Appetite Framework (RAF) to be effective, it must be anchored in the organization's governance. Indicator monitoring should not be a one-off exercise, but a systematic process.

Accountability (who?)

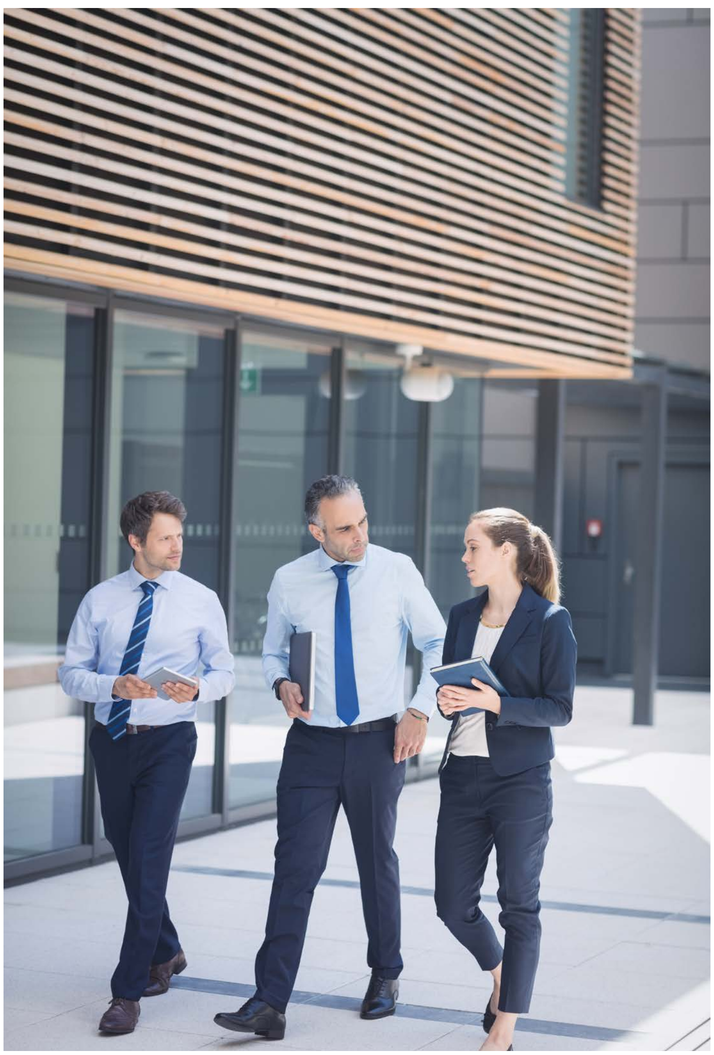
Threshold setting rests with senior management or the risk committee, while operational monitoring is carried out by asset managers in collaboration with sustainability experts.

Review frequency

- **Quarterly:** monitoring of energy performance and vacancy indicators.

- **Annual:** full reassessment of portfolio exposure (physical and regulatory risks) and updating of tolerance thresholds.

- **Ad hoc:** for each acquisition or major renovation project (Capex).



3.3.5 Operationalization: From Signal to Decision (Workflow)

Implementation rests on a rigorous methodology for converting technical data into financial decisions. When an indicator breaches a tolerance threshold, an escalation protocol must be triggered:

Detection (the signal). An asset deviates from performance averages.

- Office example: energy cost exceeding the benchmark by 15 % (reference: $1.99/sq. ft.).
- Multi-residential example: energy cost above the $4,850 per door target.

Diagnosis (Class 2 audit). Exceeding the threshold automatically triggers an in-depth technical analysis (energy audit or resilience study) to identify causes and solutions.

Sensitivity analysis (the calculation tool). Use of a standardized calculation template to simulate the financial impact. The cost of the works (e.g., HVAC, envelope) is compared against the protection of market value (avoiding a 3.5 % to 11 % discount, depending on use).

Decision (the committee). Presentation to the investment committee. If the investment preserves the target return (IRR of 7.5 % for offices, or maintenance of the 3.90 % cap rate for multi-residential), the works are approved. Otherwise, an exit strategy is planned.

3.3.6 Strategic Tolerance Thresholds

This approach enables the establishment of concrete management benchmarks:

- **Physical resilience threshold.** Cap the share of portfolio value exposed to high flood risk at 20 %. If this threshold is breached, the fund must prioritize divestment of vulnerable assets or undertake protective works to preserve insurability (thereby avoiding value drops of 1.71 % (office) to 3.53 % (multi-residential)).

- **Market-performance threshold.** Set a tolerance ceiling for brown assets. Any asset whose projected vacancy (office) or uninsurability risk (multi-residential) threatens net return is placed under strategic surveillance.

3.3.7 Regulatory and Financial Alignment

Adopting this formalized framework facilitates alignment with the expectations of regulators (OSFI, AMF) and secures access to financing:

- **Adjustment of the acquisition price.** Systematic application of the Brown Discount in pre-acquisition financial models.
- **Financing levers.** Keep assets within the compliance zone in order to benefit from rate reductions of 25 to 35 basis points, thereby optimizing the fund weighted-average cost of capital.

By embedding these mechanisms into existing governance, financial institutions strengthen the resilience of their market without overturning their fundamental decision-making structures.

Figure 9 : Summary of Recommendations

	Public policymakers	Municipalities	Financial Institutions
Key Recommandation	Data Standardization and Act 41	Upgrading stormwater systems to meet current standards	Greater variation in rate premiums (-35 basis points) and SLB based on risk
Impact Lever	Predictability and Reduction of Asymmetry	Facilitating the Insurability of Neighborhoods	Risk-Adjusted Cost of Capital

	Appraisers	Developers and builders	Real estate managers
Key Recommandation	Appendices on Prospective Climate Analyses	Design for Adaptability 2030–2050	Integration into the risk appetite framework management
Impact Lever	Sensitivity Analysis of Market Value Based on the Occurrence of Risks	Avoiding the Brown Discount upon delivery or stabilization	Proactive Management of Fund Performance Have an investment plan to reduce risk

Table 10 : Pivotal indicators of market value (multi-sectoral synthesis).

Financial lever	Pivotal parameter	Office (Class A) impact	Multi-residential impact
Attractiveness (market)	Vacancy / obsolescence	- 10.9 % (brown building)	Reduced liquidity signal
Efficiency (revenues)	Energy savings	+ $2.4 M (per $1.00/sq. ft.)	+ $615,000 (per $400/ door)
Financing (debt)	Risk premium (spread)	- 25 to - 35 bps	- 35 bps (+0.81 % value)
Insurability (risk)	Loss reserve	- 1.71 % (2 % EGI reserve)	- 3.53 % (2 % EGI reserve)
Compliance (regulatory)	Adaptation works	- 0.50 % (compliance upgrade)	- 1.54 % (compliance upgrade)

Source: Décarbone+ financial modelling, based on Boréalis simulations and market data from Pôle IDEOS — HEC Montréal (2026).

Conclusion

The transition toward a sustainable real estate stock can no longer be viewed as a mere exercise in environmental compliance or a voluntary undertaking. As this white paper demonstrates, climate performance is now intrinsically linked to the financial durability, insurability, and market value of assets.

By transforming sustainability into a shared language — grounded in quantifiable indicators (NOI, IRR, credit spreads) and formalized risk-appetite frameworks — the Quebec and Canadian real estate sector is equipping itself with the tools required to navigate a changing economy. Aligning the regulatory framework, valuation standards, and financing mechanisms is not merely a lever for decarbonization and climate resilience: it is a strategy to protect capital against irreversible technological and regulatory obsolescence that may, in time, render an asset stranded.

Operationalizing sustainability means embedding resilience at the very core of fiduciary management. Those who succeed in translating these risks into structured decisions will turn a systemic constraint into a durable competitive advantage, thereby safeguarding the liquidity and profitability of their assets for decades to come.

This shift is not instantaneous: it represents a profound paradigm change for every link in the value chain. Moving from a traditional reactive approach to proactive risk-based stewardship calls for an evolution of skills and tools. The table below summarizes this maturity trajectory, **showing how the management, valuation, and financing functions are now converging toward a forward-looking view of real estate value.**

The white paper is intended to serve as the foundation for a movement aimed at better integrating risks in order to adapt our management strategies in the face of the energy transition and climate change. By ensuring the integration of measurable, verifiable, and evolving data, while relying on risk analysis tools—even if they are imperfect in their early stages—we are fostering a market transition. In this context, early adopters will be able to maintain a more stable value for their real estate portfolios, while others will face the turbulence of a transition marked by the emergence of stranded assets. While the impacts are already becoming apparent in certain jurisdictions with more advanced regulatory frameworks, these same phenomena will inevitably occur here as well—it is only a matter of time.

Figure 10 : Maturity trajectory toward sustainable real estate finance.

	YESTERDAY Traditional approach	TODAY Transition	TOMRROW (Risk-based stewardship)
Real estate manager	▪ Annual asset-maintenance budget (no planning) ▪ Optimization of operating costs ▪ Energy-efficiency decisions based on simple ROI	▪ Identification of needs (maintenance and energy) ▪ Risk-sensitivity analyses ▪ Broader view of costs (CAPEX / OPEX)	▪ Integrated investment plan: ◦ Decarbonization ◦ Climate resilience ◦ Asset maintenance ▪ Decisions driven by risk and long-term value
Appraiser	▪ Value based on comparables ▪ Analysis of current market trends	▪ Addition of sensitivity analyses ▪ Partial consideration of risks	▪ Valuation integrating: ◦ Climate risks ◦ Energy performance ◦ Regulatory or insurance constraints ▪ Forward-looking approach
Lender/ financial institution	▪ Analysis of repayment capacity ▪ Income risk (vacancy, market) ▪ Short- to medium-term view	▪ Request for sensitivity analyses ▪ Progressive integration of ESG risks	▪ Financing based on: ◦ Asset's risk rating ◦ Transition costs (carbon, adaptation) ◦ Long-term resilience

Annexe 1 : Summary of Main Findings by Type of Risk

Type of risk	Description	Key mechanisms	Consequences for assets	Empirical findings
Regulatory risks	Progressive tightening of energy and environmental standards. High uncertainty about the evolution of the regulatory framework.	▪ New disclosure and performance obligations (e.g., Bill 41). Possible introduction of binding energy-performance ratings. Heritage standards may restrict renovations.	▪ Non-compliance risk. Regulatory obsolescence. Increased value volatility with regulatory change.	▪ Value gap of +10 % (A) to -5 % (G) — Brounen & Kok (2011). Premium of +5.4 % to +9.8 % for high-performing dwellings (A–C) — De Ayala, Galarraga & Spadaro (2016).
Market risk	Growing polarization between green and brown assets. Value and liquidity shaped by energy performance.	▪ Green premium on rents, prices, and returns. Discount for inefficient assets. Revisions in climate beliefs influencing values.	▪ Outperformance of green assets. Underperformance and gradual obsolescence of brown assets. Stronger effect in less climate-sceptic markets.	▪ Green premium: rents +3–5 %, value +15–16 % — Eichholtz et al. (2010). Returns +3–4 %/year — Eichholtz et al. (2019). Residential: +2–10 % on sale — Bloom et al. (2011), Kahn & Kok (2014), De Ayala et al. (2016). Climate beliefs: -6–7 % — Baldauf et al. (2019).
Financial and credit risks	Growing integration of energy performance into credit-risk assessment. Differentiation between green and brown assets.	▪ Fewer defaults for high-performing assets. More stable income, including higher retention and occupancy rates. Higher interest rates for carbon-intensive or energy-intensive assets.		▪ Default-risk reduction: -27 % to -34 % — Guin et al. (2022); An & Pivo (2020); Billio et al. (2022). Higher occupancy: +8 to +17 %; lower financial concessions — Devine & Kok (2015); Fuerst & McAllister (2020).
Energy-price risks	Vulnerability of energy-intensive buildings to higher tariffs.	▪ Rising operating costs. Probable future increases in commercial / industrial tariffs.	▪ Increased operating costs for energy-intensive buildings.	▪ Spain: energy savings of €826 per year (80 m²) when moving from E to C — De Ayala et al. (2016). Risk premium of +4.4 pp on long-term loans in highly exposed areas — Javadi & Masum (2021).
Location risks	Exposure to climate hazards (floods, fires, erosion). Difficulty to insure and finance.	▪ Floods (urban and fluvial). Higher insurance premiums. Costly structural damage. Growing spatial correlation of extreme events (limiting diversification).	▪ Value depreciation. More expensive credit access in risk zones. Risk of systemic losses for financial institutions.	▪ Direct impact on financial flows — Feng, Lu-Andrews & Wu (2024). Premiums +14.3 %, prices -4.2 %, transactions -2.3 % — Hennighausen et al. (2023).

Source : Pôle IDEOS - HEC Montréal

Annexe 2 : Detailed Analysis of International Best Practices

1. Integrating Sustainability into the Financial Valuation of Assets

European Union

Key best practice: Move from a short-term, market-based value to a long-term sustainable value.

- Amendment 2024/1623 to the Capital Requirements Regulation requires financial institutions to adjust the value of assets when the current market price is deemed unsustainable over the loan horizon.
- This approach aims to prevent temporarily favourable market conditions from masking long-term structural risks.
- Appraisers must consider factors likely to affect the future value of buildings, including those tied to energy performance and forthcoming regulatory obligations.
- Future energy-upgrade costs must be incorporated into the valuation when an obligation is anticipated.

Key lesson: Sustainability is not integrated as an isolated ESG criterion, but as a determinant of the financial sustainability of real estate value.

2. Setting Minimum Energy-Performance Requirements

Key best practice: Establish clear, legally binding minimum thresholds tied to building use.

United Kingdom

- Most leased buildings must hold an Energy Performance Certificate (EPC).
- Buildings rated F or G cannot be leased, subject to exemptions.
- Minimum threshold: class E for leasing.
- Approach targeted at rental use, with no minimum threshold for sale or new construction.

France

- The Energy Performance Diagnosis (DPE) is mandatory for sale, lease, and new construction.
- Classification rests on two indicators: energy consumption and GHG emissions (the label is based on the worst result).
- Progressive ban on leasing the lowest-performing dwellings (G in 2025, F in 2028, E in 2034).

Key lesson: Minimum thresholds transform energy performance into a condition of market access, rather than a simple piece of information.

3. Planning Renovation at the National and Sectoral Level

Key best practice: Frame the transition of the building stock through clear, progressive trajectories.

European Union — Energy Performance of Buildings Directive (2024)

- Each Member State must submit a national renovation plan by 2026.
- Objective: a highly efficient and largely decarbonized building stock by 2050.
- Intermediate targets for 2030, 2040, and 2050.
- Harmonized minimum performance requirements.
- New zero-emission public buildings from 2028, and all new buildings from 2030.
- Mandatory renovation of the lowest-performing non-residential buildings (16 % by 2030, 26 % by 2033).

Key lesson: Renovation is treated as a long-term structural policy, with predictable milestones for market participants.

Annexe 2 : Detailed Analysis of International Best Practices

4. Investing in Transparency and Data Standardization

Key best practice: Make energy performance measurable, comparable, and accessible.

United States — New York

- Annual obligation to disclose energy and water consumption (Local Law 84).
- Mandatory use of a standardized benchmarking tool.
- Basis for the introduction of emissions caps (Local Law 97).
- Caps differentiated by building use.
- Significant financial penalties for exceeding caps.
- An evolving framework with progressive tightening of caps.

Australia

- Public register of energy assessments for commercial buildings.
- Mandatory disclosure on sale or lease.
- Energy rating displayed in real estate listings.
- More than 20,000 certifications published between 2011 and 2025.

Key lesson: Transparency acts as a market lever, even in the absence of binding thresholds.

5. Combining Targeted

Key best practice: Tailor requirements to actual performance and encourage innovation.

Obligations and Regulatory Flexibility

United States – Austin

- Mandatory energy audits and disclosure for most buildings.
- Mandatory renovation only for highly energy-intensive multi-family buildings (consumption above 150 % of the average).
- Required minimum 20 % reduction within 18 months for these targeted cases.

Canada – Vancouver

- Incentive-based approach: regulatory advantages for projects exceeding standard requirements.
- No threshold imposed on the building stock as a whole.
- Encouragement of innovation and the voluntary adoption of low-emission practices.

Key lesson: Incentive mechanisms and targeted obligations reduce resistance while steering the market.

Annexe 3 : Synthesis of Industry Workshops

Findings from the workshops with industry professionals

Structural inaction

- Regulatory uncertainty and the lack of actionable data fuel inertia and hold back investment.
- The sector calls for a common framework: definitions, baseline, standardization, and a forward-looking approach to risk in appraisal.
- Until the rules are clear and shared, many actors prefer to wait.

Insufficient, hardly comparable, and poorly usable data

- Improving access to real, tangible data, beyond purely quantitative information, is a major need.
- Stakeholders lack comparable data to document actual risk exposure.
- Without accessible, shared data, comparing assets is difficult.

Difficulty translating sustainability into financial variables

- There is a need to clarify how sustainability and resilience translate into recognized financial metrics: revenues, NOI, attractiveness, operating costs, insurability, cap rate.
- Valuation models look primarily to the past and adapt poorly to future risks.
- Sustainability is rarely embedded directly in risk matrices.

Certifications: useful, but insufficient without a common framework.

- Certification is not indispensable for being sustainable.
- A certification does not automatically translate into a better risk rating, even if NOI improves over the long term.
- There is a risk certification becomes overvalued as a shortcut, at the expense of actual performance.
- Certifications are useful when linked to a common taxonomy and to indicators tracked over time.

Annexe 4 : Key Elements to Document in a Real Estate Asset's Sustainability Analysis

1. Intrinsic characteristics of the building

- [ ] Year of construction and major renovations
- [ ] Energy performance (rating, kWh/m^2, emissions)
- [ ] Mechanical systems and equipment efficiency
- [ ] Historical energy consumption
- [ ] Current regulatory compliance
- [ ] Technical flexibility for future upgrades
- [ ] Physical condition and remaining useful life

2. Regulatory environment

- [ ] Energy standards in force
- [ ] Applicable disclosure requirements
- [ ] Zoning constraints
- [ ] Heritage constraints
- [ ] Likelihood of regulatory tightening in the short/medium term

3. Geolocated physical climate risks

- [ ] Exposure to flooding (fluvial, pluvial, coastal)
- [ ] Wildfire risk
- [ ] Heat-wave risk (thermal comfort)
- [ ] Storm or extreme-wind risk
- [ ] Landslide risk
- [ ] Projected evolution of hazards (climate scenarios)

4. Impacts financiers potentiels

- [ ] Anticipated adaptation costs
- [ ] Effect on operating costs
- [ ] Effect on insurability
- [ ] Impact on resale value
- [ ] Impact on financing and the cost of capital

Annexe 5 : Detailed Modelling of Risk Impacts on Market Value

This appendix examines how climate and energy risks influence the market value of two asset types: Class A offices and multi-residential buildings. Each identified risk can affect several parameters within the valuation models.

1. OFFICE (CLASSE A)

Reference model: 200,000 to 250,000 sq. ft., constructed around 1980, base value of $54,000,000.

Risk category	Risk factor	Impacts on valuation parameters
Regulatory	Network upgrades (water and storm sewers)	Upgrade cost increases amortization (additional rent), possibly reduces the insurance premium, and has an impact to be assessed on base rent and market value.
	Evolution of regulations and taxation (environmental/energy rating)	Higher expenses and additional rent, leading to a decrease in base rent and market value.
Market	Growing demand for green buildings	Allows higher base rents through energy savings on additional rent, thereby increasing value.
	Vacancy rate	Higher vacancy risk for buildings less competitive on gross rent.
	Climate-risk management	Lender assessment of asset's risk relative to the overall portfolio; uninsurability risk in high-risk zones.
	Investment attractiveness	Presumed greater attractiveness of green buildings to investors (precise impact to be studied).
Financial and credit	Actual energy consumption	Impact on borrowing capacity: possible decrease in loan-to-value ratio, reduced liquidity access, and effect on the interest rate.
	Expected returns	Adjustment of investor return requirements according to the asset's risk profile (green vs. brown).
Energy	HVAC system efficiency	An efficient system generates energy savings, reduces additional rent, and raises base rent, creating value. Conversely, upgrade costs increase amortization and may reduce value.
	Choice of energy source	Fossil fuels may offer lower operating costs but raise GHG emissions and financing risk (loan-to-value ratio and rate), despite a potential positive impact on base rent.
	Energy tariff increases	Broad impact, but buildings with less efficient HVAC systems suffer higher additional rent and lower value.
Location and damage	Climate change (flooding, fire, etc.)	Higher insurance premiums increase additional rent and reduce base rent / value. A resilient building benefits from reduced premiums. Uninsurability imposes costly non-recoverable reserves, reducing value.
	Indirect losses	In the event of a loss: lost rental income, higher insurance premiums and expenses, with a negative impact on market value.

Synthesis of the financial modelling — impact on value (Office, Class A)

Risk category	Factor / technical lever	Valuation parameter modified	NOI variation	Market-value impact
Energy	HVAC / envelope efficiency	Energy saving ($1.00/ sq. ft.)	+ $317,733	+ $2,450,000 (+4.54 %)
Market	Green attractiveness	Vacancy reduced to 5.0 %	+ $341,120	+ $2,630,000 (+4.87 %)
	Brown obsolescence	Vacancy increased to 12.5 %	- $765,200	- $5,900,000 (-10.92 %)
Location	Uninsurability (risk zone)	Loss reserve (2 % of EGI)	- $119,554	- $920,000 (-1.71 %)
Regulatory	Compliance (HVAC)	Capex investment ($250k)	- $20,186	- $155,000 (-0.29 %)
	Compliance (storm)	Capex investment ($600k)	- $35,140	- $270,000 (-0.50 %)
Financial	Interest-rate spread	Green financing (-35 bps)	Cash-flow impact	loan-to-value ratio optimization

CALCULATION PARAMETERS (extracts from the model)

Fixed inputs used in this simulation:

- Effective Gross Income (EGI), base: $5,977,680.
- Total operating expenses: $2,191,500 (i.e., $10.96/sq. ft.).
- Net Operating Income (NOI): $3,786,180.
- Cap rate: 7 %.
- Average base net rent: $19.50/sq. ft.
- Standard market vacancy assumption: 7.5 %.
- Investment amortization: calculated over 25 years at a rate of 6.50 %.

INTERPRETATION OF THE RESULTS

- Major risk: the value loss tied to obsolescence (12.5 % vacancy) is the most severe risk financially ($5.9 M), far exceeding the costs of compliance work.
- Value-creation lever: combining greater energy efficiency with reduced vacancy (green building) can generate a combined uplift of more than $5,000,000 on this asset.
- Regulatory decision: stormwater resilience works ($600k), although capital-intensive, affect final value by only 0.50 %, confirming the economic viability of preventive adaptation.

2. MULTI-RESIDENTIAL

Reference model: 50 to 60 units, constructed around 2020, base value of $9,741,000.

Risk category	Risk factor	Impacts on valuation parameters
Regulatory	Network upgrades (water and storm sewers)	Upgrade cost increases amortization (non-recoverable expense), reduces the insurance premium, and impacts value.
	New environmental regulations or taxation	Higher non-recoverable expenses, leading to a decrease in market value.
Market	Demand for green buildings	Tenants potentially willing to pay a rent premium where energy savings are demonstrated.
	Vacancy rate	Heightened vacancy risk for assets that are less competitive on gross rent.
	Climate risks and investment	Risk assessment by financial institutions; presumed greater attractiveness of green buildings to investors.
Financial and credit	Energy consumption and borrowing capacity	Risk of a lower loan-to-value ratio, financing difficulties, and impact on the interest rate.
	Returns	Investor return requirements based on risk (green vs. brown asset).
Energy	HVAC system efficiency	Potential energy and maintenance savings for central systems. Upgrade costs are non-recoverable capital expenditures that reduce value.
	Choice of energy source	Fossil fuels can reduce operating costs and increase NOI, but raise GHG emissions and financing risk.
	Energy tariff increases	Impact on value through lower base rent to offset higher additional rent, especially for inefficient buildings.
Location and damage	Impacts climatiques et pertes indirectes	La hausse des primes d'assurance ou la non-assurabilité (nécessitant des réserves non recouvrables) diminuent le RNE et la valeur. Un bâtiment adapté améliore son RNE via des primes d'assurance réduites.

Synthesis of the financial modelling — impact on value (Multi-Residential)

Risk category	Factor / technical lever	Valuation parameter modified	NOI variation	Market-value impact
Energy	Energy optimization	Saving of $400/door/year	+ $24,000	+ 6.31 % (+ $615,000)
Financial	Green financing	Rate reduction (-35 bps)	Cash-flow impact	+ 0.81 % (+ $79,000)
Location	Uninsurability (risk zone)	Loss reserve (2 % of EGI)	- $13,420	- 3.53 % (- $344,000)
Regulatory	Compliance (storm)	Capex investment ($150,000)	- $5,850	- 1.54 % (- $150,000)

CALCULATION PARAMETERS (extracts from the model)

- Effective Gross Income (EGI), base: $671,000.
- Total operating expenses: $291,000 ($4,850/door).
- Net Operating Income (NOI): $380,000.
- Cap rate: 3.90 %.
- Investment amortization: calculated over 25 years at 6.50 %.

INTERPRETATION OF THE RESULTS

- The uninsurability threat. The multi-residential sector displays marked vulnerability to location risk. The obligation to set aside a loss reserve (2 % of EGI) erodes the building's value by 3.53 %, an impact proportionally twice as severe as that observed for offices.
- The performance lever. Because the cap rate is lower (3.90 %), each dollar of expense savings translates into greater value creation. A performance gain of $400 per unit generates an immediate value uplift of 6.31 %.
- Regulatory decision. Although the $150,000 investment in stormwater resilience is a non-recoverable expense, its impact on overall value (-1.54 %) remains lower than the risk of massive depreciation tied to a loss of insurability or recurring damage.

This table projects the net financial advantage of a proactive (green) building relative to one experiencing obsolescence (brown).

Long-Term Financial Performance Dashboard (Office vs. Multi-Residential)

Horizon (years)	Asset type	Energy savings (cumulative)	Income gains (vacancy avoided)	Insurance savings (reserves avoided)	Asset-value protection	Net uplift (after Capex)
0 (Invest.)	Office	—	—	—	+ $11,900,000	+ $11,050,000
	Multi	—	—	—	+ $1,038,000	+ $888,000
5 years	Office	+ $1,588,665	+ $5,531,600	+ $597,770	+ $11,900,000	+ $18,768,035
	Multi	+ $120,000	(included)	+ $67,100	+ $1,038,000	+ $1,075,100
10 years	Office	+ $3,177,330	+ $11,063,200	+ $1,195,540	+ $11,900,000	+ $26,486,070
	Multi	+ $240,000	(included)	+ $134,200	+ $1,038,000	+ $1,262,200
20 years	Office	+ $6,354,660	+ $22,126,400	+ $2,391,080	+ $11,900,000	+ $41,922,140
	Multi	+ $480,000	(included)	+ $268,400	+ $1,038,000	+ $1,636,400
30 years	Office	+ $9,531,990	+ $33,189,600	+ $3,586,620	+ $11,900,000	+ $57,358,210
	Multi	+ $720,000	(included)	+ $402,600	+ $1,038,000	+ $2,010,600

*Note: Initial Capex deducted is $850,000 for Office (HVAC + storm) and $150,000 for Multi-Residential.

1. **Office (Class A)**

- Annual Operating Gains: $1,543,607 (Breakdown: Energy $317,733 + Avoided Vacancy $1,106,320 + Insurance $119,554).
- Capital Protection: A market value gap of $11.9 million, calculated based on the stabilization of the capitalization rate and the avoidance of the “brown” discount.

2. **Multi-Residential**

- Annual Operating Profits: $37,420 (Breakdown: Energy $24,000 + Insurance $13,420)
- Capital Protection: Market value difference of $1,038,000 (including the $79,000 green financing bonus).

Annexe 6 : Sample Risk Matrix

Financial Risk Assessment Checklist - Real Estate Assets

Score ranging from 0 (excellent) to 4 (critical) — weighted by category

Variable	Description	Weight	Score
1. Energy Efficiency and Adaptability [25 %]			
Energy Intensity	ESPM Rating	7,5	0
Peak Energy Demand	kW/m²	7,5	0
System Adaptability	Water Network, System Flexibility	2	0
Building Envelope Performance	Insulation Quality, Window-to-Wall Ratio	2	0
Energy Management	Energy Control and Monitoring System	4	0
Energy Source Flexibility	Multiple Energy Sources	2	0
Sub Total 1			
2. Physical and Climate Risks [20 %]			
Thermal comfort / heat island	Heat Islands and Passive Measures	2	0
Risque inondation	Flood zone	4	0
Flood Risk	History and Conservation	4	0
Assurability	Changes in Premiums and Coverage	8	0
Sub Total 2			
3. Transition risk [8 %]			
Regulatory Risk	Energy Rating or Water Management	3	0
Environmental Certification	LEED, BOMA, CBZ	5	0
Sub Total 3			
4. Operational Risk [12 %]			
Energy Cost	$/m² comparable	5	0
Maintenance Costs	$/m² comparable	3	0
Internal Business Continuity	Redundancy Level	1	0
External Business Continuity	Grid Reliability or Generator	1	0
Information Availability	Digital twin or available technical drawings/documents	2	0
Business Continuity Plan	Maturity of the plan	1	0
Sub Total 4			
Financial Risk [35 %]			
Energy CAPEX	CAPEX-to-Asset Value Ratio	7,5	0
Climate CAPEX	CAPEX-to-Asset Value Ratio	7,5	0
Necessary asset maintenance	Aging Index	10	0
Vacancy / Rental Appeal	Market Trends / Vacancy Rates	10	0
Sub Total 5			

Annexe 7 : Bibliographie

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