REDBRICK LMD

Building with Intention

Value Creation Through Decarbonization:

Redbrick LMD's Approach to Net Zero Carbon Buildings

INTRODUCTION

The global real estate sector is undergoing a transformative shift towards decarbonization, driven by the urgent need to address climate change. Real estate is one of the largest contributors to climate change, accounting for approximately 36% of global energy consumption and 39% of energy-related carbon dioxide emissions. Building operations alone emit an estimated ten gigatons (Gt) of CO2 annually, while construction activities contribute an additional 2.4 Gt of carbon each year. In response to emerging regulatory standards, escalating climate risks, and shifting societal expectations, the sector is facing an evolutionary shift.

In 2023, I published a book titled *Investment Opportunities in Decarbonizing Real Estate*, featuring case studies of innovative development firms from North America and Europe that are leading the way in low-carbon construction and net-zero building operations. Recently, I got the opportunity to expand the case studies to include Redbrick, LMD ("Redbrick"), which stands out as a prominent nationwide example of how sustainability can be a core strategy to creating value in real estate development. This case study focuses on Redbrick's approach to decarbonization, highlighting their impressive pipeline of over ten whole lifecycle net-zero carbon buildings ("WL-NZC"). Considering the impressive scope of Redbrick's sustainable development, exploring the origins and progression of their strategy could offer valuable insights to other players in the market.

— Paul Rabinovitch, Author
Net Positive Capital

Rendering of the Bridge District, a planned development by Redbrick LMD.

ABOUT REDBRICK LMD

Redbrick is a vertically integrated real estate investment, development and management firm primarily operating in the Washington, DC metro area. Their focus is on developing build-to-core, institutional quality, place-making projects. They have committed to decarbonization as part of a "single bottom line" approach. Meaning that, for Redbrick, decarbonizing their buildings is strategically integrated with a singular goal of maximizing returns for their investors. Redbrick is distinct from many other development firms pursuing decarbonization in that Redbrick has chosen to pursue decarbonization as a core business strategy whereas many other firms pursue decarbonization with a mission-driven motivation.

They have identified low carbon construction and operations as a material driver for their investment success over the long term and believe that inherent to the strategy are new potential competitive advantages, the opportunity to mitigate transition risks, and possible engagement with investors interested in climate conscious investments. As such, Redbrick is emblematic of an emergent class of developers who are committing to decarbonize their investments based on the identification of a competitive advantage that could be accretive to their economic returns. I find this recognition of inherent value from sustainability encouraging as it points to a broader adoption of a low carbon approach to real estate investment, development and management across the country and provides a more hopeful perspective to meaningfully addressing global climate change.

Other notable aspects of the firm include:

- Redbrick is among the largest private landowners in Washington, DC and has an ~8 million square foot (SF) development pipeline of build-to-core projects on owned or controlled land, of which 4 million SF are in Opportunity Zones.
- One of Redbrick's buildings, began leasing in Q1-2025, will be the largest market-rate multifamily building in the world, and the only one in the U.S. to seek International Living Future Institute ("Living Future") Certification. Living Future is one of the most rigorous external rating organizations for WL-NZC buildings.
- Three current Redbrick development sites — Navy Yard, Bridge District and St. Elizabeth's East — are multi-parcel, mixed use and phased placemaking developments. These new neighborhoods do not displace any residents, in fact they contribute significantly to job creation, support small businesses, and provide professional training opportunities for residents.
- Most of the land under development is along the Anacostia River in southeast DC, next to national parks, miles of pedestrian and bike trails, and accessible to public transportation via the Metro's Green line.

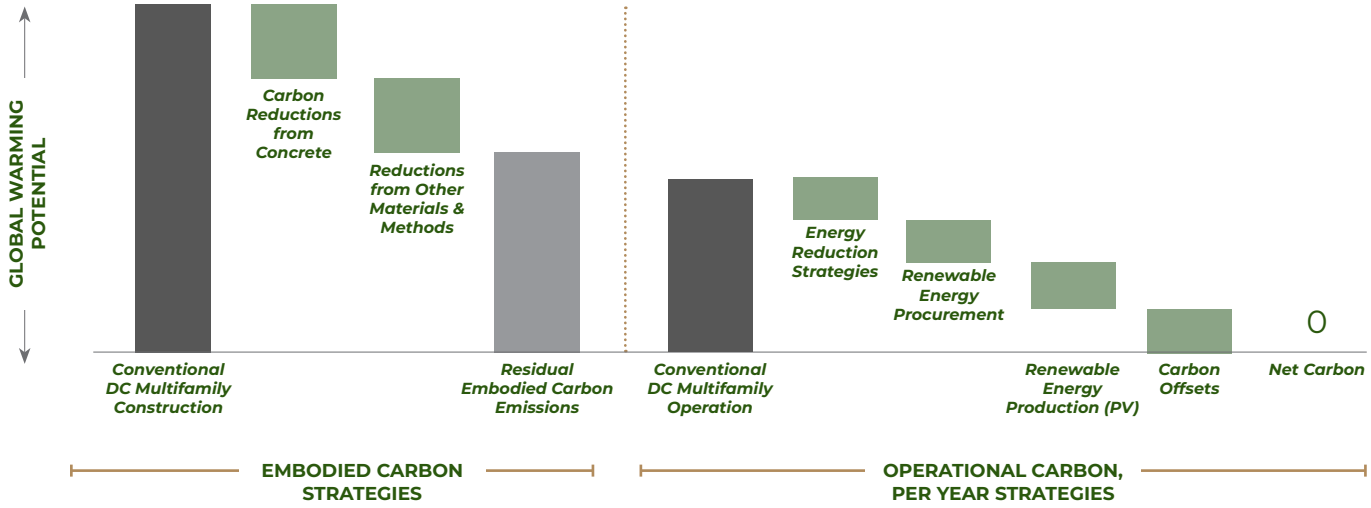
Almost all current Redbrick projects are designed to achieve the rigorous International Living Future Institute (ILFI) Zero Carbon Certification™ as well as the USGBC-Leadership in Energy and Environmental Design (LEED) Certification. Importantly, Redbrick's buildings are designed from inception as WL-NZC

buildings. The term “Whole Lifecycle Net Zero Carbon” refers to a building that has minimized or offset its carbon emissions across its life cycle, from the extraction of raw materials through construction and into operations, effectively achieving a net zero carbon footprint throughout its lifespan[1]. There is a spectrum of decarbonization outcomes and being a WL-NZC building represents the current state of the art, or pinnacle, of decarbonization.

Redbrick intends to design and construct more than ten WL-NZC standard buildings, potentially the largest number developed by a single entity in the United States. This positions Redbrick as a leading nationwide example of leveraging sustainability as a core business strategy. This case study aims to elucidate the fundamental underpinnings of their decarbonization strategy.

NET ZERO WHOLE LIFECYCLE CARBON BUILDINGS

Illustrative Example of Concrete Construction of Multifamily Building in Washington, DC



THE FIVE MAJOR FINDINGS OF THE CASE STUDY:

Decarbonization For Value Creation and Risk Mitigation Prudent operators and developers are recognizing a market shift toward decarbonization, positioning investor capital to align with this trend.

Strategically, there may be financial advantages in WL-NZC buildings, including energy efficiency gains, potential green premiums, and reduced risk from future municipal penalties on high-emission properties.

Decarbonization Requires New Thinking and Approaches Decarbonization in real estate demands challenging the “heuristic”, or status quo, of building construction and rethinking every step of the design and construction process.

Decarbonization Comes from Commitment, Discipline, and Diligence Altering the status quo of a deeply ingrained system requires constant diligence and reinforcement by the project sponsor to guide the larger development team.

Decarbonization Uses Existing Materials and Technologies Building materials, technologies, and approaches to meaningfully decarbonize buildings are all in existence and accessible. There are no exotic or expensive approaches needed — the requirement is commitment and diligence — not technology.

Decarbonization Is Achievable at Economic Parity to Conventional Building
Building a WL-NZC building at economic parity in a gateway market, is achievable. Redrick calculates the lifecycle value creation of a net zero carbon building, as compared to a conventional building, in their underwriting.

[1]World Green Building Council, Whole Life Carbon Vision.

Before we dive into the specific tactics of how Redbrick is approaching decarbonization, it is worthwhile to take a step back and set the context for how and why decarbonization strategies are manifesting in the U.S. market.

THE CHANGING LANDSCAPE OF REAL ESTATE DEVELOPMENT — A SECULAR TREND TOWARD DECARBONIZATION

According to numerous experts, there is growing evidence that the global real estate sector is undergoing a secular shift toward decarbonization. A secular shift refers to a change in an industry or a market that develops over a longer-term period, sometimes driven by large levers like demographics, technological advancements, or regulatory shifts. The contention is that climate change is pushing multiple industries to adjust to new risks and thereby creating a secular shift. For example, insurance companies are tightening their risk underwriting, banking institutions are offering better rates for "green" loans, and governments are now seeking to enforce new carbon emissions standards to comply with the will of their electorate. These parallel drivers are creating a flywheel effect that are driving changes distinct from market cycles. The belief is that the decarbonization shift will not be a passing fad, rather, the rapidly increasing incidence of climate-driven catastrophes such as hurricanes, wildfires, and other effects will be a reinforcement mechanism that, while inflicting a devastating consequence, will also create a durable driver of change.

In the context of a transition to a low carbon economy, there could be investment approaches that are positioned to achieve greater returns than normal. The winning approaches in this transition could be the managers, sponsors and developers who have anticipated the shift and are at the forefront of producing new decarbonized assets for markets that have decarbonization regulations in place and/or tenant bases that are demanding decarbonized spaces. They will be delivering differentiated assets that are in high demand and in short supply. These pioneering developers, like Redbrick, believe that they stand to benefit from an opportunity to earn a "green premium" as well as improved financial returns from lower operating costs. In real estate, where assets take five to ten years to permit, build, and stabilize, it takes a long time for competitors to catch up and produce new supply, so being a front runner with an in-demand product type can have meaningful competitive advantages. Notably, there is quantitative data that shows this type of green premium effect taking place in Europe, where the decarbonization shift in real estate is prevalent and much more firmly entrenched than in the U.S. This contrast suggests a potential future economic scenario that the U.S. market could eventually follow.

In the U.S., the shift to decarbonization is apparent but patchy: significant efforts are being undertaken only in a handful of states, counties, and cities (For more specifics, see graphics in the Building Performance Standards section below). It is unlikely that there will be very much effort to advance decarbonization from the federal level, at least in the near term, and therefore the majority of regulatory decarbonization activity will continue to be at the local municipality and state level. It should be noted that the Redbrick decarbonization strategy is not necessarily an appropriate strategy to be uniformly applied across the United States, rather, the Redbrick strategy was tailored to respond specifically to the transition risk of the local Washington, DC market.

Washington, DC is one of the local markets that has moved early to address building emissions by passing a set of regulations and code changes that enforce strict emissions standards. If the standards are not met, then fines and penalties are assessed. This section explains how Redbrick and their pipeline of ten or more WL-NZC projects, could be well positioned to benefit since their predicted building emissions will fall well below the standard set by the city. The expected energy efficiency of their buildings creates a measure of safety from potentially punitive fines for their term of investment as well as potentially the next owner's term of investment. The Washington, DC regulatory changes are further explained below.

BUILDING PERFORMANCE STANDARDS (BPS) — THE REGULATORY DRIVER OF CHANGE IN U.S. REAL ESTATE SECTOR

Building Performance Standards are a type of building code that serves as an outcome-based policy, overlying the existing zoning, and is applied to a specified subset of commercial, institutional, and multifamily buildings within a certain jurisdiction. Typically, a BPS seeks to regulate investment properties with a minimum size threshold, below which penalties will not apply. A BPS typically regulates a specific CO2 emissions outcome, but they are also utilized to address other natural resources such as water. An important mechanism associated with the BPS are the date-certain deadlines by which buildings must achieve the designated CO2 emission reduction target

levels. The regulated buildings' energy performance must meet the goals by the deadline or face non-compliance penalties/fines[2]. According to national brokerage firm CBRE, thirteen cities have a BPS in place and between 30 to 50 additional cities plan to pass a BPS by no later than 2026 (see table at right). As of July 2024, these policies already cover about 25% of all buildings in the U.S. and it is worth noting that most gateway or "core" cities are subject to a BPS. Many of the existing BPS also become more stringent, or ratchet up, over time. In cities with a BPS like NYC, Portland, Denver, and Boston there are clear negative financial consequences for being non-compliant with the BPS. In NYC, for example, the BPS went into effect in 2024 and will assess a $0.50/SF penalty on buildings that fail to file an emissions report, a penalty of $500,000 for providing false statements, and a penalty of $268 per metric ton of CO2 over the limit.

The existence of a BPS in Washington, DC was a material factor in Redbrick's decision to pursue the development of WL-NZC buildings. Their risk analysis and planning concluded that assets brought to market that performed worse than the emissions standards set by the DC BPS, either during their investment period OR during the next owner's investment period, had a heightened risk of value impairment due to exposure to fines or the need to invest in upgrading energy performance (See the illustration on the next page). Therefore, as a rational investment decision, Redbrick determined that the best course of action would be to "build it right the first time." That is, construct a building that could operate at a low emissions level, over a term of 20 years or more, and could therefore be categorized as a "future proof" investment, or reliably safe from incurring fines or fees from the BPS.

This early recognition of the market changes taking place around them underlies key finding #1 of the case study. Redbrick identified the implications of incoming carbon emission fines and chose to steer their development plans on a course that aligned with the prevailing direction of the regulation. Once Redbrick committed to the WL-NZC pathway, the next critical point was how to build a WL-NZC building that would produce the necessary yield on cost to meet its investment goals. This next step into low carbon construction required a whole new mindset on behalf of Redbrick and the professionals they work with.

Existing BPS Jurisdictions

States
Colorado
Maryland
Oregon
Washington

Counties
Montgomery

Cities
Boston
Cambridge
Chula Vista
Denver
New York City
Seattle
St. Louis
Washington DC

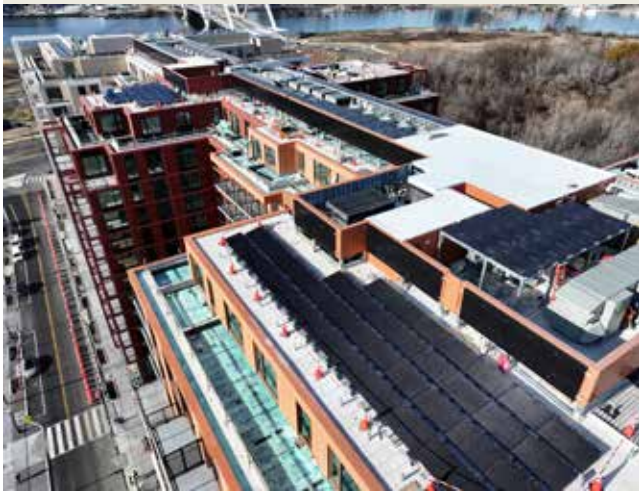
Committed BPS Jurisdictions

States
California

Counties
Los Angeles

Cities
Ann Arbor
Atlanta
Berkely
Boulder Aspen
Chicago
Colombus
Fort Collins
Grand Rapids
Ithaca
Kansas City
Los Angeles
Milwaukee
Minneapolis
Montpelier
New Orleans
Orlando
Philadelphia
Pittsburgh
Portland
Reno
Sacramento
San Diego
San Francisco
Santa Monica
Savannah
West Hollywood

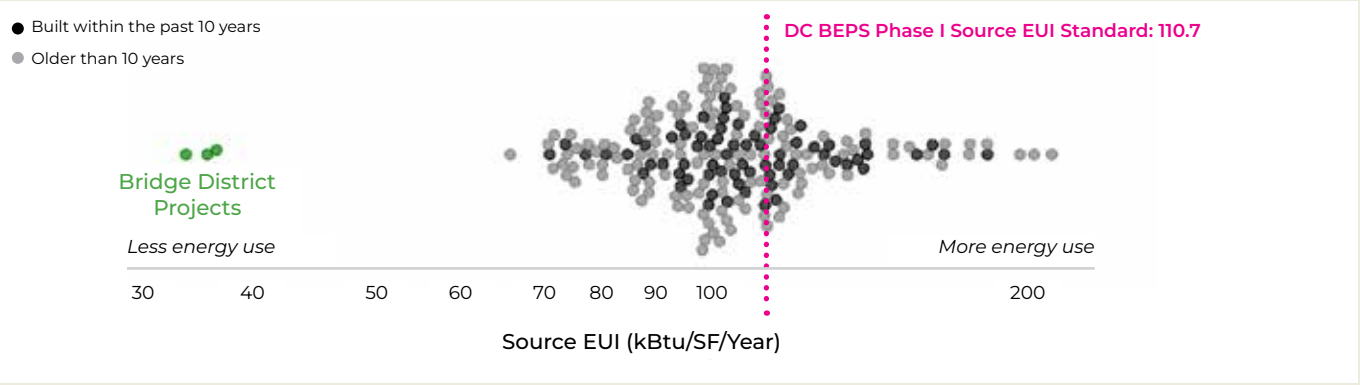
Exisiting: Indicates municipalities that have passed BPS legislation. Committed: Indicates municipalities that have committed to passing BPS legislation.



Rooftop solar panels at Redbrick's Parcels 3 & 4 Bridge District project.

[2]Adapted from the Institute Market Transformation definition.

WASHINGTON, DC BUILDING PERFORMANCE STANDARD AND PROJECTED REDBRICK BUILDING ENERGY PERFORMANCE



Redbrick buildings' projected energy performance is designed to comply with Phase I Building Energy Performance Standards (BEPS) set by the DC government. In the chart above, buildings to the left of the dotted line will be in compliance with the standard, while those to the right will be subject to new fines/fees. It is Redbrick's belief that due to the high efficiency of its buildings, they will remain in compliance for the long term, even as DC tightens the code requirements. Redbrick projects will purchase renewable energy through a Virtual Power Purchase Agreement ("VPPA"), which will source renewable power from the same interconnection as the buildings. The chart does NOT reflect if other buildings have VPPAs and/or if those VPPAs are sourcing renewable energy from the same interconnection. The source EUIs on the chart assume that other buildings are sourcing energy from the grid or, if they are sourcing renewable energy for offsets, it is located on a different interconnection than their building.

THE HEURISTIC APPROACH AND ITS DRAWBACKS

It is extremely difficult, if not impossible, to build a WL-NZC building at a reasonable cost if one follows a conventional real estate design and construction approach. The reason being that conventional development mostly relies on a heuristic approach, ingrained by generations of "this is the way that we have always done it" thinking. The heuristic approach also leans on piecemeal problem solving instead of holistic problem solving. While there is some efficiency that can be gained in utilizing the heuristic approach, it is also stifling to innovation and detrimental to adapting to the rigorous requirements of a NZC or highly energy efficient building. To solve problems like optimizing the energy efficiency relationship between the building envelope, the building's windows and the HVAC system, for example, requires breaking away from the heuristic models and carefully rethinking and reanalyzing every aspect of how those pieces of the building could work together in an integrated way. A key element of Redbrick's approach to decarbonization is a willingness, even enthusiasm, to break the heuristic approach in order to achieve the performance outcome they are seeking. This is key finding #2 of the Redbrick case study.

Following are two examples of how Redbrick re-engineered their approach to development to break free of the typical heuristic model of development.

Example One: The Integrative Design Approach

A "conventionally" built real estate project starts when the architect meets with the owner and gains a perspective on the basics of the building program. The program is usually defined as building use (residential, office, etc.), size, height, and massing. Once the program has been documented the architect creates an iterative series of sketches called schematic design, over weeks or months, until the owner agrees that everything meets the requirements. The schematic design is then sent out to construction specialists selected by architects such as HVAC engineers, electrical engineers, structural engineers, and others. Each of these professionals are experts in their disciplines and are skilled at perfecting their respective systems.

Typically, each of these systems are designed in isolation, separated from the larger system(s) they are meant to operate within. In this way, multiple linear processes are completed in parallel, each designed within the silo of that discipline and based on rules of thumb conventions and standards for each specialty. Unfortunately, in many cases, the specialists will overdesign or "upsize" the system so that there is a margin of safety in their design. It is safe to assume that each of the systems has

English does not contain a suitable word for "a system of problems. "Therefore, I had to coin one. I choose to call such a system a "mess." The solution to a mess can seldom be obtained by independently solving each of the problems of which it is composed"

from Russell Ackoff "Systems, Messes, and Interactive Planning" 1974

been slightly (or grossly) overdesigned since they are being designed in isolation. The architect then becomes the regulator of which building component design, if any, should be "right sized." Too often, the architect may not have the time or requisite technical expertise to make that sizing judgement for each component of the design, so they end up in the plans and larger than necessary.

At this point there are typically months of work and thousands of hours invested by the design teams in the plans. And then what happens? The architect will then issue the next set of design documents to the general contractors for bidding and the contractors typically have four weeks to respond with a cost estimate. In this way the contractors are required to put a price on systems that they may not completely understand. This typically results in them putting a margin of safety in their numbers, commonly called "padding." Inevitably the cumulative effect of the larger than necessary systems and padded numbers will result in the cost of the building being too high, and it must then go through successive rounds of re-design, sometimes ironically called "value engineering." This term is ironic since it is neither about creating value nor does it require engineering. Lastly, in some cases, the project is awarded to the lowest cost builder, which in my experience means that the project is awarded to the team that understands the project the least!

Returning to the original point, utilizing the heuristic approach that is outlined above will typically result in prohibitively high costs for constructing WL-NZC buildings. Therefore, to achieve their goal of a dramatically different type of building performance, Redbrick recognized the need to adopt a fundamentally different methodology for construction. Driven primarily by the objective of achieving economically viable outcomes, Redbrick embraced an alternative design strategy known as integrative design for its WL-NZC buildings. Under an integrative design approach, Redbrick mandated from the outset that the building's whole lifecycle carbon emissions and energy performance were essential to the design. This mandate required the integration of all systems with the program, size, and massing of the project. With this directive established, the design methodology was managed as a collaborative process involving key stakeholders, architects, engineers, contractors, and owners — working together from inception. The goal was to optimize design decisions across various disciplines, thereby achieving a holistic outcome that balanced sustainability, functionality, cost-effectiveness, and user needs throughout the building's lifecycle, instead of addressing each component separately. The integrative design approach emphasizes constructive communication and collaboration among all the different building specialties to attain the optimal balance of performance and cost. One significant advantage of this approach is that since it involves all stakeholders in the design and decision-making process, it greatly reduces or eliminates the need for value engineering and price adjustments.

While it was critically important for Redbrick to set clear energy goals for the building from the outset and to organize an integrative design approach, it was not sufficient to achieve the carbon reduction goals. Key finding #3, is that Redbrick found that constant engagement and reinforcement are required to keep the process away from the default heuristics and construction approaches. It is essential to constantly reinforce the low carbon emissions mandate with the design and construction teams all the way through the process. Simply mandating an energy requirement is not enough; an ongoing engagement is needed to achieve a highly energy efficient or WL-NZC building. Part of the integrative design process, as it applies to WL-NZC construction, includes continuous

Redbrick Bridge District parcel 3 onsite concrete production

evaluation of the cost-benefit of high-performing building materials. The goal of this analysis is to achieve optimal energy performance at a cost that has a reasonable payback period. To accomplish this, every sustainable material or technology should have a clear return on cost that is measurable not only in absolute dollars but in the energy savings/dollar invested. This type of analysis is a key approach to designing cost effective high performing buildings.

For example, if there are five different window/facade assemblies, each with an energy performance rating, it then becomes a mathematical exercise to figure out which of the five options delivers the best energy performance per dollar invested. In most cases, this mathematical exercise shows a declining curve where incremental dollars invested, after a certain point, yields a diminishing return on energy saved. This type of analysis is new in real estate and being adept at it will be an increasingly important differentiation between real estate development firms.

A prime example of this core competence is that after years of study, analysis and refinement, Redbrick has reduced the cost premium for constructing an institutional quality WL-NZC building in Washington, DC to the point where the WL-NZC building cost is comparable to the cost of a conventional building, when cost is measured on a return-on-cost metric. This is Key finding #4. This finding is significant in that for years it has been asserted that NZC buildings are prohibitively more expensive than conventional buildings. It is a considerable breakthrough that Redbrick has found a way to deliver high performing NZC institutional quality buildings at close to cost parity with conventional buildings, and without any subsidy.

An integrative design approach contrasts with the heuristic design approach in building construction and design by focusing on system-wide collaboration and optimization from the start. Here's how Redbrick has used the integrative design approach in contrast to a standard heuristic approach:

1. Holistic vs. Problem-by-Problem

- ***Heuristic Design:*** Often based on "rules of thumb," it tackles problems individually and sequentially, addressing issues as they arise. This can result in suboptimal solutions because one decision may negatively impact on another part of the system.
- ***Integrative Design:*** Seeks to understand the interconnections between various building systems (e.g., energy, water, materials) from the beginning. By bringing all stakeholders (architects, engineers, contractors, and owners) together early in the process, the team ensures that decisions benefit the entire system. By employing an integrative approach, Redbrick considered the entire system on a holistic basis and identified concrete as the key pathway to cost-effectively lower the carbon emissions of the building (see example #2 below).

2. Optimized Resource Efficiency

- ***Heuristic Design:*** The design may solve individual challenges, like selecting sustainable materials or improving insulation, but without considering how they fit into the rest of the system. This can lead to inefficiencies like energy waste, over-engineering, or increased costs.
- ***Integrative Design:*** By considering the building as an integrated system, the approach seeks synergies. For example, improving natural ventilation and using passive solar design can reduce the need for mechanical systems, lowering energy consumption and costs. Or, as is the case of a Redbrick project, the design uses balconies as a shield against direct solar gain and therefore reduces the need for extra air conditioning while adding a valuable building amenity — an outdoor balcony — to appeal to renters.

3. Long-Term Value vs. Short-Term Fixes

- ***Heuristic Approach:*** Tends to focus on immediate, obvious problems without fully accounting for the building's long-term sustainability, flexibility, or operational costs.
- ***Integrative Design:*** Focuses on improving long-term value, such as reducing lifecycle costs, and minimizing environmental impact. By considering the building's full life cycle from the beginning, this approach leads to designs that perform better over time. In the case of Redbrick, the buildings will be held for at least 10 years, therefore the integrative approach allows the investors to amortize their investment in sustainability over a longer term. (See Opportunity Zone section)

4. Innovation and Flexibility

- ***Heuristic Approach:*** Solutions are often based on existing methods, which may stifle innovation and limit the design's flexibility to adapt to future needs.
- ***Integrative Design:*** This approach is conducive to innovation, encouraging teams to think beyond standard practices, outside of their silo's, and try the latest ideas. In the Redbrick case the team was able to innovatively design systems that captured and recycled "waste" heat. Or heat that is normally vented to the outside. Redbrick also innovated an approach to concrete that is further detailed in example #2.

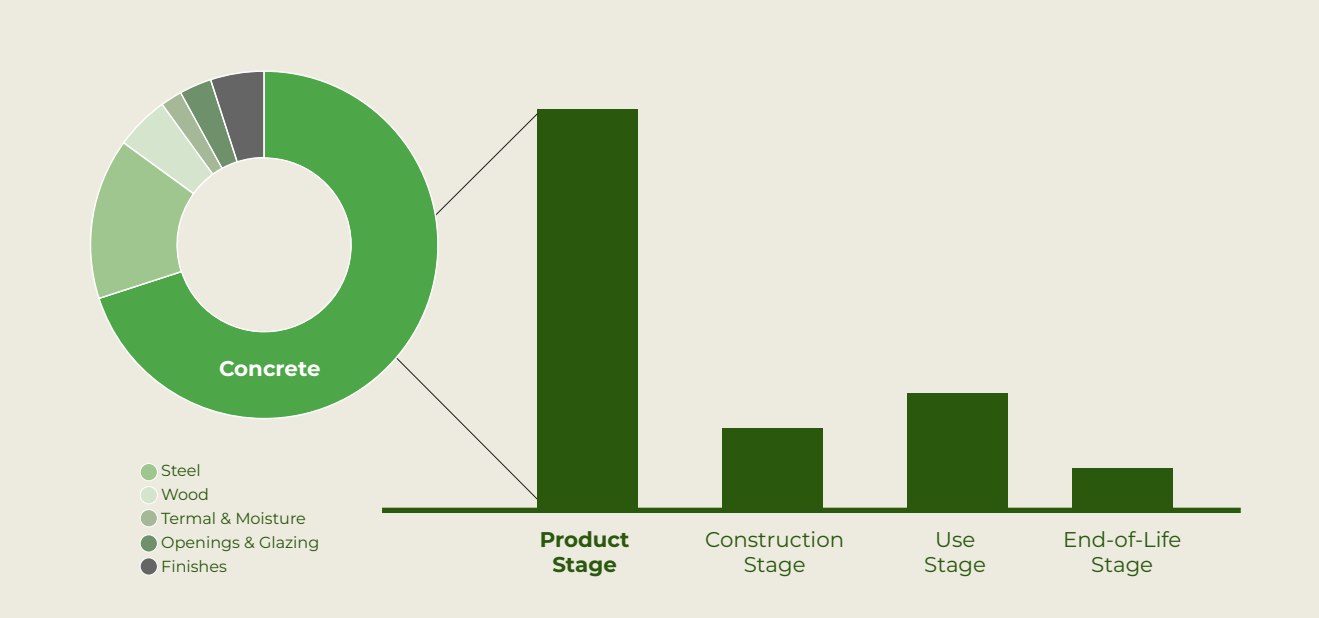
5. Risk Management

- ***Heuristic Approach:*** With each building part considered in isolation, the heuristic approach depends on the architect to function as coordinator and, by default, the risk manager. If the components of the building do not work seamlessly then there is the inevitable finger pointing, or potentially a costly adjustment during construction or operation.
- ***Integrative Design:*** By considering all aspects of the building from the outset, the integrative approach helps identify and mitigate risks early. Potential conflicts between systems are addressed during the design phase rather than during construction, reducing costs and delays.

Example Two: Trucking Concrete To The Construction Site

Concrete is the world's most widely used building material (over ten billion tons produced annually) and is also the most used man-made material on earth (more than plastic). It is a major contributor to climate change, accounting for 50-85% of the embodied carbon in a building project and 8% to 9% of global carbon emissions[3].

As shown on the graphic below, concrete is the largest constituent of carbon emitted in the production of a building. Logically, any attempt to significantly reduce a building's embodied carbon emissions must consider the largest source of those emissions — the concrete used in construction.



The standard practice in the construction industry is to procure concrete from a plant which is usually located some distance away from the construction site. This not only requires transporting concrete in a truck over that distance but also necessitates adjusting the concrete mix to prevent degradation of its structural integrity during transit. The adjustment is typically to increase the cement content in the mix, so that it arrives at the site with the required structural strength specifications. This heuristic does not consider the CO2 emissions of either the concrete itself or the transport of that concrete over some distance.

As an example of breaking a heuristic in construction, Redbrick achieved a 35% reduction in the embodied carbon of the concrete used in their Bridge project building, and combined with other carbon reduction approaches, they also achieved an overall 35% reduction of embodied carbon in the building.

This is a laudable achievement, especially since one of the most advanced buildings in the Washington, DC market, up to this point, is the Amazon HQ2 "Met Park" buildings, which achieved a 20% reduction in the embodied carbon of the concrete, as compared to the industry baseline. Redbrick made that meaningful reduction in concrete emissions by relocating the production of concrete to a smaller, temporary "batch plant" on a vacant lot next to the building site. This reduces CO2 emissions in several ways, primarily by improving efficiency, reducing transportation emissions, and enhancing the ability to use specific concrete mix designs for a particular use.

[3]BBC.com

Following is a summary of how the on-site batch plants reduced the carbon footprint of concrete production for the Redbrick project:

1. Reduced Transportation Emissions
Concrete produced off-site must be transported to the construction location, often requiring significant fuel consumption from heavy trucks. On-site batch plants eliminate the need for long-haul transportation, directly reducing fuel usage and emissions.

By producing concrete on-site, there is less truck travel between the concrete plant and the construction site. This reduces traffic congestion, fuel consumption, and the emissions associated with idling trucks.

On-site plants can source materials like aggregate and water locally, thereby reducing the carbon emissions associated with transporting these heavy materials over long distances. In their projects, Redbrick sources locally available materials, as practical.

2. Improved Efficiency in Production
On-site batch plants allow precise control over the concrete mix. For the Redbrick project, thirty-five specific mixes were tailored to meet the building's engineering strength requirements. Typically, fewer mixes with oversized tensile strengths are used; for example, using 500PSI concrete when only 200PSI is needed. This approach does not significantly affect costs but increases embodied carbon emissions. By customizing concrete batches in real-time to match construction needs, the team reduced the building's overall embodied carbon.

Traditional off-site batching sometimes results in excess concrete being produced, which can go to waste. On-site production minimizes overproduction, leading to less waste and reduced emissions from material disposal or recycling.

3. Use of Low-Carbon Mix Designs
On-site batch plants offer the flexibility to include alternative cementitious materials such as fly ash, slag, or ground limestone in the mix. These materials can partly replace cement, thereby reducing overall carbon emissions. Redbrick used slag in their first building and is examining methods to further lower carbon through other low-carbon mix designs in future projects.

4. Enhanced Quality Control and Reduced Rework
On-site batch plants allow for greater control over the quality of the concrete. Better quality control leads to fewer defects, less waste, and reduces the need for rework or later repairs, which would otherwise lead to increased emissions.

5. Innovation in Sustainability
Some on-site batch plants can integrate carbon capture technologies, such as CO2 curing, where CO2 is injected into the concrete mix. This process not only sequesters CO2 but also improves concrete strength, reducing the need for higher cement content. One promising approach involves adding Biochar to the concrete mix,

which is an effective method of sequestering carbon. Biochar, a form of charcoal produced from organic materials, enhances concrete properties by increasing durability and strength. Moreover, it provides an additional benefit of improving soil health when used in landscaping around the construction site.

In the future, these innovative approaches will have the potential to transform buildings from net carbon emitters to net zero or even carbon-positive structures. Though Redbrick did not adopt this option in their first building, they are actively exploring ways to integrate these methods in their upcoming projects.
The use of an on-site batch plant did not require exotic technology, specialized knowledge, or hard-to-find technical talent. It did require a willingness to look beyond the conventional approach, break the heuristic, and adopt an approach that delivered on the desired outcome. This is key finding #4 of this case study. The building materials, technologies, and approaches to meaningfully decarbonize buildings are all currently in existence and accessible. There are no exotic or expensive approaches needed, the requirement is commitment and diligence, not technology.

VALUE CREATION THROUGH DECARBONIZATION

This section of the paper outlines how Redbrick (or any WL-NZC developer) can monetize the value they create from a decarbonized real estate asset. To re-iterate an earlier point, Redbrick's assertion, from the very beginning, was that a WL-NZC building could be a higher returning investment than a conventional building — believing that the NZC building could be operated at a lower cost, could generate stronger rents, may appreciate faster, and potentially could be built at a cost equal to or less than a conventional building. In their view, if all these points are correct, why wouldn't you want to create an asset with those features?

In this section we look at the components of value creation in greater detail.

Value is created in a real estate development project in several ways:

1. Acquisition of well-located land at an advantageous price.
2. Securing financing for the project at advantageous terms.
3. Building the project for an advantageous price.
4. Leasing the project at rates above expectations and/or operating the project below projected costs.

The value created can then be monetized as financial returns in three ways:

1. Cash flow from operations
2. Proceeds from refinancing
3. Sale of the asset

For decades, incorporating sustainability into real estate development has been seen as a drag on financial returns due to a perception of a) a higher construction cost, b) an inability to capture green premiums on rent or sale, and c) an inability to earn a reasonable return on cost over a 5–7-year time frame. Many of these assumptions are now being challenged or overturned by developers like Redbrick. The question is evolving from whether decarbonization can create new value in a real estate investment but how much value is created and when does it accrue to the owner's benefit?

It should be noted that the answers to these value creation questions may not be well quantified for a few years. There are an insufficient number of high performance or NZC assets in the market to make reasonable conclusions about the green premiums and we will need to see significantly more assets trading and other types of comparable data collected. However, there are several very plausible indicators of value creation that derive from decarbonization. From the categories outlined above, the following are some observations about how decarbonized assets can create material value.

Cash Flow from Operations:

There are several ways in which highly energy-efficient buildings can demonstrably reduce operating expenses. For instance, investing in a well-insulated building envelope and a highly efficient HVAC system can significantly lower energy operating costs, enhancing the Net Operating Income (NOI). Similar savings can be realized through water conservation and waste management, common features of sustainable buildings. The Redbrick buildings are projected to have 40 to 50% lower operational carbon emissions compared to conventional buildings in Washington, DC, leading to reduced utility operating costs. This reduction in carbon emissions translates into lower energy expenditures. Furthermore, these buildings offer a degree of risk mitigation by being less susceptible to sudden increases in energy or water prices over the long term. Over the past decade, electricity costs in Washington, DC, have risen by an average of 2.9% annually.

The lower operating costs of NZC assets are well understood. However, there are several other areas where a decarbonized building could achieve other distinct financial advantages, and these are still being proven in various markets. These aspects include:

- ***Faster Lease-Ups:*** A faster absorption or lease-up period means the building will begin to produce positive cash flow faster. In the commercial office and retail sectors, faster lease-up periods have been reliably shown in certain markets. There is high demand for decarbonized office/retail space as companies seek to align their leasing with their net zero commitments. Redbrick demonstrated this dynamic in their first WL-NZC building, when a locally well-known company with a sustainable brand identity pre-leased significant retail space, based on the building's decarbonization profile, more than 18 months prior to the ribbon cutting ceremony.
- In the multifamily residential sector, the pre-leasing and accelerated absorption is not as prominent, but Redbrick has commissioned market studies that point to "highly more likely"

decisions made among their target market due to the high environmental performance of the building. Redbrick's target renters see the WL-NZC profile as a differentiation and a valuable amenity of the building.

- ***Higher Occupancy / Lower Turnover:*** All real estate asset managers seek to maximize the occupancy and keep the rate of turnover as low as possible since turnover is a costly expense. Currently, the supply of WL-NZC level buildings is extremely low compared to the demand. Therefore, a logical assumption is that if there is a persistent supply/demand imbalance for WL-NZC buildings then the tenants who are attracted to or requiring a building with that WL-NZC profile will have few options to move. This would create a sticky tenancy and keep occupancy at an elevated level. Due to the time frame of developing a new WL-NZC building, this potential competitive advantage could persist.
- ***Rent Premiums:*** The green rental premium is the extra rent that tenants are willing to pay for a property that has strong sustainability features. There have been numerous studies of potential green premiums in real estate. The findings for multifamily indicate potential premiums in the range of 7% to 9%, subject to numerous considerations and conditions. Redbrick has not underwritten a green rental premium into their initial rental projections in the base case underwriting. However, they do consider that green premiums are possible if the green building supply/demand imbalance continues, or if tenants are willing to pay a green rent premium in recognition that their utility bill will be lower than a conventional building.

Proceeds from Refinancing

As in the insurance discussion above, the same carbon disclosure conditions exist for banks and thus, so do the possibilities of securing improved loan terms when a WL-NZC asset is ready to assume permanent financing. The banks want those kinds of assets on their books.

As noted earlier, a WL-NZC building could also potentially have lower operating expenses as well as achieve higher than projected income compared to a conventional building. These beneficial outcomes would be reflected in the Net Operating Income (NOI) of the property. NOI is a measure of the profitability of the building. NOI is also a key metric used by lenders in figuring out the value of the building and the sizing of the loan. The stronger the NOI, the higher the loan proceeds are, and the more capital is available to distribute back to the investors after paying off the construction loan.

Sale of the Asset

Regarding asset value creation of a NZC property, the belief is that at the end of the term of investment, the property will be marketed for sale and a potential new purchaser will commence to underwrite and value the asset. As part of that process, the potential purchaser will consider:

1. The current and projected growth of the NOI, compared to other comparable properties in the specific market as well as nationwide
2. The risk of incurring carbon fines or the requirement to invest in building energy efficiency improvements for their contemplated investment term.
3. The occupancy rates and turnover percentages over the last 24-36 months of ownership

If the purchaser determines that these aspects are more robust than a conventional building and may have a low transition risk exposure, then it is reasonable to conclude that the decarbonized asset will command a green premium versus other similar vintage assets that may have higher transition risk profiles. This premium will be expressed as a lower cap rate (a higher price) compared to the conventional asset. It is also conceivable that institutional investors, such as pension funds, endowments, or insurance companies, may have their own mandate to decarbonize their respective portfolio and may also be willing to pay a green premium for an asset that already aligns with their goals. In the EU there is evidence that highly energy efficient, decarbonized and future-proofed assets are gaining a 25 to 50 basis point green premium on cap rate (equivalent to a 5 to 10% higher price for every dollar of NOI).

The "Hidden Value" Of Opportunity Zones

It is worth noting that a sizable portion of Redbrick WL-NZC projects will be in an Opportunity Zone ("OZ") and could gain significant benefit from the combination of being a WL-NZC asset in an OZ.

OZ regulations created a powerful tax incentive for investors to adopt a ten-year investment horizon. In a designated OZ, if the investors continuously hold an asset for the required time frame, then the appreciation of asset value will be free of federal

taxes upon the sale. In some calculations that benefit could add hundreds of basis points to an after-tax return analysis. From a regulatory perspective, these tax incentives were set up to support community development and keep the investment capital in place long enough for ancillary developments to spring up and mature around the OZ investments, therefore creating greater community stability and cohesion. However, there is also a "hidden value" to this ten-year OZ tax benefit as it pertains to building decarbonized high performing buildings.

Building a WL-NZC or high-performing green building often costs more upfront due to pricier components like HVAC systems and high-performance glass. These higher initial costs make it difficult for green buildings to match conventional real estate returns on a five-year timeline. However, over eight to ten years, the investment pays off with lower operating costs and increased net income. Redbrick planned early to leverage the "green premium" upon sale and benefit from OZ tax advantages and the efficiency of a high-performing building in the investment's latter half.

Redbrick is a firm committed to rigorous financial and risk analysis on behalf of their investors. Their decision to build a set of more than ten WL-NZC buildings had to "pencil" as a realistic way to create value before they moved forward. Based on all the ways in which real estate assets could create value through decarbonization, as listed above, their determination is that WL-NZC buildings will create more value with a lower risk profile, than a conventional building in the Washington, DC market. At this early stage in the transition to a low carbon economy, it is premature to say that all the factors listed above are evident. Clearly some factors related to green premiums are speculative. However, the early signs are beginning to appear in certain markets and having a robust sustainability strategy, over the next decade, may well become a key competitive advantage for real estate development firms.

CONCLUSION

Redbrick is leading a pioneering approach to decarbonization and pushing against the ingrained heuristics of real estate decarbonization in new construction. As Redbrick continues to innovate and lead in sustainable WL-NZC real estate development, it sets a compelling example for others to follow. The following are five lessons that surfaced from research and interviews associated with creating this report:

Decarbonization For Value Creation and Risk Mitigation

Prudent operators and developers are recognizing a market shift toward decarbonization, positioning investor capital to align with this trend. Strategically, there are financial advantages in WL-NZC buildings, including energy efficiency gains, potential green premiums, and reduced risk from future municipal penalties on high-emission properties.

Decarbonization Requires New Thinking and Approaches

Decarbonization in real estate demands challenging the "heuristic", or status quo, of building construction and rethinking every step of the design and construction process.

Decarbonization Comes from Commitment, Discipline, and Diligence

Altering the status quo of a deeply ingrained system requires constant diligence and reinforcement by the project sponsor to guide the larger development team.

Decarbonization Uses Existing Materials and Technologies

Building materials, technologies, and approaches to meaningfully decarbonize buildings are all in existence and accessible. There are no exotic or expensive approaches needed — the requirement is commitment and diligence — not technology.

Decarbonization Is Achievable at Economic Parity to Conventional Building

Building a WL-NZC building at economic parity in a gateway market, is achievable.Redrick considers the lifecycle value creation of a net zero carbon building, as compared to a conventional building, in their underwriting.

ABOUT THE AUTHOR

For over two decades, Paul Rabinovich has worked at the intersection of real estate, sustainability, and impact investing, leading organizations that merge financial performance with environmental and social values. He has held leadership roles across for-profit, nonprofit, and governmental sectors, aligning all types of capital with high-impact projects that demonstrate sustainability isn't just an ethical position, it's a strategic advantage.

Paul has built impact investment programs from the ground up and managed high-performing impact investment and lending teams across dozens of U.S. and Canadian markets for institutional capital, family offices, wealth management firms, and NGO's. Over his career, he has built and managed real estate investment programs that have deployed over $450 million in equity, helping to catalyze more than $3 billion in total investment value. Paul has the distinction of building one of the largest private portfolios of Net Zero Energy operating real estate in the U.S. His work spans more than 21,000 residential units and over a million square feet of commercial space across multiple asset types. The investments have consistently delivered strong, risk-adjusted returns — averaging a net IRR of 19% — demonstrating financial success and positive impact can go hand in hand.

A national expert in real estate decarbonization and the author of *Investment Opportunities in Decarbonizing Real Estate* (2024), Paul believes that the future of real estate belongs to those who boldly integrate sustainability with pragmatic investment strategies.

Redbrick Bridge District (rendering)

ABOUT REDBRICK

Redbrick LMD is a diversified real estate investment management and development firm focusing on proprietary, large-scale, institutional quality assets. With an objective of value creation and risk mitigation, we employ an innovative and forward-looking approach to sustainability and resiliency such as pioneering a strategy in the U.S. to decarbonize real estate and developing resilient solutions for national-security related initiatives. Our focus on the Washington, DC metropolitan region, while working closely with several government agencies, has created unique opportunities locally and nationally, for Redbrick to develop multiple mixed-use multifamily, commercial, industrial, and defense-related projects in strategic locations.

As one of the largest private landowners in DC, we have a build-to-core development pipeline of approximately eight million square feet at a cost of $5 billion and a comparable amount in early-stage development located across the country. We have delivered the largest multifamily building in the world to seek International Living Future Institute (ILFI) certification, and our pipeline includes 10 buildings under development or construction that are designed to achieve the same certification. As long-term owners and stewards of our own and other's capital, the cornerstone of our approach to optimize investor returns is aligning stakeholder interests, inventive problem solving, a relentless focus on future-proofing our investments, and a demonstrated agility to capture emerging opportunities.

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