BofA SECURITIES

# ESG Matters - US

# Building greener homes while saving $$$

**Equity Strategy**

## Decarbonization begins at home...

Did you know residential buildings constitute 20% of both total energy usage and $CO_2$ emissions in the US (DOE)? However, sustainable practices such as investing in weatherization (e.g., improving insulation) and energy-efficient appliances can help reduce energy consumption by up to 30%, water usage by up to 50% and GHG (greenhouse gas) emissions by up to 40% (UN). Additionally, integrating sustainable materials, such as recycled plastic, into building materials not only contributes to managing plastic waste and promoting circularity but also aligns with consumer preferences for more durable and longer-lasting materials, ultimately reducing maintenance and upkeep costs.

## Greener living pays off: lower costs & higher premiums

Green homes offer financial benefits by reducing utility bills through decreased water, electricity, and heating usage. Certifications for green buildings, backed by a comprehensive analysis of 42 studies, yield a rent premium of 6.0% and a sales premium of 7.6%. Our expert speaker, Elizabeth Beardsley from the US Green Business Council, also highlighted a $25,000 premium for green-certified homes in Texas, emphasizing the importance of energy efficiency in the face of grid challenges. For individual borrowers, Energy Efficient Mortgages (EEMs) feature tax-deductible benefits and better rates compared to other fixed-rate mortgages. Our analysis further reveals that US homebuilders and residential REITs implementing green building policies enjoy an average 0.9ppt lower cost of capital.

## The IRA is boosting the home energy transition

While the initial investment in greening homes may be higher than non-green alternatives, federal and local incentives and rebates can effectively offset these costs. The IRA, for example, provides tax credits worth up to $5,000 for homes certified as Zero Energy Ready Home, $2,500 for homes certified as ENERGY STAR, and $3,200 for energy efficiency and heating system upgrades by qualified homeowners. Consequently, the energy transition gains momentum through these home upgrades. The IRA earmarks ~$4bn in incentives for electric heat pumps, resulting in a 5ppt increase in new homes embracing this technology between 2021 and 2022. Residential solar panel adoption also has experienced a 5x increase in the past decade, while the drive for EV adoption is pushing homes to undergo electrical upgrades to accommodate EV charging stations.

## OC, BLD, AZEK, TREX to benefit from green building push

Addressing heat loss through measures such as improving insulation and upgrading windows, commonly known as "weatherization," can effectively tackle over 90% of heat loss attributed to cracks and inefficient structures. Insulation providers like Owens Corning (OC) and TopBuild (BLD) are strategically positioned to benefit from the surge in demand fueled by energy efficiency incentives under the IRA. On the sustainable materials side, the shift towards circularity presents an opportunity for composite decking companies like AZEK (AZEK) and Trex (TREX), which are increasingly using recycled materials to make their products both more durable and more sustainable.



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IRA: Inflation Reduction Act

BIL: Bipartisan Infrastructure Law

EV: electric vehicle

See inside for stock screens

# Advancing sustainability at home

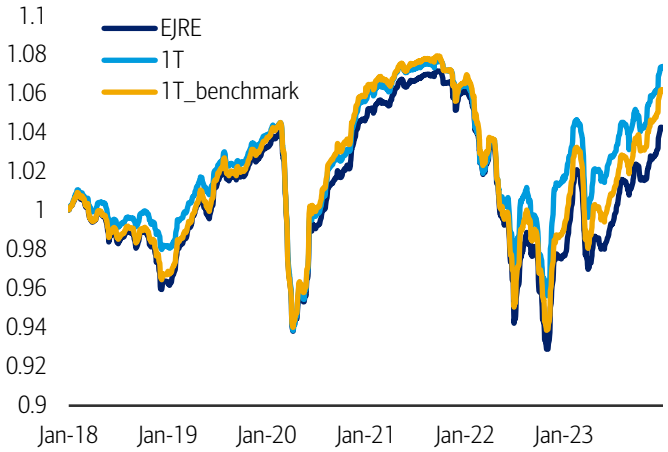
Homebuilders and building materials companies play a crucial role in advancing sustainability in construction. This involves an increasing incorporation of recycled materials, not only for their cost-effectiveness but also to contribute to a circular economy. In the US, buildings account for a substantial 40% of total energy use, 75% of electricity consumption, 35% of $CO_2$ emissions, and 14% of potable water use (source: NREL, US Green Business Council). Specifically, residential buildings contribute to 21% of total energy consumption and 19% of total $CO_2$ emissions in the US (source: DOE).

Energy efficiency concerns are shaping consumer choices, leading to a surge in demand for insulation, high-performance windows, and more efficient HVAC systems and appliances. Notably, the growing popularity of rooftop solar installations is influencing decisions regarding roof replacements. Additionally, increasing adoption of electric vehicles (EVs) is prompting the need for in-home wiring tailored for EV charging infrastructure. This transformative trend benefits various companies, including homebuilders and building material firms mentioned in this report. Their strategic positioning allows them to capitalize on rising demand for sustainable and energy-efficient building practices.

## Greener homes pay off...

Green homes offer substantial financial benefits to homeowners by reducing utility bills through decreased water, electricity, and heating usage. This cost-saving effect positively impacts mortgage payments, resulting in a 32% reduction in default risks and allowing banks to provide lower-cost capital (source: Institute for Market Transformation). Beyond financial advantages, lower utility bills and improved indoor air quality drive consumer demand for these eco-friendly homes. This increased demand translates into enhanced returns, including higher leasing rates, faster sales, elevated sales prices, and increased rent prices. While the initial investment in greening homes may be higher, federal and local incentives and rebates can offset costs.

**Exhibit 1: More energy efficient Real Estate companies (1T) outperformed the EJRE index throughout the period, and outperformed the customised benchmark especially in periods of vol**
Energy intensity: cumulative excess backtested return compared to the customised benchmark




**Source:** BofA Global Research, Bloomberg, ICE Data Indices LLC. This performance is back-tested and does not represent the actual performance of any account or fund. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the timeframe indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. We should highlight that the above backtest does not include transaction costs. Using historical data 1 Jan 2018-31 Dec 2023

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**Exhibit 2: More energy efficient Real Estate companies (1T) outperformed benchmark by 0.09 in terms of information ratio**
Energy intensity backtested performance

| | 1T | Benchmark | EJRE |
|---|---|---|---|
| Annual return | 1.18% | 1.00% | 0.70% |
| Annual volatility | 2.31% | 2.39% | 2.30% |
| Information Ratio | 0.51 | 0.42 | 0.30 |
| Max Drawdown | -11.21% | -13.06% | -13.34% |

**Source:** BofA Global Research, Bloomberg, ICE Data Indices LLC. This performance is back-tested and does not represent the actual performance of any account or fund. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the timeframe indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. We should highlight that the above backtest does not include transaction costs. Using historical data 1 Jan 2018-31 Dec 2023

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### Greener homes: from lower utility bills to cost-effective mortgages

Green homes can offer financial benefits to homeowners by reducing utility bills through decreased water, electricity, and heating usage. This cost-saving effect positively impacts mortgage payments, resulting in reduction in default risks. Beyond financial advantages, lower utility bills and improved indoor air quality drive consumer demand for these eco-friendly homes.

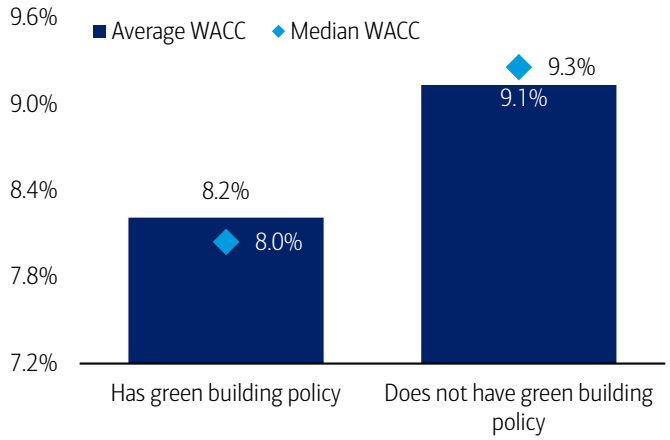
Moreover, green buildings with lower operational costs and healthier living environments experience heightened consumer demand, leading to higher sale prices, rent rates, and occupancy rates. Green certifications, based on an analysis of 42 studies by Dalton and Fuerst, result in a rent premium of 6.0% and a sales premium of 7.6%. Our green building policy expert, Elizabeth Beardsley from the US Green Business Council, also highlighted a study that indicated a $25,000 premium among green-certified homes in Texas, where energy efficiency is crucial due to grid challenges.

Additionally, backtesting conducted by BofA's ESG fixed income analyst, Kay Hope, highlights the material impact of energy efficiency on European Real Estate bond performance. This analysis indicates that bonds issued by more energy-efficient companies within the EJRE outperform both their benchmark and the ICE BofA Europe Real Estate Index (EJRE). The outperformance has widened since interest rate hikes in 2022, with the more energy-efficient cohort (1T) demonstrating lower volatility than their benchmark (Exhibit 2). See Real estate: Quantifying sustainability in EUR IG, 6 February 2024.

Our analysis also shows that US homebuilders and residential REITs implementing green building policies enjoy an average 0.9ppt lower cost of capital (Exhibit 3). Individual borrowers can leverage lower costs of capital through Energy Efficient Mortgages (EEMs), offering an eco-friendly financing options for energy-efficient upgrades in new and existing homes. EEMs often feature tax-deductible benefits and better rates compared to other fixed-rate mortgages. Similarly, BofA's ESG fixed income analyst identifies an 8.5bps "greenium" for European Real Estate bonds (see Getting back to greenium).

**Exhibit 3: Lower costs of capital for homebuilders and residential REITs with green building policies**

Average and median weighted average cost of capital (WACC) among US-listed homebuilders and residential REITs with market cap >$1B with/without green building policies




**Source:** BofA Global Research, Bloomberg. Based on US-listed companies that are classified as Residential REITs or Homebuilders and have a market cap of at least $1B. Within the 38 companies meeting this criteria, 20 have green building policies and 16 do not have green building policies (per Bloomberg). 2 companies are excluded as they do not have data available for this field.

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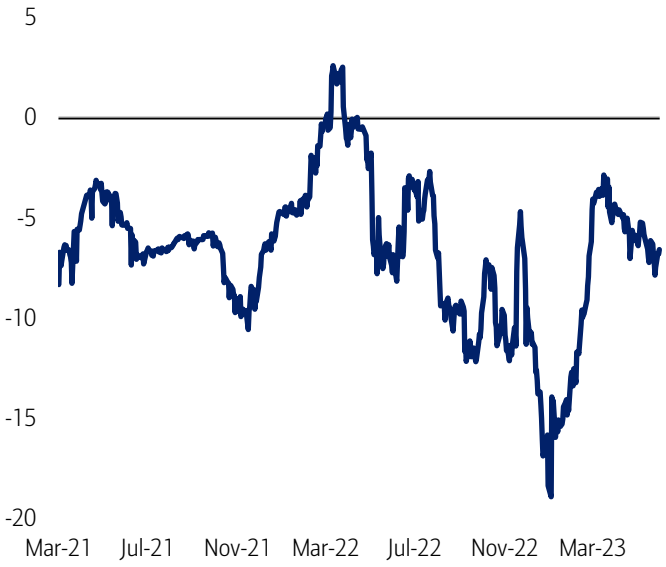
**Exhibit 4: European real estate companies have seen an average greenium of 8.5bps**

Greenium for real estate companies in the EUR IG corporate index (bps), 3/1/2021-5/31/2023




**Source:** BofA Global Research, Bloomberg

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**Greener homes = lower operational costs:**
While the initial investment in greening homes may be higher, federal and local incentives and rebates can effectively offset these costs. The Inflation Reduction Act (IRA), for example, provides tax credits worth up to $5,000 for homes certified as Zero Energy Ready Home, $2,500 for homes certified as ENERGY STAR, and $3,200 for energy efficiency and heat system upgrades. (See the Green building policies driving spending section of the report).

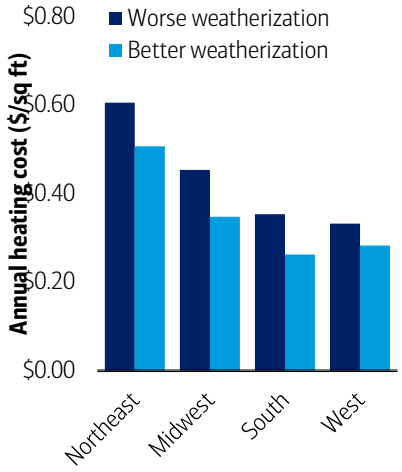
Green homes can lower:

- **Heating costs**: Homes lose less heat when they are better protected from external elements ("weatherized") with better insulation and thicker windows. Our analysis of data from the US Energy Information Administration's (EIA) Residential Energy Consumption Survey shows that homes with better weatherization (i.e., better insulation and thicker windows) see 15-30% lower heating costs per square foot on average. Our analysis also suggests that saved heating costs can add up to $1-4K over 10 years, outweighing the initial installation costs in many cases—particularly when tax credits from the Inflation Reduction Act (IRA) are factored in (Exhibit 6). This is especially beneficial for homes in colder climates, larger homes with older systems, and those in high-energy cost areas.

For every dollar spent on weatherization, households gain $1.72 in energy benefits and $2.78 in additional benefits, including lower medical expenses (source: Department of Energy).

- **Water utility costs**: Did you know, upgrading a main bathroom with more water-efficient products can pay for itself in just one year, saving homeowners $70-$250 annually? This is because water-efficient appliances consume up to 35% less water than alternative products (source: American Water Works Association).
- **Electricity usage**: By replacing older appliances with energy-efficient models, the average household can save $450 a year (source: ENERGY STAR). At a national level, the Department of Energy (DOE) has estimated that its federal building energy codes and proposed standards for consumer appliances could save more than $15 billion in net costs to electricity users over the next 30 years. Installing solar panels at homes can reduce electricity costs by more than $1,000 annually (source: Illinois Power Agency; see tax benefits in Green building policies driving spending).
- **Maintenance and replacement costs**: Choosing more durable materials can reduce costs associated with maintenance and replacement. For example, recycled plastic fences can cost less on a lifetime basis vs wood fences thanks to longer life spans and less required maintenance. Unlike a plastic fence, a wood fence requires re-painting or staining every two to three years, which runs $1,700 on average (source: Angi).
- **Equipment costs**: Heat pumps are $2,000 to $10,000+ more expensive versus comparable AC units without a heat pump (see Heat Pumps: IRA and electrification impacts likely limited in near term). However, better weatherized homes require less powerful heat pumps, which cost less to purchase and operate.

**Exhibit 5: Greener building characteristics reduce space heating costs by 15-30%**
Average annual cost for space heating (USD per square footage of the house that is heated), by region and weatherization




**Source:** BofA Global Research, US Energy Information Administration (EIA) 2020 Residential Energy Consumption Survey (RECS), released in 2023. Better weatherization means the house is either well-insulated or adequately insulated (as reported by the home's residents) and has double- or triple-pane windows. Worse weatherization means the house is poorly insulated or not insulated (as reported by the home's residents) and/or has single-pane windows.
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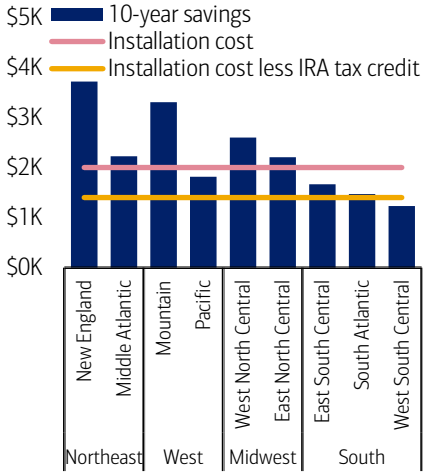
**Exhibit 6: Savings and IRA tax credits for insulation upgrades outweigh installation costs, particularly in cooler regions**
Hypothetical 10-year savings, installation costs, and installation costs cost less IRA tax credit given a 1000 sq ft insulation upgrade, by region




**Source:** BofA Global Research, CIMA's Insulation Savings Calculator, US Bureau of Labor Statistics, US EIA, HomeGuide. Based on regional Heating Degree Days (per the US EIA) and average cost of natural gas in each region in December 2023 (per the Bureau of Labor Statistics). Assumes an installation upgrade from R-10 to R-30 and use of natural gas to heat. Estimated total cost based on square-foot estimates to install R-30 insulation from HomeGuide. IRA offers a 30% tax credit on insulation.
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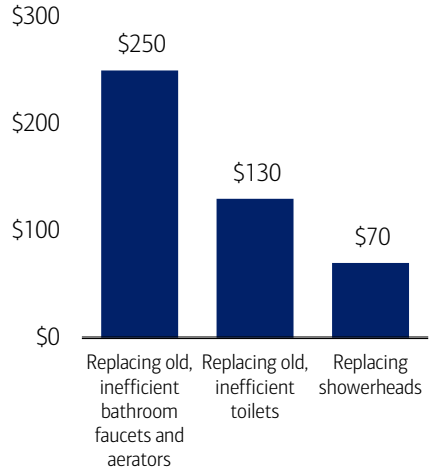
**Exhibit 7: The average family can save $70-$250 p.a. with more water-efficient products**
Annual savings for the average family by upgrading to WaterSense-labeled products




**Source:** US Environmental Protection Agency
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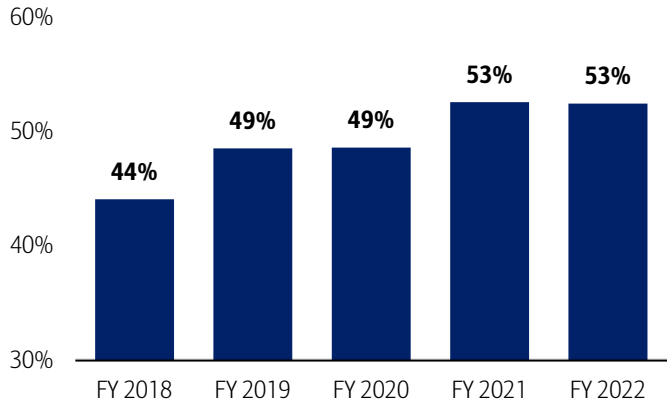
# Greener building solutions

The growing emphasis on demand and cost factors is driving building and construction materials companies to expand their offerings to include more sustainable building products. These encompass solutions geared towards enhancing energy efficiency, water efficiency, and incorporating more environmentally friendly raw materials (Exhibit 8). Notable examples of sustainable raw materials involve the use of green concrete, green steel, and recycled plastic. Building upgrades also play a pivotal role in advancing energy efficiency, with measures such as weatherization (shielding a home's interior from external elements), transitioning to energy-efficient appliances and lighting, and integrating smart home devices contributing to the overall goal of creating more sustainable homes.

**Exhibit 8: More US building and construction materials companies are offering sustainable building materials**
Percent of US-listed Materials and Construction Materials companies with market cap >$1B that develop sustainable building products, FY2018-FY2022




**Source:** BofA Global Research, Refinitiv. See definitions in the methodology appendix. Based on 41 companies that fit the screening criteria (US-listed Building Materials and Construction Materials companies with market cap >$1B).

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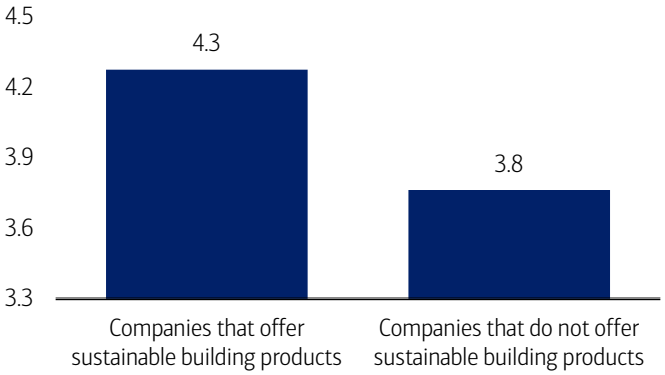
**Exhibit 9: And those that develop sustainable options tend to see higher ESG scores**
Average Bloomberg ESG score of US-listed Materials and Construction Materials companies with market cap >$1B that offer/don't offer sustainable building products




**Source:** BofA Global Research, Refinitiv. See definitions in the methodology appendix. Based on companies that fit the screening criteria (US-listed Building Materials and Construction Materials companies with market cap >$1B). Bloomberg's ESG score ranges from 0-10, where 10 is best.

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## Building upgrades can improve home efficiency

Green certification and labelling programs allow homeowners to assess their homes' efficiency and/or to choose more efficient products when making home upgrades. Some programs focus specifically on energy efficiency (like ENERGY STAR and the Home Energy Rating Score) or water efficiency (like WaterSense), while others take a more holistic assessment of a building's sustainability (like LEED and BREEAM). With 9 in 10 US households aware of the ENERGY STAR label, there has been an increase in construction of ENERGY STAR homes over the last decade (Exhibit 11).

**Exhibit 10: Popular green building labelling programs**
Description of green building labelling program characteristics

| Program | Run by | Applies to | Focuses on |
|---|---|---|---|
| Building Research Establishment Environmental Assessment Methodology (BREEAM) | BRE Group | Buildings (both commercial and residential) | Broad set of metrics, including energy efficiency, water efficiency, low impact design, design durability and resilience, adaption to climate change, ecological value and biodiversity protection, health & wellbeing |
| ENERGY STAR | US Environmental Protection Agency (EPA) | Buildings (both commercial and residential) and products | Energy efficiency |
| Home Energy Rating Score (HERS) | RESNET | Residential buildings | Energy efficiency |

**Exhibit 10: Popular green building labelling programs**
Description of green building labelling program characteristics

| Program | Run by | Applies to | Focuses on |
|---|---|---|---|
| Indoor Air Plus (IAP) | US Environmental Protection Agency (EPA) | Residential buildings | Indoor air quality |
| LEED (Leadership in Energy and Environmental Design) | US Green Building Council (USGBC) | Buildings (both commercial and residential) | Broad set of metrics, including energy efficiency, water efficiency, emissions reduction, and indoor environmental quality |
| National Green Building Standard (NGBS) | American National Standards Institute (ANSI) | Residential buildings | Broad set of metrics, including energy efficiency, water efficiency, resource efficiency, lot development, operation & maintenance, indoor air quality |
| Passive home certification | Passive Home Institute US (PHIUS) | Buildings and products | Energy efficiency, indoor air quality |
| WaterSense | US Environmental Protection Agency (EPA) | Residential buildings and products | Water efficiency |
| Zero Energy Ready Home (ZERH) | US Department of Energy (DOE) | Residential buildings | Energy efficiency |

**Source:** BofA Global Research; online research. Note: this is a non-exhaustive list.

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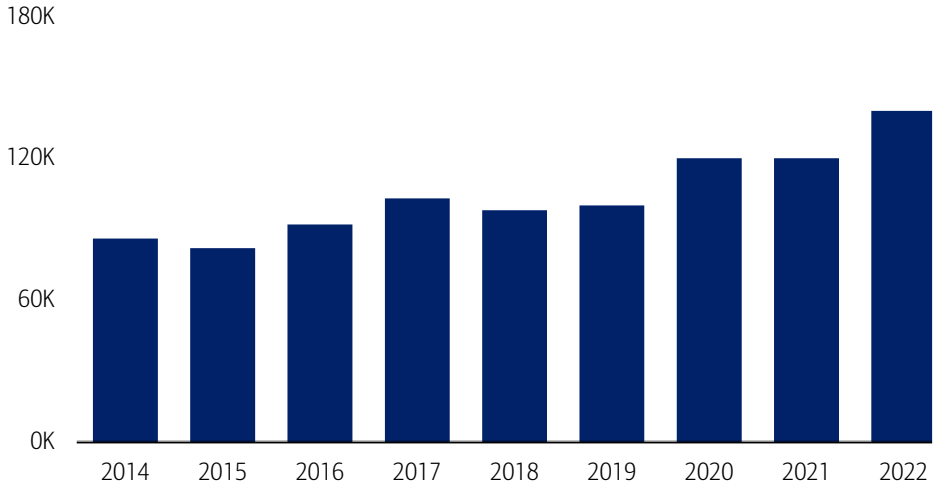
**Exhibit 11: Increasing number of ENERGY STAR certified homes being constructed in the US**
Number of ENERGY STAR certified homes built in the US during the year, 2014-2022




**Source:** US Environmental Protection Agency's ENERGY STAR Annual Reports

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**Home upgrades can support the energy transition**: Decarbonization trends are driving electrification and a shift to renewable power, with several implications for home construction and renovation.

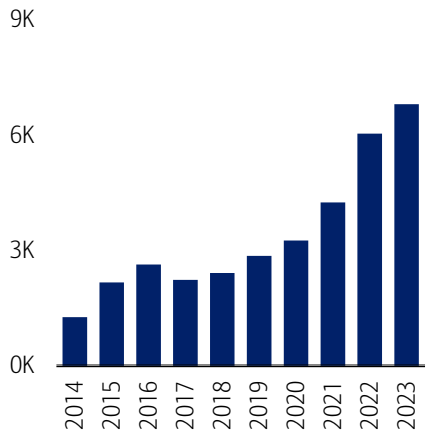
- **Solar**: Installations of residential solar panels have risen >5x over the last decade (Exhibit 12). The Inflation Reduction Act (IRA) further incentivizes solar panel installation by offering a 30% tax credit (with no dollar limit) for panels installed between 2022-2032. Because it can cost between $1,500-$6,000 to uninstall and re-install solar panels, homeowners will replace the roof when installing solar panels if it's likely the roof would need to be replaced during the solar panels' lifetime. This suggests that solar installations increase homeowner spending on roofing materials.
- **Electric vehicles (EVs)**: The IRA offers tax credits of up to $7,500 for new electric cars. Although challenges like affordability and range anxiety are slowing EV demand

growth, BofA's US Automotive analysts still expect EVs to make up one-third of new vehicle sales by 2030 (Exhibit 13; see Year Ahead 2024: Five Auto themes & top stock picks as volatility remains). The typical EV charging station requires a 240-volt dedicated circuit, so homes with less electrical capacity will need to be upgraded to be able to support these chargers. This often involves installing a heavy-duty electrical outlet and upgrading electrical panels, which can cost $850-$4,000 (source: CapitalOne Auto Navigator). On the back of increasing homeowner demand for EV charging capabilities and new laws in states like California and Illinois mandating EV charging infrastructure in new homes, more homebuilders are pre-wiring garages with enough electrical capacity for EV charging.

- **Heat pumps**: Electric heat pumps can run on renewable electricity rather than fossil fuels, reducing emissions and air pollution. The IRA contains approx. $4bn of heat pump incentives (relative to approx. $60bn US HVAC market), which are a positive for HVAC stocks (JCI (Johnson Controls), CARR (Carrier), and TT (Trane Technologies)) but likely with a limited impact on incremental demand. The share of new homes built with heat pumps jumped 5ppt between 2021 and 2022 following the enaction of the IRA (Exhibit 14). Making homes more airtight and energy efficient enables homeowners to install less powerful heat pumps, which makes this upgrade more affordable. See Heat Pumps: IRA and electrification impacts likely limited in near term.

For further details on how the incentives from the Inflation Reduction Act see Green building policies driving spending.

**Exhibit 12: US residential solar installations have taken off in the last decade**
Capacity of residential solar installations (MWdc) by year in the US, 2014-2023




**Source:** BofA Global Research, Wood Mackenzie
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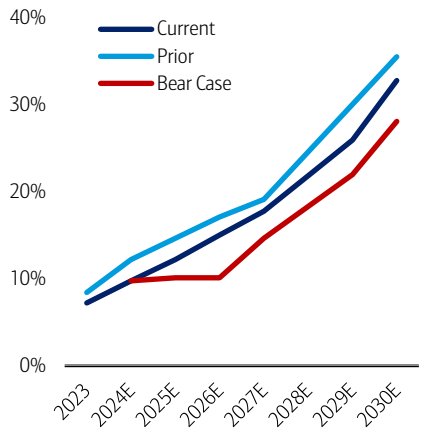
**Exhibit 13: BofA's US auto analysts now expect 33% EV penetration by 2030**
US EV Penetration Rate Forecast: Current vs Prior vs Bear Case




**Source:** Wards, BofA Global Research
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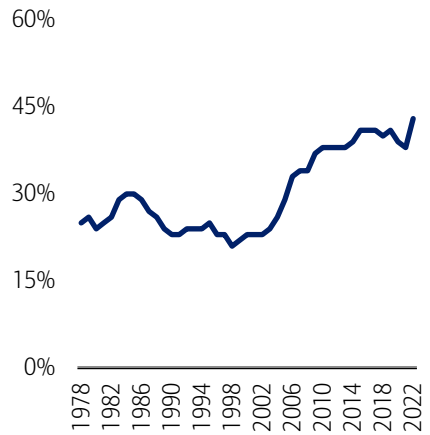
**Exhibit 14: 43% of homes built in 2022 have heat pumps**
US percentage of new single-family homes with heat pumps, 1978-2022




**Source:** US Census Bureau Characteristics of New Housing, 2022 (published in June 2023)
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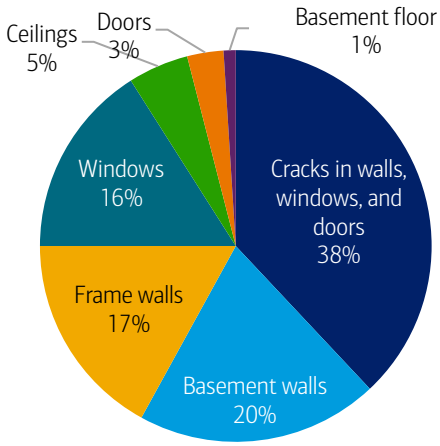
**Investing in weatherization pays off**: Weatherization plays a crucial role in regulating building temperature. Even well-insulated homes lose 1-5% of heat per hour through walls, windows, ceilings, and doors; poorly insulated homes can lose even more (source: Green Wave Distribution). Weatherization focuses on improving insulation and upgrading windows, addressing over 90% of heat loss due to cracks and inefficient structures (Exhibit 15) while also helping to make homes more resilient to grid interruptions, as better insulated homes hold heat and cooling for longer periods.

**Exhibit 15: >90% of lost home heat is due to cracks, walls, and windows**
Sources of residential heat loss




**Source:** Pennsylvania State University

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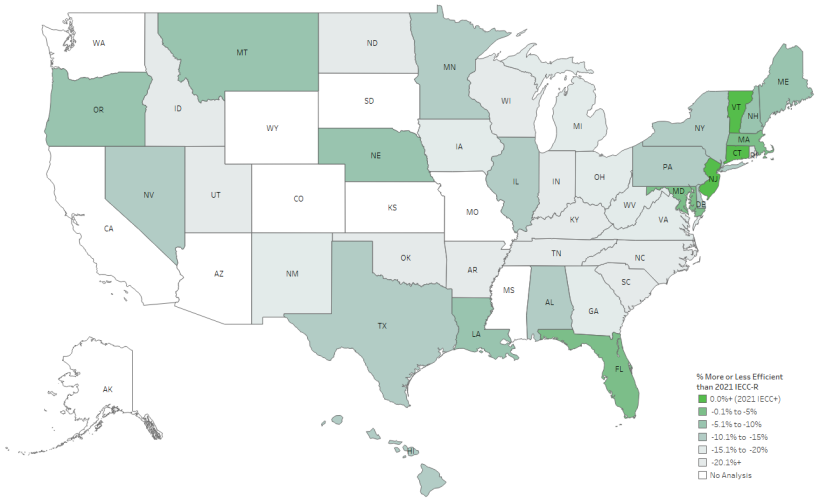
## Owens Corning & TopBuild to benefit from insulation-focused incentives

The Inflation Reduction Act (IRA) and the High-Efficiency Electric Home Rebate Act (HEEHRA) included in the IRA provide new green incentives for homeowners to make energy efficient improvements more affordable. We believe Owens Corning (OC; 2nd largest US insulation manufacturer) and TopBuild (BLD; larger US insulation installer) are well positioned to benefit from the insulation-focused energy efficient initiatives given: (1) BLD has high exposure to insulation (79% of Installation segment and 89% of Specialty Distribution sales) and OC generated roughly 30% of operating profit from insulation in 3Q23; (2) we estimate 90% of US homes are under-insulated (see below), with heating and cooling costs the second-largest household expense; and (3) tax rebates of up to $1600, the highest tax credit payout for weatherization projects, are attractive to homeowners that are mandated to increase insulation for energy efficient homes.

**Exhibit 16: Majority of the US is less efficient than the national model code**
Map of residential energy by state index relative to current model code (2021 IECC)




**Source:** US Office of Energy Efficiency & Renewable Energy
Data as of 12/28/2023

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According to OC's 2021 Investor Day presentation, an additional 270mm lbs/year of insulation is needed if all US states adopted the 2021 International Energy Conservation Code (IECC). Reinsulating existing homes is not only a key component to achieving decarbonization, but also properly insulated homes pay back in less than 90 days for energy saved. The 2021 IECC is the latest standard for energy conservation, and several minimum insulation requirements have been raised from the 2018 IECC. The R-value, or the measure of insulation's ability to resist heat traveling through it, has been increased in four different categories. As insulation prices increase due to increased demand from government policies, the tax credit incentives will become more beneficial once more states adopt the IECC rules for insulation. Roughly 40% of the world's energy consumption comes from buildings today.

> Using the United States as an example, using buildings that are not insulated to the current code, the Environmental Protection Agency estimates that 80 million out of 120 million of homes in the United States are under-insulated.

**Exhibit 17: Key Changes to Prescriptive insulation Values**
Most insulation requirements have been increased in the 2021 IECC Code

| | 2018 IECC Code | 2021 IECC Code |
|---|---|---|
| Fenestration U-Factor | 0.32 | 0.3 |
| Glazed Fenestration SHGC | NR | 0.4 |
| Ceiling R-Value | 49 | 60 |
| Wood Frame Wall R-Value | 20 or 13 + 5ci | 20 + 5ci or 13 + 10ci or 0 + 15ci |
| Basement Wall R-Value | 15ci or 19 | 15ci or 19 or 13 + 5ci |
| Slab R-value and Depth | 10 ci, 2 ft down | 10 ci, 4 ft down |

**Source:** International Code Council (ICC)

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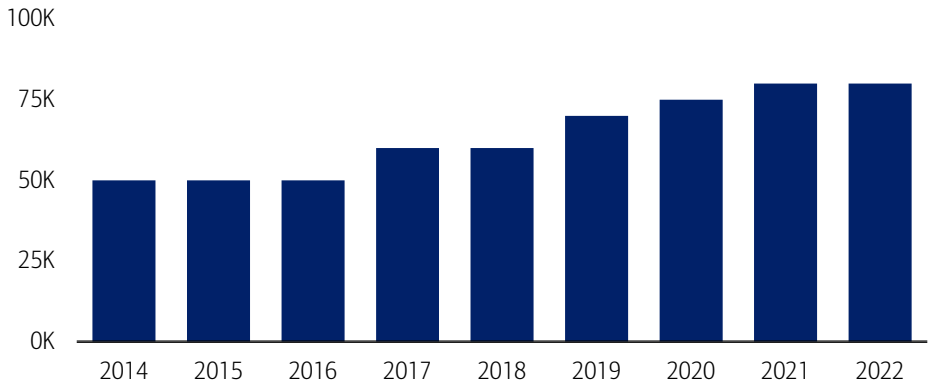
**Appliance and lighting upgrades to use less energy:** Appliances (including refrigerators and lights) consume two-thirds of all electricity used by US households (source: US Energy Information Administration [EIA]). Households can benefit from the increasing number of energy-efficient products are coming to the market. ENERGY STAR has added over 30,000 certified product models in the last five years, representing an increase of 60%. Bolstering this, the Inflation Reduction Act (IRA) offers tax credits of 30% of total energy efficient home improvement expenses for a maximum annual limit of $1200 (see Green building policies driving spending below).

**Exhibit 18: ENERGY STAR certified products on the rise**
Number of ENERGY STAR certified product models, 2014-2022




**Source:** US Environmental Protection Agency's ENERGY STAR Annual Reports

**Exhibit 18: ENERGY STAR certified products on the rise**
Number of ENERGY STAR certified product models, 2014-2022

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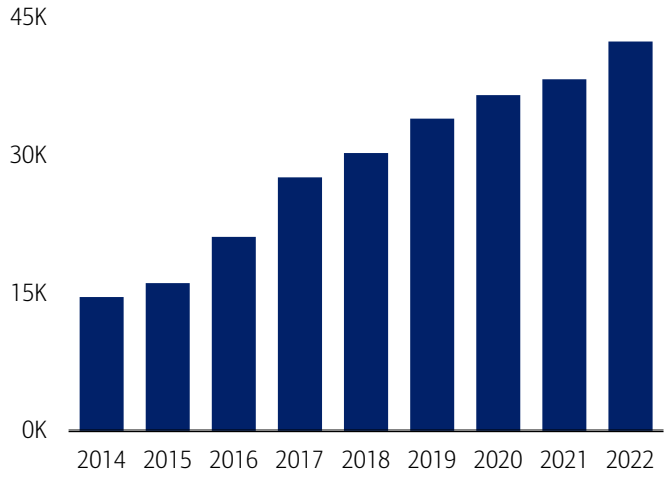
**Building upgrades can improve water efficiency:** Over the last two decades, the western United States has experienced some of the driest conditions on record, making water efficiency measures more critical. Switching to water-efficient appliances can cut indoor household water use by more than 35% (source: American Water Works Association). The WaterSense program, which identifies products that are at least 20% more water-efficient, has seen a 40% increase in the number of labeled products in the last five years (Exhibit 19). The program focuses particularly on bathroom appliances, which contribute two-thirds to indoor water use.

**Exhibit 19: The no. of WaterSense-labeled products +40% over 5 yrs**
Number of WaterSense-labeled product models, 2013-2022




**Source:** US Environmental Protection Agency (EPA)

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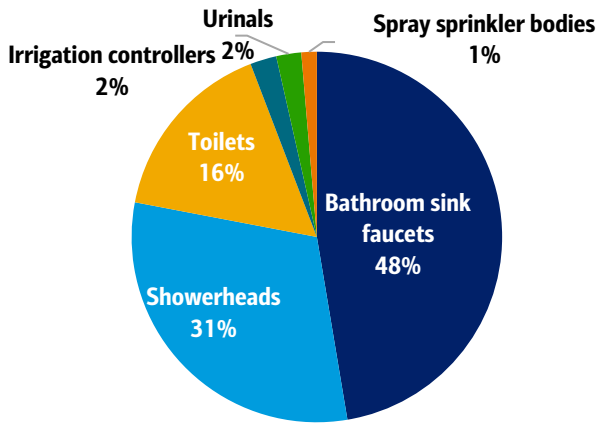
**Exhibit 20: Water-efficient products focused on the bathroom**
Percent of WaterSense-labeled product models by type of product, as of 2022




**Source:** US Environmental Protection Agency (EPA)

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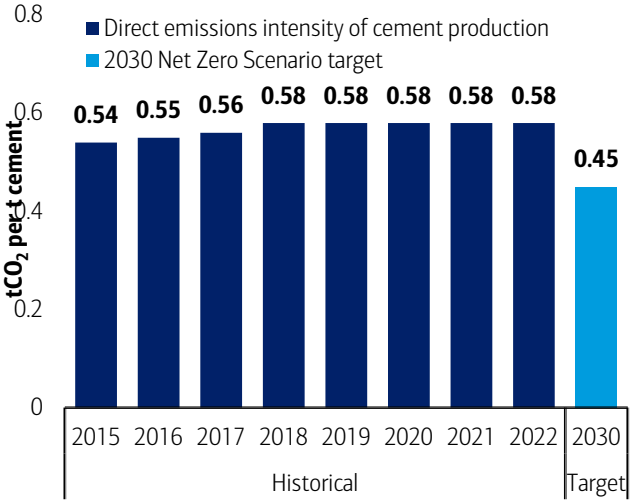
## Choosing more sustainable raw materials

Achieving net-zero emissions in the construction sector is challenging, especially in steel and cement production, which collectively contribute nearly 7% of global emissions (source: IEA). These industries face formidable obstacles due to the high heat required for essential chemical reactions. Yet, to reach net-zero targets by 2030, cement and steel emission intensity must decrease by 22% and 24%, respectively. Meeting these goals necessitates efficiency improvements, reducing material usage, and implementing innovative technologies. Sustainable building materials that encompass green steel and concrete, responsibly sourced lumber and engineered wood, and recycled plastics are crucial in this transformative journey.

**Exhibit 21: Cement emissions intensity needs to fall 22% by 2030 to achieve net zero**
Historical direct emissions intensity of cement production, 2015-2022; target direct emissions intensity in 2030 under the Net Zero Scenario




**Source:** IEA

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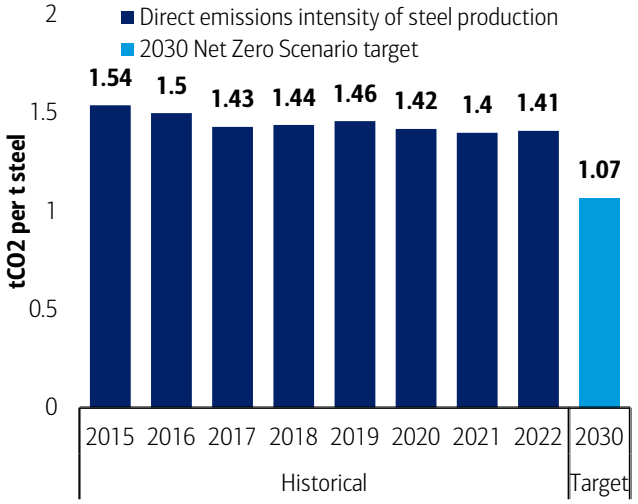
**Exhibit 22: Steel emissions intensity needs to fall 24% by 2030 to achieve net zero**
Historical direct emissions intensity of steel production, 2015-2022; target direct emissions intensity in 2030 under the Net Zero Scenario




**Source:** IEA

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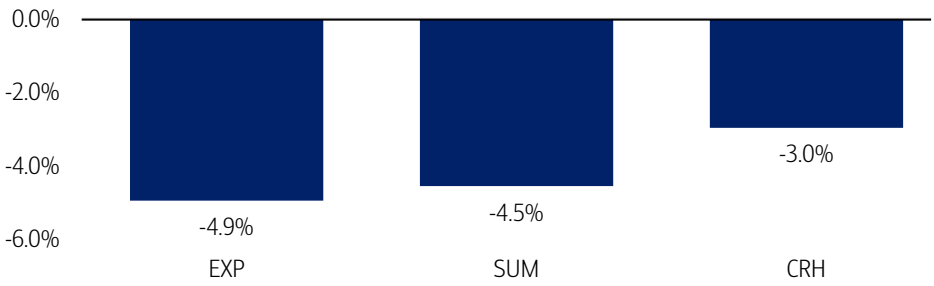
## Cement: More sustainable formulas can reduce emissions

CRH Plc (CRH), Eagle Materials (EXP), and Summit Materials (SUM) have successfully achieved notable reductions in the carbon intensity of their cement, ranging from 3-5% over the past year (Exhibit 23). Strategies for decarbonization include implementing emissions abatement through Carbon Capture, Utilization, and Storage (CCUS), utilizing less clinker in cement production, exploring innovations in alternative cement, and substituting cement with other eco-friendly materials, such as sustainable timber. As an illustration, a subsidiary of Summit Materials (SUM) has transitioned its entire annual production to Portland Limestone Cement, boasting a 10% lower carbon footprint compared to traditional cement.

**Exhibit 23: Yet individual companies are making progress**
YoY change in cement $CO_2$ intensity between FY2022 and FY2021




**Source:** BofA Global Research, Refinitiv, Bloomberg.

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## Plastic: Using recycled materials supports circularity and adds longevity

Incorporating recycled plastic into building materials not only addresses plastic waste and promotes circularity but also provides additional functional benefits. Currently, less than 10% of plastic waste in the US undergoes recycling. Recycled plastic is increasingly replacing lumber in decks or fences, extending their lifespan from 14 years to 20-30 years. Additionally, it serves as an additive in concrete, enhancing its lightweight properties to reduce emissions during transport, impeding water absorption, and

improving insulation. This versatile material can also substitute virgin materials in floor tiles, roofing tiles, and bricks.

Despite these advancements, tracking progress on the use of recycled materials, including recycled plastics, remains challenging. Only four out of 41 major US-listed building and construction materials companies with a market cap over $1 billion have reported the percentage of their raw materials sourced from recycled origins in the last two years (Bloomberg data).

### AZEK and TREX's recycling goals align with green building initiatives

Composite decking companies AZEK (AZEK) and Trex (TREX) are well positioned to benefit from the consumer preference shift to sustainable materials as well as favorable margin tailwinds from increased use of recycled materials. We forecast composite decking to grow at a high-single-digit CAGR through 2035 consisting of mid-single-digit market growth and an annual conversion rate of 100-200bps from wood decks to composites. We believe composites will reach 45-50% of the industry, driven by consumer preference for products that: (1) are more durable and longer lasting; (2) are environmentally friendly; and (3) require less maintenance and upkeep costs.

- **Trex's low-cost production and recycled material are wide moats:** TREX announced in their 3Q23 Investor Day presentation that 95% of decking is upcycled from diverted wastes, and almost 100% of production waste is recycled internally. TREX has been collecting recycled plastic film and reclaimed wood to use in their composite decks since 1992. They officially named this initiative the NexTrex program in 2019, and today NexTrex collects plastic film waste from more than 32,000 locations in the U.S. to make eco-friendly outdoor products. TREX is the lowest cost producer in the industry due to its superior ability to source and process recycled material. Trex uses 95% recycled and reclaimed material in decking boards and 40% in railing. Trex's recycled materials cost between $0.05/lb and $0.30/lb, compared to $0.60/lb-$0.70/lb for virgin resin. TREX has built competency in recycling over 30 years, which has allowed it to move further down the "waste stream" to use lower cost materials from a broad range of sources compared to competitors.

- **AZEK continues to expand its use of recycled materials:** AZEK considers their recycling initiatives to be an advantage to their business goals. AZEK is the largest integrated polyvinyl chloride (PVC) recycler in North America and has vertically integrated in polyethylene (PE) recycler supplying the majority of AZEK needs. AZEK consumed about 500 million pounds of recycled material in FY201 and has a goal to consume 1 billion pounds of recycled content by the end of 2026. In their 2022 Investor Day presentation, AZEK said it expects increased recycle content to drive significant margin expansion, with $40-50mm in savings from driving increased recycle PVC utilization and conversion to 90%+ low density polyethylene (LDPE) formula, and 50% savings of every pound of recycled PVC.

**Exhibit 24: Recycled supply streams are mostly untapped**
At most, 20% of the total available waste stream of wood flour is being recycled annually, and even less for other categories

| Recycle Supply Streams | Estimated size of U.S. Recycle Source Streams (Billion pounds/year) | Percent recycled of the total waste stream |
|---|---|---|
| Wood Flour | 110 | 15-20% |
| LDPE/LLDPE | 17 | 3-5% |
| HDPE | 13 | 8-10% |
| PVC | 6 | 10-15% |

**Source:** AZEK 2022 Investor Day Presentation, Company estimates, EPA MSW report 2018, EPA C&D report 2018, and the Vinyl Institute .

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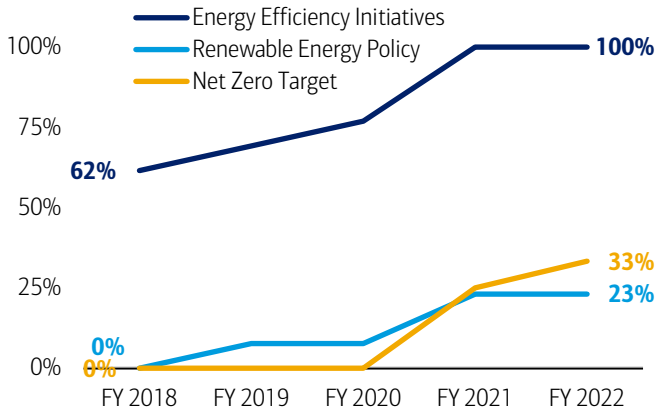
### Steel: Recycling and material reduction critical while new tech is developed

In the US, various steel decarbonization projects employing diverse technologies have been actively announced (Exhibit 26). These initiatives involve implementing Carbon Capture, Utilization, and Storage (CCUS) and replacing fossil fuels with green hydrogen. However, current green steel technologies are 40% more expensive than unabated production, posing challenges for widespread adoption in the construction sector, where thin margins prevail (source: BNEF).

Although economies of scale are expected to reduce these costs over time, recycling and enhancing steel efficiency present more immediate, cost-effective strategies. Recycling scrap steel consumes 75% less energy than processing iron ore and can be achieved using renewable electricity. Additionally, reducing steel emissions can be accomplished by extending building lifetimes by 30-40 years and employing steel more efficiently in construction. US steel companies are actively pursuing emission reduction through energy efficiency initiatives, renewable energy policies, and the adoption of net-zero targets (Exhibit 25).

**Exhibit 25: More US steel companies are setting GHG targets**
Percent of US-listed Steel companies with market cap >$1B that have energy efficiency initiatives, renewable energy policies, and net zero targets, FY2018-FY2022




**Source:** BofA Global Research, Bloomberg. See definitions in the methodology appendix. Based on 14 companies that fit the screening criteria (US-listed Steel companies with market cap >$1B).

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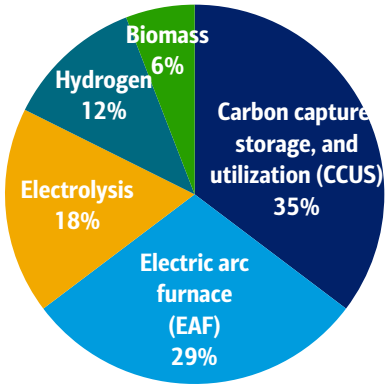
**Exhibit 26: Green steel: 17 US steel decarbonization projects have been announced, spanning an array of abatement technologies**
Percent of US steel decarbonization project count by abatement technology




**Source:** BloombergNEF. EAF=electric arc furnace. CCUS=carbon capture, and/or utilization, and/or storage.

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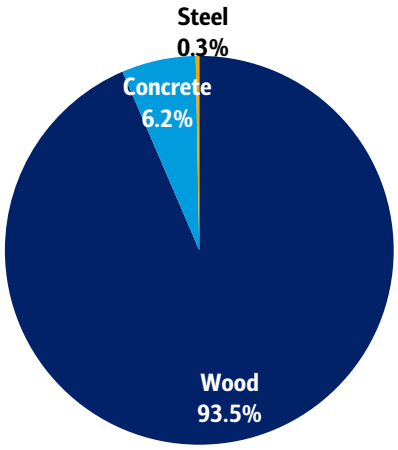
### Wood: Building alternative with lower manufacturing and transport emissions

Wood is by far the most common framing material in in the US, particularly in single-family homes (94% of single-family homes built in 2022 used wood framing, vs 73% of multi-family homes). The share of wood used in multi-family homes could rise further given growing interest in mass timber (a type of load-bearing engineered wood that can replace steel and concrete). There are now over 2,000 mass timber projects in the US (source: WoodWorks; as of December 2023).

Whether wood should be considered a sustainable building material is heavily debated. Proponents highlight that wood is a renewable and reusable resource that continues sequestering carbon even after harvested. Manufacturing engineered wood uses 24x less energy than producing steel and 5x less energy than concrete, making it a less carbon-intensive building material (source: Engineered Wood Association). Moreover, wood is 5x lighter than concrete and 15x lighter than steel, reducing transport emissions (source: Kirksey Architecture).

However, the use of wood is often associated with deforestation, which harms biodiversity. While certifications can help ensure that wood is harvested in a sustainable manner, it is difficult to track the sustainability of the wood used for building due to lack of reporting. Just three (of 41) US-listed building materials and construction materials companies with at least $1B market cap have reported on their wood certifications in the last two years (per Bloomberg data). Additionally, to avoid releasing the sequestered $CO_2$ emissions at the end of a building's lifetime, the wood would need to be re-used or stored without decomposing.

**Exhibit 27: Wood is by far the most popular framing material for single-family homes...**
Percent of single-family homes built in the US in 2022 by framing material




**Source:** BofA Global Research, US Census Bureau

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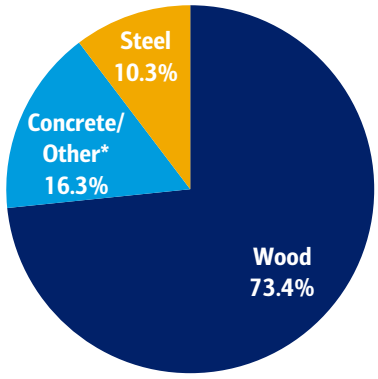
**Exhibit 28: ...while steel and concrete make up a larger percentage of framing in multi-family homes**
Percent of multi-family homes built in the US in 2022 by framing material




**Source:** BofA Global Research, US Census Bureau. *Note: Includes concrete, insulated concrete forms, and other types of framing (not shown separately).

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# Green building policies driving spending

To champion energy efficiency in buildings, the US federal government launched the National Building Performance Standards Coalition in January 2022. This coalition enables state and local governments to collaborate in advancing building performance legislation. Participating jurisdictions, representing one-quarter of US buildings, are committed to passing a building performance policy by Earth Day this year (see Exhibit 29). Additionally, the federal government introduced the first-ever Federal Building Performance Standard in 2022, applicable solely to federal buildings in the US. This standard aims to reduce energy consumption and transition equipment and appliances to electrification in 30% of federal building space by 2030. Given that the federal government is the largest building owner and manager in the US, this standard could inspire state and local governments to enact similar laws.

**Exhibit 29: 25% of US jurisdictions are part of the National Building Performance Standard Coalition**
Members of the National Building Performance Standards Coalition, as of December 2023


**Source:** Institute for Market Transformation (www.imt.org/bps)

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### The IRA is the bigger talking point...

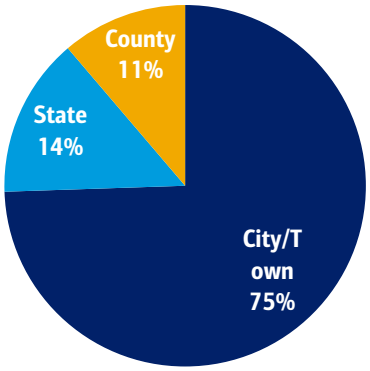
The Inflation Reduction Act (IRA) and the Bipartisan Infrastructure Law (BIL) collectively offer US state governments over $1.2 billion to encourage the adoption of building energy codes. The Energy & Climate provisions of the IRA allocate $27 billion for building efficiency and electrification through grants and government loan programs. This includes $8.5 billion for states to implement home energy rebate programs.

The IRA also incentivizes homeowners by making tax credit available for a portion of qualifying expenses. Starting in 2023 through 2032, 30% of total energy efficient home improvement expenses can be applied to tax credits, for a maximum annual limit of $1200. For heat pumps, biomass stoves and boilers, there is a separate annual credit limit for $2000. There are no lifetime limits for energy efficient credits. Included with the IRA, the High-Efficiency Electric Home Rebate Act (HEEHRA) is a voluntary program that covers 100% of electrical efficient projects (up to $14k) for low-income households and 50% of costs (up to $14k) for moderate-income households. HEEHRA also provides up to $1600 in weatherization rebates to improve windows, insulation, and air seals in existing homes. For new residential construction, the IRA provides tax credits worth up to $5,000 for homes certified as Zero Energy Ready Home and up to $2,500 for homes certified as ENERGY STAR.

### Patchwork of US state- and local-level laws encouraging greener buildings

While the benefits of the IRA seem to be widely understood among investors, state- and local-level policies are an underappreciated driver of spending on green building products, in the view of BofA's Homebuilders and Building Products Analyst, Rafe Jadrosich. The sheer number of policies make this impact difficult to quantify, yet these policies are meaningfully impacting spending at the local level. Based on our analysis of the US Green Building Council's Policy Library, there are over 420 green building policies (targeting both residential and commercial properties) in effect at the state- and local-level across the United States. The vast majority of these (86%) fall at the city, town, or county level. 98% of these policies focus on new construction. Only half of the policies set a requirement, with the remainder providing incentives and/or enabling future legislation instead (Exhibit 32).

**Exhibit 30: Majority of green building policies at the local level**
US green building policies in effect by level




**Source:** BofA Global Research, US Green Building Council
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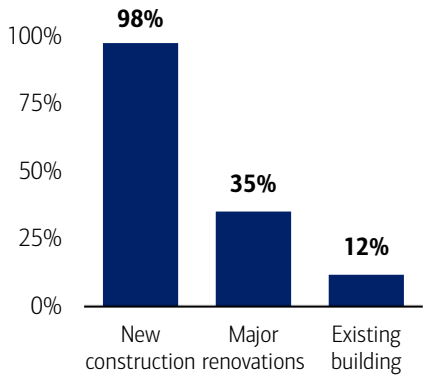
**Exhibit 31: Nearly every policy focuses on new builds**
Percent of US green building policies that apply to new construction, major renovations, and/or existing buildings




**Source:** BofA Global Research, US Green Building Council. Policies may apply to more than one type of building.
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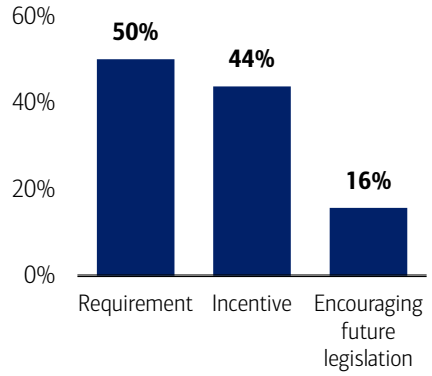
**Exhibit 32: Only half of the green building policies actually set requirements**
Percent of US green building policies that set requirements, provide incentives, and/or encourage future legislation




**Source:** BofA Global Research, US Green Building Council. A policy may involve more than one method.
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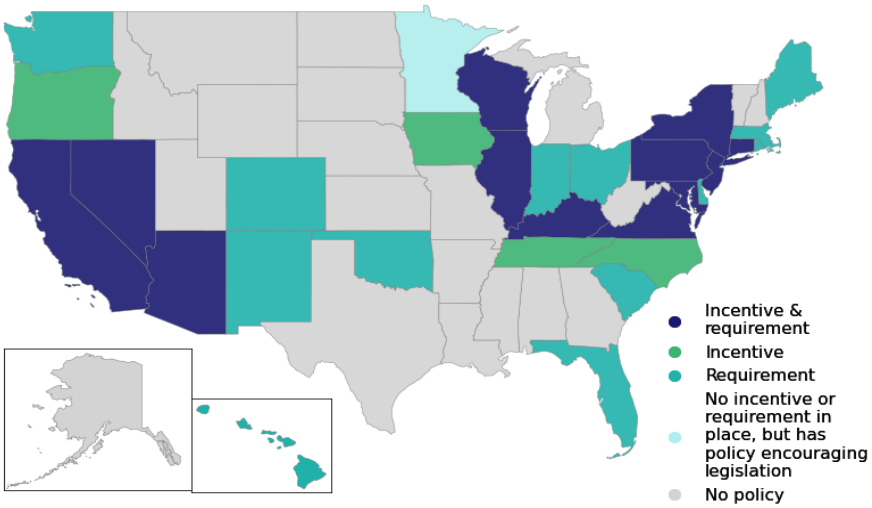
In fact, 30 states have at least one policy in effect that incentivizes, requires, or encourages high-performance buildings (residential and commercial). Nearly all of these states (25) have mandated certain building standards (e.g., requiring LEED certification for any new construction), while 16 states are offering incentives, which may be structural (like density and height bonuses and expedited or no-cost permitting) or financial (like tax credits, grants and low interest loans).

**Exhibit 33: 30 states in the US have at least one policy in effect**
Green building policies by state




**Source:** BofA Global Research, US Green Building Council
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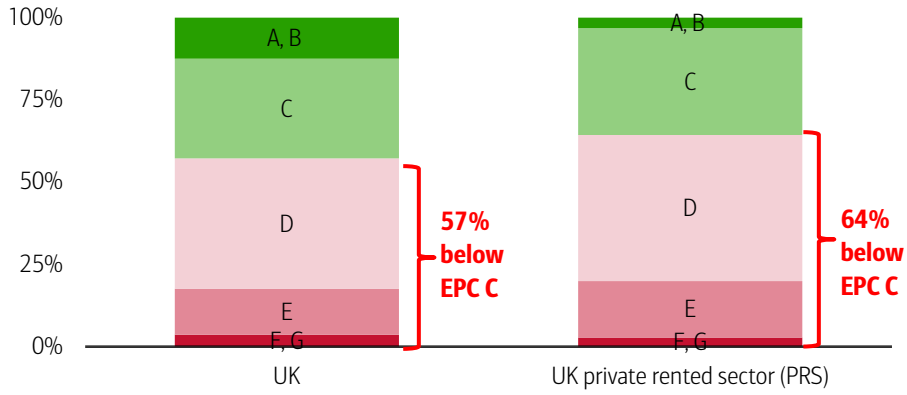
**New Europe legislation could lead the way for US state and local governments**
Proposed building energy performance bills in the UK and the EU could offer US states and localities a framework for their own policies. Many of these bills apply to both residential and commercial buildings.

The Minimum Energy Performance of Buildings Bill (MEPB) is making its way through the UK Parliament. Although the precise text is yet to be finalized, the bill proposes a new Minimum Energy Efficient Standard (MEES) for buildings in the UK. The bill seeks to improve the UK's housing stock to a minimum Energy Efficient Rating (EER) of C, with deadlines varying from the end of 2025 for new private rentals to 2035 for homes. 80% of privately rented properties in the UK with an energy efficiency rating below C would need to spend around £10,000 to achieve compliance with the UK's Minimum Energy Efficiency Standards (MEES) (source: Propflo). See UK RMBS carbon footprint, 31 July 2023.

Similarly, in the EU, a revision to the Energy Performance of Buildings Directive is now pending formal adoption after legislators reached a provisional agreement on the directive in December 2023. The directive sets out a range of measures to improve the energy performance of buildings, including requiring EU countries to set minimum energy performance requirements and establish long-term renovation strategies to decarbonize the building sector.

**Exhibit 34: Majority of UK residential housing will need upgrades to comply with MEES**
Residential property performance across UK, % by EPC




**Source:** Kamma EPC register sweep, BofA Global Research. September 2022. Note: *National and social housing data does not include Northern Ireland where housing classification is not recorded on certificate

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# Screens

*The exhibits below are screens and not recommended lists either individually or as a group of stocks. Investors should consider the fundamentals of the companies and their own individual circumstances/objectives before making any investment decisions. The screens are intended to be indicative metrics only and may not be used for reference purposes or as a measure of performance for any financial instrument or contract, or otherwise relied upon by third parties for any other purpose, without the prior written consent of BofA Global Research. These screens were not created to act as a benchmark.*

### Screening criteria

We utilize data from Bloomberg and Refinitiv to screen for US-listed companies with market caps of at least $1 billion USD that are helping to make US homes more sustainable.

### Residential REITs and homebuilders

Residential REITs and homebuilders play a role in making greener homes available to US consumers by making energy and water efficiency improvements and obtaining green building certificates for homes in their portfolios. To identify residential REITs and homebuilders with exposure to greener homes, we screen for US-listed residential REITs and homebuilding companies with market caps greater than $1 billion that have a green building policy, energy efficiency initiatives, and water efficiency initiatives in place.

**Exhibit 35: Homebuilders and residential REITs screen**

US-listed homebuilding and residential REIT companies with at least $1B in market cap (as of 2/15/2024) that have a green building policy, energy efficiency initiatives, and water efficiency initiatives in place, per Bloomberg data

| Bloomberg Ticker | Company Name | GICS Industry | GICS Sub-Industry | Market Cap (USD bn) |
|---|---|---|---|---|
| AIRC US Equity | Apartment Income Reit Co | Residential REITs | Multi-Family Residential REITs | 4.7 |
| AIV US Equity | Apartment Invt & Mgmt Co -A | Residential REITs | Multi-Family Residential REITs | 1.2 |
| AVB US Equity | Avalonbay Communities Inc | Residential REITs | Multi-Family Residential REITs | 25.1 |
| CPT US Equity | Camden Property Trust | Residential REITs | Multi-Family Residential REITs | 10.3 |
| DHI US Equity | Dr Horton Inc | Household Durables | Homebuilding | 48.4 |
| ELME US Equity | Elme Communities | Residential REITs | Multi-Family Residential REITs | 1.3 |
| ELS US Equity | Equity Lifestyle Properties | Residential REITs | Single-Family Residential REIT | 12.4 |
| EQR US Equity | Equity Residential | Residential REITs | Multi-Family Residential REITs | 22.7 |
| ESS US Equity | Essex Property Trust Inc | Residential REITs | Multi-Family Residential REITs | 14.9 |
| IRT US Equity | Independence Realty Trust In | Residential REITs | Multi-Family Residential REITs | 3.5 |
| KBH US Equity | Kb Home | Household Durables | Homebuilding | 4.7 |
| MHO US Equity | M/I Homes Inc | Household Durables | Homebuilding | 3.4 |
| MAA US Equity | Mid-America Apartment Comm | Residential REITs | Multi-Family Residential REITs | 15.0 |
| TMHC US Equity | Taylor Morrison Home Corp | Household Durables | Homebuilding | 6.1 |
| BLD US Equity | Topbuild Corp | Household Durables | Homebuilding | 12.4 |
| TPH US Equity | Tri Pointe Homes Inc | Household Durables | Homebuilding | 3.5 |
| UDR US Equity | Udr Inc | Residential REITs | Multi-Family Residential REITs | 11.7 |
| VRE US Equity | Veris Residential Inc | Residential REITs | Multi-Family Residential REITs | 1.4 |

**Source:** BofA Global Research, Bloomberg

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### Building products and construction materials

Increasing the availability of sustainable building products can enable the construction of greener homes. To identify building products and construction materials companies facilitating greener homes, we screen for US-listed building products and construction materials companies with market caps greater than $1 billion that offer sustainable building products and are working to reduce their environmental impact through energy efficiency initiatives, water efficiency initiatives, and net zero targets.

**Exhibit 36: Building products and construction materials REITs screen**
US-listed building products and construction materials companies with at least $1B in market cap (as of 2/15/2024) that offer sustainable building products and have energy efficiency initiatives and water efficiency initiatives in place, per Refinitiv and Bloomberg data

| Bloomberg Ticker | Company Name | GICS Industry | Market Cap (USD bn) |
|---|---|---|---|
| AWI US Equity | Armstrong World Industries | Building Products | 4.6 |
| BLDR US Equity | Builders Firstsource Inc | Building Products | 23.0 |
| CSL US Equity | Carlisle Cos Inc | Building Products | 16.9 |
| CRH US Equity | CRH Plc | Construction Materials | 52.5 |
| GFF US Equity | Griffon Corp | Building Products | 3.5 |
| JELD US Equity | Jeld-Wen Holding Inc | Building Products | 1.7 |
| JCI US Equity | Johnson Controls Internation | Building Products | 39.3 |
| LII US Equity | Lennox International Inc | Building Products | 15.8 |
| MAS US Equity | Masco Corp | Building Products | 16.2 |
| DOOR US Equity | Masonite International Corp | Building Products | 2.8 |
| OC US Equity | Owens Corning | Building Products | 12.3 |
| NX US Equity | Quanex Building Products | Building Products | 1.1 |
| SSD US Equity | Simpson Manufacturing Co Inc | Building Products | 8.2 |
| TREX US Equity | Trex Company Inc | Building Products | 9.7 |
| ZWS US Equity | Zurn Elkay Water Solutions C | Building Products | 5.5 |

**Source:** BofA Global Research, Bloomberg, Refinitiv

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# Methodology

## Field definitions

**Exhibit 37: Definitions for Bloomberg and Refinitiv fields used**
Field definitions

| Source | Field | Bloomberg definition |
|---|---|---|
| Bloomberg | Bloomberg ESG Score | Provides the Bloomberg score evaluating the company's aggregated Environmental, Social and Governance (ESG) performance. The score is based on Bloomberg's view of ESG financial materiality. The score is a weighted generalized mean (power mean) of Pillar Scores, where the weights are determined by the pillar priority ranking. Values range from 0 to 10; 10 is best. |
| Refinitiv | Cement $CO_2$ Equivalents Emission | Total $CO_2$ and $CO_2$ equivalents emission in tonnes per tonne of cement produced. - applicable to cement producing companies only - following gases are relevant : carbon dioxide ($CO_2$), methane (CH4), nitrous oxide (N2O), hydrofluorocarbons (HFCS), perfluorinated compound (PFCS), sulfur hexafluoride (SF6), nitrogen trifluoride (NF3) - we follow greenhouse gas (GHG) protocol for all our emission classifications by type |
| Bloomberg | Company Claims Net Zero Emissions Target | Indicates whether the company has disclosed its ambition and engagement related to achieving Net Zero greenhouse gas (GHG) emissions. Net Zero refers to a state in which GHG emissions released into the atmosphere are balanced by removal of emissions from the atmosphere. This information is sourced from a company's Corporate Social Responsibility/Environmental Social Governance/Sustainability reporting for a given fiscal year and is not validated against information available from third parties such as the Science Based Targets initiative (SBTi). |
| Bloomberg | Direct carbon intensity | Carbon intensity measured in metric tonnes of direct or Scope 1 Carbon Dioxide ($CO_2$) equivalent per metric tonne of cement produced, as reported by the company. |
| Bloomberg | Energy Efficiency Initiatives | Indicates whether the company has implemented any initiatives to make its use of energy more efficient. "N" indicates that the company has not explicitly disclosed any such efforts in its most recent Annual or Company Responsibility reports. |
| Bloomberg | Green Building Policy | Indicates whether the company has obtained any green building certificates that apply to the properties owned by the company including, but not limited to, LEED (Leadership in Energy and Environmental Design), GRESB (Global Real Estate Sustainability Benchmark), CASBEE (Comprehensive Assessment System for Building Environment Efficiency), BREEAM (Building Research Establishment Environmental Assessment Methodology), etc. and the local equivalents of such certificates. "N" indicates that the company has not explicitly disclosed any of those certificates in its most recent Annual or Company Responsibility reports. |
| Bloomberg | Percentage Recycled Materials | Percentage of raw materials used from recycled sources. |
| Bloomberg | Renewable Electricity Target | Indicates whether the company has set a target for its use of renewable electricity. "N" indicates that the company has not explicitly disclosed any such efforts in its most recent reports. Includes electricity generated from renewable energy sources such as solar, wind, biomass, biogas, geothermal and hydro. |
| Refinitiv | Sustainability Building Products | Does the company develop products and services that improve the energy efficiency of buildings? - in focus are products and services that the company offer to improve the energy efficiency of buildings - also on companies that provide smart metering services to improve the energy efficiency of buildings |
| Bloomberg | Water Efficiency Initiatives | Indicates whether the organization has undertaken any initiatives to reduce the quantity of water used or to improve the efficiency of its processes, and whether the company is considering the potential water stress to its areas of operation. |

**Source:** Bloomberg, Refinitiv

BofA GLOBAL RESEARCH

## US Green Building Council (USGBC) Policy Library

The USGBC Policy Library is an interactive tool that showcases policies that incentivize, require, or encourage high-performance buildings, including but not limited to LEED, across state and local jurisdictions in the United States. Policies, including structural incentives like density and height bonuses and expedited or no-cost permitting, information mechanisms, and financial incentives like tax credits, grants and low interest loans - help drive the market for high-performance buildings. The USGBC Policy Library is available online at public-policies.usgbc.org.

USGBC defines a high-performance building is a new building designed and constructed to perform well above code, or an existing building whose performance exceeds those of code buildings. For USGBC, it is a holistic concept for creating healthy, resource efficient buildings.

The USGBC Policy Library currently includes policies enacted at a state and local (municipal & county) level, of which they are aware. At present, the library does not include federal policies or regulations.

USGBC sources its data from public records. The provided library of policies is neither exhaustive nor subject to government review. While they attempt to maintain the information accurately, users of the library should contact the appropriate government entity to verify a policy before relying upon it.

## Fixed income backtest methodology

*Note: As published in Real estate: Quantifying sustainability in EUR IG, 6 February 2024.*

While there are a number of initiatives globally by regulators, legislators and other bodies to establish standards for ESG disclosures, currently, there is not an established set of requirements for disclosure of ESG attributes. This is a rapidly evolving area and the nature and level of disclosures, and the regulatory landscape may change.

### Data preparation

We select our investment universe to be the European investment grade index (ER00 index), as investment grade issuers tend to have better ESG data disclosure than their high yield counterparts. We conduct our backtested analysis on the period between 1 January 2018 and 31 July 2023; we do so as ESG data became broadly available for a high proportion of issuers in the index since 2017.

We follow two data preparation steps:

- We source daily excess return data from the ICE data platform, for the 6600+ bonds that existed in the ER00 index since 2018. Excess returns to capture pure credit risk performance, thus excluding impact from rates market fluctuations. We then replicate the index excess return using bond level return data by following index entry and exit rules. This helps to make sure that our analysis is strictly in line with the index at any point in time. We observed that the tickers in the index changed over time, which was mainly driven by downgrades. We saw most of the downgrade happened in the post-covid period.

- We also map each bond to their corresponding equity issuer tickers (800+ distinct tickers), so that we can use ticker-specific attributes from Bloomberg, including ESG scores and other ESG related metrics. Data coverage was around 71% in 2022 and 2023, depending on the metric; we think that is adequate and sufficiently robust to perform our analysis and is a good level of coverage comparing with other data providers.

- It is important to note that overall ESG scores and component E, S and G scores sourced from Bloomberg are calculated based on a sector-specific framework. Therefore, score percentiles are used to make each score comparable across different sectors.

- ESG scores may not always capture bond-level variations due to ranking issues specific to fixed income, but bond level ESG data is rare. Our analysis mapped to parent company scores.

### Methodology

To conduct the backtest, we group the tickers into terciles (3 buckets) on the first trading day of each year based on a sustainability metric, using the most recent data as of that date. The first or top tercile ("1T") contains bonds from best scoring issuers and the third or bottom tercile ("3T") contains the worst. In addition, a fourth 'no score' bucket is created for tickers that do not have data available for the sustainability metric.

To be clear, the tickers within each bucket remain the same throughout the year while bonds under each ticker can vary month by month as index rebalances at month end. We then regroup the tickers into 4 buckets on the first trading day of the following year based on newly available ESG data. By now we would know which bonds are in which bucket for each year of the backtesting period.

We then calculate excess return for each bucket by aggregating performance for all the bonds under the bucket, weighted by market value. In the end, we receive a time series

of daily excess return for each of the 4 buckets over the entire backtesting period. From the excess return data, we calculate cumulative excess return, annualised excess return, annualised volatility of excess return, information ratio and maximum drawdown. Note that the **information ratio** is calculated as the ratio between annualised return and annualised volatility. We then plot cumulative excess return over time for each bucket, and show the rest of the performance metrics per bucket in a table.

We also examined each bucket in terms of duration, rating and sector profile to make sure they are comparable. We recognize that these factors should always be considered for their ability to act as drivers of returns.

When running the backtest on each sector, some sectors were combined to make sure there are sufficient data points (at least 25 tickers) in each sector. Consumer goods and retail are combined under Consumer/Retail, and telecommunications, media and technology became TMT.

# Disclosures

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