BUILDING DECARBONIZATION IN THE U.S.

AN INFRASTRUCTURE INVESTMENT PERSPECTIVE

May 2025

EXECUTIVE SUMMARY

Building decarbonization refers to strategies, initiatives, and measures that aim to reduce the greenhouse gas emissions ("GHG") of buildings throughout their lifecycles.

This can be viewed from several different stakeholder lenses, including infrastructure ownership or utility investment, real estate asset ownership or an occupant perspective. The main purpose of this paper is to highlight the growing **infrastructure investment** opportunity for building decarbonization strategies in the U.S.

Building decarbonization can be achieved in various ways, including implementing energy efficiency measures, deploying renewable energy infrastructure, building electrification, on-site energy generation and storage, utilizing low carbon construction materials, and incorporating building automation, monitoring, and optimization.

Measures can be applied to both new developments and existing assets and, as described in more detail herein, the initiatives to achieve decarbonization typically fall into one or more of the following categories:

1. **ENERGY USE REDUCTION —** Investments both upfront (e.g., the use of low carbon construction materials) and ongoing (e.g., upgrading existing equipment to more efficient technologies) that reduce the baseline energy consumption needs of a building.

2. **"GREENING" OF EXISTING ENERGY USAGE —** transitioning the energy sources of a building towards a greener and less carbon intensive energy mix (e.g., on-site renewable energy generation).

3. **OPTIMIZATION OF ENERGY USAGE —** enabling buildings to manage the energy that must be consumed, in the most efficient and optimal manner (e.g., smart building controls and demand response).

There are a range of practical drivers, aside from the potential environmental benefits, behind the push to decarbonize buildings to reduce greenhouse gas emissions in the U.S., including improved long term financial performance, building resilience, corporate pledges, federal, state and local regulatory pressures, the potential for tax incentives, and investor preferences.

The approach to building decarbonization infrastructure investment in the U.S. is fragmented and varied, and there are a range of different business models which are aimed at building decarbonization. The pros and cons of these varying approaches are discussed within this paper.

WHY DECARBONIZE BUILDINGS?

Buildings are one of the largest consumers of electricity and most substantial emitters of GHG in the U.S. with commercial and residential buildings accounting for 35% of total U.S. GHG emissions and using 75% of electricity generated in the country.[1] In addition to this, there are several key tailwinds that are driving the market opportunity for an evolving building decarbonization market in the U.S.

Asset ownership drivers: The potential for operating cost savings combined with the reduced risk of reliance on the energy grid (and the related potential protection from energy price spikes) allows developers/owners to support their GHG reduction targets without compromising on the bottom line and, in many cases, potentially improving it, therefore aligning economic and environmental interests.

Asset-level distributed energy infrastructure projects, including building decarbonization initiatives, can help bridge near-term energy supply/demand gaps for building owners. All in all, more resilient buildings with energy security may limit operating disruptions, alleviate tenant concerns, reduce ongoing energy costs (via energy efficiency and optimization measures), and/or increase revenues (by providing on-site power generation back to the grid) and potentially even trade at higher values.

Affinius Capital has long understood the benefits of developing, retrofitting, and operating innovative and sustainable assets. As part of its Responsible Investment guidelines, Affinius aims to improve energy efficiency, reduce water consumption, increase recycling, reduce waste, improve indoor air quality, implement green cleaning methodologies, and improved air filtration in asset portfolios, where possible.

Affinius Capital earned its **first ENERGY STAR Partner of the Year award**, an award given by the U.S. Environmental Protection Agency to organizations that have made significant contributions to promoting energy efficiency, **in 2002** and has won this award

ENERGY STAR PARTNER

21 CONSECUTIVE YEARS

Affinius' equity portfolio across the U.S. has:

69 properties **&** more than **25M SF** of buildings

that have received various sustainability and green building certifications.

Affinius Capital is also a leader in sustainable construction practices, having completed the first mass timber industrial logistics warehouse of its kind in the U.S. in Dallas, TX.

The **161,000 SF** facility uses:

- Cross-Laminated Timber in lieu of conventional concrete tilt-walls
- MEGASLAB® concrete technology for the slab and site paving

This combination reduced the project's Embodied Carbon by **43%** compared to conventional methods.

1. https://www.nrel.gov/news/features/2023/nrel-researchers-reveal-how-buildings-across-the-united-states-do-and-could-use-energy.html

REGULATORY PRESSURES While the 2024 U.S. election results may bring reduced focus on decarbonizing buildings, various state-level and city-level mandates are expected to continue and increase in number. Nevertheless, in the long-term, at the federal level, the Department of Energy ("DOE") has set a goal to achieve a net-zero economy by 2050, inclusive of building decarbonization targets.

At the municipal level, about 13 cities in the U.S. already have building performance standards in place, and over 30 more U.S. cities have committed to passing such standards by 2026 or earlier. According to JLL, as of early 2024, these policies cover about 25% of all buildings in the U.S.[2] At the city level, for example, in New York City, Local Law 97 mandates that large buildings reduce carbon emissions by 40% by 2030 and 80% by 2050, with costly upgrades like HVAC replacements and insulation improvements.[3] Non-compliance could result in fines up to $268 per ton of excess CO2. For a state level example, California's Title 24 requires new buildings to be "zero-net-energy" and encourages energy efficiency upgrades in existing structures to meet decarbonization goals by 2045.[4] Compliance can increase construction costs as it often necessitates incorporating more energy-efficient building materials and systems upfront.

TAX INCENTIVES To encourage adoption of renewable energy across the U.S., the Inflation Reduction Act ("IRA") was passed in 2022, which expanded and extended the tax credits available to numerous clean building technologies including geothermal exchange, high-efficiency HVAC and rooftop solar. The IRA is the largest climate investment in the history of the U.S., covering all segments of the new energy industry and emphasizing the goal of reducing carbon emissions by 40% by 2030.[5] Again, while the 2024 U.S. election results may bring reduced federal incentives in the near-term, there are numerous other existing incentives and initiatives that continue to support building decarbonization at the federal, state, and municipal level, including the 45L credits for efficient dwelling units, Solar Renewable Energy Credits, and the 179D commercial building energy efficiency tax deduction.

CORPORATE PLEDGES Approximately 68% of Fortune 500 companies had a published GHG reduction target as of 2022 (up 6% from 2016).[6] As building space leased by corporations directly contributes to a company's operating emissions, reducing building emissions is becoming a critical component of corporate emissions reduction targets.[7]

ENERGY AFFORDABILITY AND RELIABILITY FOR TENANTS Between 2021 and 2023, U.S. retail electricity prices grew at an average annual rate of ~7.2%.[8] With energy prices expected to continue to rise while energy infrastructure continues to age in the U.S., consumers have concerns with both increasing energy costs and the dependability of the grid.

Building decarbonization can benefit occupants through offering energy availability, affordability and reliability. Occupants can benefit from ongoing cost savings via potentially reduced (and less volatile) energy bills, as well as increased building resiliency given reduced reliance on the energy grid.

INSTITUTIONAL INVESTOR SUSTAINABILITY PRIORITIES While building decarbonization is an evolving market for infrastructure investment in the U.S., Canadian, European and Australian institutional investors, as well as insurers and re-insurers, are increasingly prioritizing allocating capital to investment managers who can demonstrate a focus on sustainability. This is evidenced by several U.S. building decarbonization platforms attracting equity funding in recent years.

And as it is expected that a more energy efficient building may be more attractive on exit. By targeting investments in building decarbonization assets and companies, institutional investors can both satisfy or exceed return requirements while addressing their sustainability priorities, should they choose to do so.

POTENTIAL CHALLENGES TO BUILDING DECARBONIZATION The evolving landscape for building decarbonization infrastructure investment does face some potential challenges and risks for potential investors to understand and manage. Factors that can contribute to the reluctance of some real estate owners to adopt building decarbonization include the initial capital costs associated with implementation, concerns regarding scalability and technology, potential changes or deficiencies in regulatory support, incompatible hold period and payback metrics and insufficient availability of incentives to render these measures economically viable in the short term. Some of these challenges can be overcome, however, with the right solutions.

2. https://www.us.jll.com/en/trends-and-insights/cities/future-proof-your-investments
3. https://www.nyc.gov/assets/buildings/pdf/presentations/2023bsls/ll97.pdf
4. https://planning.lacounty.gov/wp-content/uploads/2024/07/gp_2045_Climate_Action_Plan_June-2024.pdf
5. https://www.epa.gov/system/files/documents/2022-12/12%2009%202022_OAR%20IRA%20Overview_vPublic.pdf
6. USGBC_Report_231128.pdf (pardot.com)
7. Moody's CRE | Demand for Green Buildings Outpaces Supply (moodysanalytics.com)
8. https://www.spglobal.com/marketintelligence/en/news-insights/research/us-retail-electric-prices-likely-moderate-in-2024-continuing-2023-trend

HOW IS BUILDING DECARBONIZATION ACHIEVED?

Building decarbonization is achieved by making investments and employing strategies that either reduce energy demand, "green" existing energy usage, or optimize how and when energy is used.

Investment in "behind the meter" energy solutions, which are energy systems located on the building's side of the utility meter (where energy produced or stored is used for the building's own consumption or can be sold back into the grid), can reduce energy consumption and reliance on the electricity grid.

Installation of renewable energy, storage, or co-generation reduces emissions and the intensity of energy consumption, while also providing backup power to manage energy grid disruptions. Studies have indicated that the installation of a microgrid with renewable capacity and co-generation could reduce the carbon emissions of a commercial building by 25-50%.[9]

Building decarbonization solutions are suitable for both retrofits of existing buildings, as well as new building developments, and the ideal initiatives for a building will often depend on a range of factors including geography, geology, energy supply/demand, power prices, demographics, regulations, and tax incentives, amongst others.

The potential range of measures suitable for an individual building are numerous and will vary from one building to the next. Such measures are summarized as follows:

BUILDING EFFICIENCY

- Efficient heating/cooling
- Combined heat/power
- Geothermal exchange
- Lighting upgrades
- Water conservation
- Sealing and insulation

ON-SITE POWER GENERATION

- Onsite solar
- Energy/battery storage
- Back-up generators
- Microgrids

BUILDING AUTOMATION AND MONITORING

- Lighting control
- HVAC optimization
- Energy savings management
- Monitoring and analytics

9. https://www.power-grid.com/der-grid-edge/only-proper-microgrid-design-will-ensure-maximum-carbon-reduction-in-energy-systems/

Retrofit solutions (generally suited for older, less efficient buildings where there are opportunities to upgrade existing building components) can include efficient heating/cooling, onsite solar, sealing and insulation (including energy efficient windows), lighting controls, and monitoring and analytics systems used for energy management optimization.

For new building developments, most building decarbonization solutions above (and many more not listed) can be considered depending on the location and type of real estate development and the objectives of the stakeholders. Relative to retrofits, new developments are better suited for building decarbonization solutions that are most economical and efficient to be implemented early in the real estate development process, such as geothermal heat exchange, rooftop solar, and the use of sustainable construction materials such as low carbon cement and cross-laminated timber, in each case, where the financial trade-off makes sense.

SIZE OF BUILDING DECARBONIZATION INFRASTRUCTURE INVESTMENT MARKET OPPORTUNITY

Some forward-thinking real estate owners have long been implementing building decarbonization solutions by incorporating strong design, capable engineering staff and systems, and continuous improvements to systems for their assets. Since 1980, energy efficiency investments from select forward thinking asset owners have reduced building carbon emissions by 60%, saving building owners a combined ~$800 billion.[10]

However, there is a potentially large untapped segment of real estate owners who recognize the need for building decarbonization but lack the capital or expertise to implement changes independently. Affinius Capital finds this market opportunity attractive given the fragmented nature of the need, the ability to aggregate investments into a platform, as well as the variety of value creation levers.

Per the Department of Energy ("DOE"), there are 130 million residential and commercial buildings in the U.S., which cost over $400 billion annually to heat, cool, light, and power. If construction trends continue, an additional 40 million new homes and 60 billion square feet of commercial real estate space will be completed by 2050.[11] These figures, in addition to the various drivers and tailwinds discussed above, point to a sizeable market opportunity in the building decarbonization space in the U.S. – an opportunity that is further supported by the DOE's target of reducing building emissions by 65% by 2035 and 90% by 2050.[12] Beyond commercial real estate, there is market opportunity in educational institutions (e.g., universities, schools) and medical facilities (e.g., hospitals, other care facilities) as two major examples.

Finally, rising energy costs, technological advancements, and a shift towards sustainability for policymakers and end users are generally improving the economics of building decarbonization solutions and should continue to drive significant growth in this market opportunity.

By way of example, this is demonstrated by the cost of solar panels and batteries (two key components of building decarbonization), which has decreased by ~99% over the past thirty years and is expected to continue dropping,[13] making these sub-sectors more economically competitive and feasible.

The aggregation potential of building decarbonization assets makes for a significant and investable potential market opportunity, with a runway to a scalable portfolio of assets that would be interesting for investors in the infrastructure and broader real assets sector.

10. Energy Efficiency Report 2023 (https://energyefficiencyimpact.org/)
11. https://www.energy.gov/articles/doe-announces-national-definition-zero-emissions-building#:~:text=There%20are%20nearly%20130%20million,constructed%20between%20now%20and%202050.
12. https://www.archpaper.com/2024/06/us-department-of-energy-national-definition-zero-emissions-building/
13. https://pv-magazine-usa.com/2024/03/06/battery-prices-collapsing-grid-tied-energy-storage-expanding/#:~:text=Looking%20back%20thirty%20or%20forty,expected%20to%20continue%20into%202024

WHAT IS THE CURRENT STATE OF PLAY FOR BUILDING DECARBONIZATION INFRASTRUCTURE INVESTMENT IN THE U.S.?

OWNERSHIP STRUCTURES AND FINANCING

Historically, building decarbonization solutions have been owned and financed on the balance sheet of the building developer/owner, who is then responsible for the management and maintenance of the energy infrastructure (often by hiring an external service provider).

Modern building decarbonization solutions often can have energy infrastructure funded, owned, and serviced by an external party separate from the building owner under an energy services agreement. These solutions have gained ground as an alternative turnkey delivery mechanism, providing greater benefits than rigid and limited "service-only" contracts, as well as offering "capex avoidance" for the building developer/owner. Under this approach, the building owner/occupant is still likely to receive a net benefit due to a corresponding reduction in utility bills from a more energy efficient dwelling.

Third-party infrastructure ownership (separate from real estate ownership) is very commonplace in the U.S. for other public and privately owned utilities (e.g., water, electricity, gas, and fiber); thus, building decarbonization solutions, if accompanied by real asset ownership, rather than just service provision, can be considered an extension of this type of bifurcated ownership between the physical real estate and the infrastructure that supplies/supports the real estate and its end user.

DEBT FINANCING

Like other public and privately owned utilities in the U.S., building decarbonization measures can be debt financed separately from the real estate both during construction and post-stabilization of real estate projects. Since 2023, at least $3.0 billion of private debt financing was raised for assets that support building decarbonization in the U.S. including rooftop solar, combined heat and power, building electrification, and microgrids.[14]

Debt capital markets for renewable energy assets (solar, wind, etc.) have grown significantly in the past few decades, as continued federal tax credit support, state-level renewable standards targets, and lower costs of delivery assisted in institutionalizing private debt capital support for these assets.

14. Affinius Capital research from publicly available company press releases and investor presentations.

INVESTOR PERSPECTIVE ON BUILDING DECARBONIZATION

Per the U.S. Green Building Council, many real asset investors have increasingly become invested in and have been prioritizing building decarbonization strategies in recent years.[15] This is not only due to the sustainability priorities of many institutional investors, but also to the potential for accretive risk-adjusted returns.

Depending on the measures utilized and the development stage of the underlying real estate, infrastructure related building decarbonization investments have the potential to deliver returns comparable to or beyond core plus or value-add investments. Investments in this sub-sector benefit from the potential outsized rewards of investing in a more nascent and less competitive market, while retaining the long-term contracts, security and financeability characteristics of traditional real assets. Additionally, investing directly into businesses or platforms that develop and own building decarbonization assets can potentially provide enhanced returns while offering the benefits of an infrastructure risk profile.

BUILDING DECARBONIZATION INFRASTRUCTURE INVESTMENT MARKET PARTICIPANTS WITH COMPETITIVE ADVANTAGES

While the building decarbonization infrastructure investment sector continues to evolve, there are likely few market participants that can bring together the products, services, investment capital and investment execution at scale to support the long-term implementation of building decarbonization solutions for the U.S. real estate sector.

Those market participants most suited to do so will likely have: cross-disciplinary infrastructure and real estate expertise to best identify, source and execute building decarbonization strategies and solutions; industry relationships and the cross-sector specialized knowledge to find and create investment opportunities; extensive experience in investing in development and value-add opportunities; and the ability to fund and aggregate a portfolio of smaller infrastructure assets.

15. https://www.usgbc.org/articles/green-building-trends-and-drivers-us-commercial-real-estate-investors

CONCLUSION

Investment in building decarbonization is an evolving sub-sector providing actionable market opportunities at the intersection of infrastructure and real estate. There has been near-term growth fueled by an increase in market participants with varied business models, as well as increasing capital markets activity from both equity and debt providers. Continued growth and investment in the sector are supported by near-term policy at the state and city level, increasing end-user demand, and the potential for environmental and economic benefits for all parties involved.

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