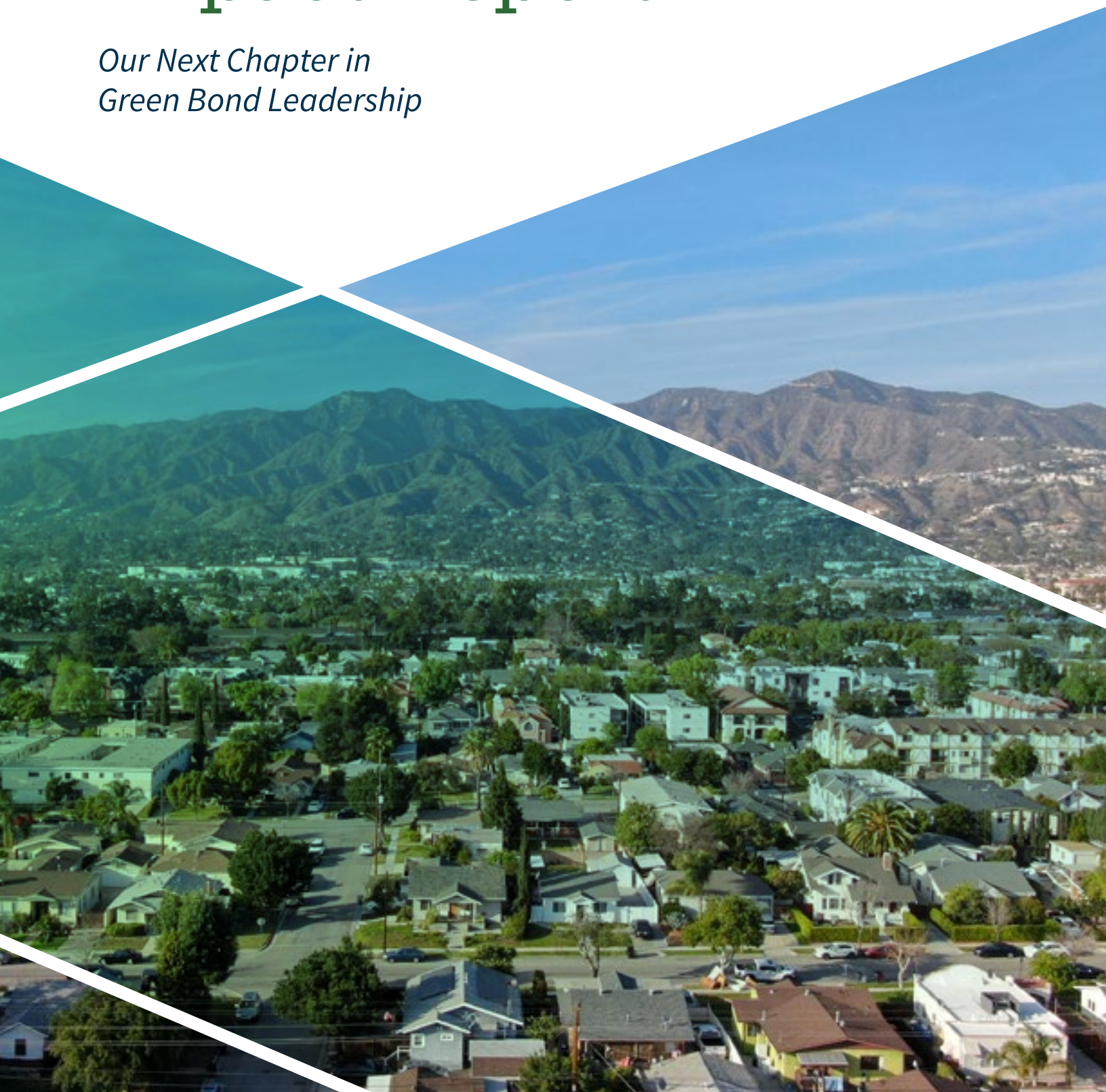
Fannie Mae®

2020 Green Bond Impact Report

Our Next Chapter in Green Bond Leadership



2020 GREEN BOND IMPACT REPORT

Table of Contents

Letter from Our Chief Executive Officer

Welcoming the next chapter

Fannie Mae is the largest issuer of green bonds in the world.[1]

This fact reflects Fannie Mae's long-standing and living commitment to meeting the housing needs of today and, importantly, those of tomorrow.

By charter and by choice, Fannie Mae is a purpose-driven company. Since 1938, we have focused on expanding affordable housing opportunities in communities across the United States, through good times and tough times. Since 2010, we have built on this mission by growing our Green Bond Business to support greener housing.

Fannie Mae knows firsthand the foundational and transformative power of safe, affordable, and stable housing for individuals, families, and communities. But we also know that building and powering homes leave a significant environmental footprint. In fact, residential households account for roughly 20% of all greenhouse gas emissions[2] and use 9.7 trillion gallons of water annually across the United States.[3] As one of the nation's largest investors in housing, Fannie Mae can help reduce that footprint and support more sustainable and resilient housing for people who live in properties we finance. That's what we're doing.

With the issuance of our first Multifamily Green Bond in 2012, we began to harness the power of capital markets to accelerate the transition to a lower-carbon economy and greener multifamily housing stock in the U.S. In 2020 alone, we issued approximately $13 billion in Multifamily Green Bonds — and we have issued nearly $88 billion since 2012.[4]

In 2020, our Green Bond Business reached a new milestone when we issued our first Single-Family Green Mortgage-Backed Security (MBS) on April 22, the 50th anniversary of Earth Day. Through December 2020, we issued $94 million in Single-Family Green MBS. This expansion to the single-family market is a tangible demonstration of our ongoing commitment to being an innovator and catalyst in green financing and to leading this market into the future. There were nearly 1.3 million new single-family homes built in 2020[5], and when surveyed, 79% of homebuyers say that a whole home ENERGY STAR rating is either "essential" or "desirable."[6]

Combined, our Multifamily and Single-Family Green Bond issuances since 2012 have helped prevent an estimated 634,000 metric tons CO_2 equivalent of greenhouse gas emissions, which is equivalent to removing roughly 137,000 passenger vehicles from the road.[7]

While this report focuses on the impact of our 2020 Green Bond issuances, we are also proud of our first Multifamily Social Bond issuance of $315 million, which debuted to the market in January 2021. You can expect more in the year ahead.

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[1] Largest by cumulative issuance through year-end 2020. Climate Bonds Initiative recognized Fannie Mae as "Largest Global Green Bond Issuer Over the Last 10 Years" in 2020 and as the largest issuer in 2020. "Climate Bonds Announces 2020 Green Bond Pioneer Award Winners," and "Record $269.5bn green issuance for 2020," Climate Bonds Initiative (accessed May 17, 2021).

[2] Benjamin Goldstein, Dimitrios Gounaridis, and Joshua P. Newell, "The carbon footprint of household energy use in the United States," *Proceedings of the National Academy of Sciences of the United States of America* (Aug. 11, 2020).

[3] Cheryl A. Dieter, Molly A. Maupin, Rodney R. Caldwell, *et al.*, *Estimated Use of Water in the United States in 2015*, U.S. Geological Survey Circular 1441, U.S. Department of the Interior, p. 23. 26,600 million gallons per day implies 9.7 trillion gallons per year.

[4] As of year-end 2020. Numbers may not foot due to rounding.

[5] "Monthly New Residential Construction," U.S. Census Bureau (April 2021): Table 5b, New Privately-Owned Housing Units Completed, Not Seasonally Adjusted.

[6] Rose Quint, "What Home Buyers Really Want," National Association of Homebuilders (March 2021).

[7] "Greenhouse Gas Equivalencies Calculator," U.S. Environmental Protection Agency (Oct. 15, 2018). Assumes 4.63 $MTCO_2e$ of annual greenhouse gas emissions per passenger vehicle.

As a part of our broader corporate strategy, Fannie Mae is committed to tying our business activities to measurable and positive environmental, social, and governance (ESG) outcomes. We know, for example, that supporting a market that rewards energy- and water-efficient residential development and operations has the power to create well-paying jobs and utility cost savings for families. Through 2020, we are proud to have realized an estimated $146 million in tenant utility cost savings for families and $9.5 billion in wages paid to construct or retrofit properties as a result of our Green Bond issuances.[8] In short, we believe that doing well as a company is inseparable from doing good for the communities we serve. And we are committed to doing more.

By charter and by choice, Fannie Mae is a purpose-driven company … we have built on [our] mission by growing our Green Bond Business to support greener housing."

The events of the past year have demonstrated for all of us the importance of home, and they have laid bare — sometimes painfully — the interconnectedness of our societal challenges. The direction of our times is clear: The future belongs to those who recognize these challenges and rise to meet them.

Fannie Mae intends to answer this call. This 2020 Green Bond Impact Report demonstrates just one of the ways we do this. It provides an overview of our Green Bond Business and is a tangible demonstration of our commitment to utilizing our planet's scarce resources efficiently. I also invite you to learn more on our ESG webpage and in the "ESG Matters" section of our 2020 Form 10-K.

Onward.

Hugh Frater
Chief Executive Officer
Fannie Mae

[8] Estimates are one-year impacts of Fannie Mae's cumulative Green Bond issuances.

AT A GLANCE

Fannie Mae's Green Bond Business

The challenge we face and our strategy for impact

Safe, affordable housing is at the foundation of economic well-being for individuals and families. However, building, heating, cooling, and powering single-family and multifamily homes have undeniable environmental consequences. In fact, roughly 20% of greenhouse gas (GHG) emissions in the United States stem from residential households.[9]

Fannie Mae is leveraging our leading role in the mortgage finance market to encourage property owners and developers to make environmental improvements to their properties. In parallel, we offer a transparent and high-quality investment opportunity to global investors seeking to accelerate the transition to a low-carbon economy.

How it works

Our Green Bond Business supports the single-family and multifamily housing markets by purchasing mortgages backed by properties that meet our criteria for energy and water efficiency and/or renewable energy generation.

Multifamily Green Bonds

We offer two Green Multifamily Financing products:

- **Green Rewards Mortgage Loan:** Provides incentives for borrowers to make property improvements that target specific reductions in energy and water use and/or generation of renewable energy.
- **Green Building Certification (GBC) Mortgage Loan:** Offers incentives for borrowers with multifamily properties that possess an eligible, nationally recognized green building certification.

A loan that uses our Green Financing products is eligible to be securitized as a Fannie Mae Green Bond, which we issue as:

- **Multifamily Green Mortgage-Backed Securities (MBS):** Through our Delegated Underwriting and Servicing (DUS®) model, a Multifamily DUS MBS is generally backed by one green mortgage loan on one property.
- **Green Guaranteed Multifamily Structures (Fannie Mae GeMS™):** A resecuritized pool of Multifamily Green MBS is structured as a Real Estate Mortgage Investment Conduit (REMIC), providing greater collateral diversity to investors.

Single-Family Green Bonds

We issue:

- **Single-Family Green MBS:** Comprises pools of single-family mortgage loans backed by newly constructed single-family homes with certifications that meet or exceed the national program requirements for ENERGY STAR Certified Homes, Version 3.0.

We partner with a third party to verify the green building certification achieved by the properties collateralizing the Single-Family Green MBS.

Our Green Bond issuances through 2020

Nearly $88 billion
in Multifamily Green MBS issued and approximately $11 billion resecuritized into Green GeMS.

$94 million
in Single-Family Green MBS issued in 12 issuances since the first in April 2020.

[9] Goldstein, Gounaridis, and Newell, "Carbon footprint of household energy use."

FANNIE MAE ISSUANCES 2012 – 2020

Our Environmental, Social, and Economic Impacts

All numbers are based on one-year estimated impacts and reflect both Single-Family and Multifamily issuances unless otherwise noted.

ENVIRONMENTAL

9.5B	kilo British Thermal Units (kBtu) of source energy saved
8.5B	gallons of water saved*
634K	metric tons carbon dioxide equivalent ($MTCO_2e$) of GHG emissions prevented

SOCIAL

$146M	utility cost savings by multifamily tenants, or an average of $184 per family per year*
$843	average homeowner utility cost savings per single-family home per year**
872K	units retrofitted or green building-certified
224K	well-paid jobs created or supported

ECONOMIC

$9.5B	wages paid to construct or retrofit properties, contributing $19.9 billion to U.S. gross domestic product (GDP)
$410M	borrower investment commitment for energy and water efficiency measures on 3,696 properties through the Multifamily Green Rewards Mortgage Loans*
$2.83	economic output per dollar invested

** Includes estimated impacts only from Fannie Mae Multifamily Green Bonds.*
*** Includes estimated impacts only from Fannie Mae Single-Family Green Bonds.*

About Fannie Mae

Fannie Mae is a leading source of financing for mortgages in the United States, with $4.0 trillion in assets.[10] Organized as a government-sponsored enterprise (GSE), Fannie Mae is a shareholder-owned corporation. Our organization was chartered by the U.S. Congress in 1938. We have a mission under that charter to provide liquidity and stability in the U.S. single-family residential and multifamily rental mortgage markets and to promote access to credit for homeownership and affordable rental housing. Since September 6, 2008, Fannie Mae has operated under the conservatorship of the Federal Housing Finance Agency and subsequently entered into a senior preferred stock purchase agreement with the U.S. Department of the Treasury that permits us to continue to fulfill our mission.

Fannie Mae operates in the secondary mortgage market, primarily working with lenders, who originate loans to borrowers. We do not have authority to originate loans or lend money directly to borrowers in the primary mortgage market. Fannie Mae supports the liquidity and stability of the U.S. mortgage market by purchasing mortgage loans from lenders and securitizing them into MBS, on which we then guarantee timely payment of principal and interest.[11] Our revenues are primarily driven by ongoing guaranty fees we receive for assuming the credit risk on loans underlying the MBS we issue.

Fannie Mae has two business segments:

- **Our Single-Family Business** purchases mortgage loans secured by properties that have four or fewer residential dwelling units. In 2020, this business provided $1.4 trillion in mortgage market liquidity, which enabled the financing of 1.5 million single-family home purchases and 3.4 million single-family refinancings. We were the largest issuer of 30-year single-family mortgage-related securities in the U.S. in 2020. Our Single-Family Business helps make the 30-year fixed-rate mortgage possible, enabling homeownership and home affordability nationwide.
- **Our Multifamily Business** enables financing for professionally owned and operated residential buildings with five or more units. This business provided $76 billion in multifamily mortgage market liquidity in 2020, which enabled the financing of approximately 792,000 rental units across the country.

Fannie Mae's Green Bond Business

Our Green Bonds leverage the power of capital markets to accelerate the transition to a low-carbon economy and greener housing stock. We purchase mortgages backed by single-family and multifamily properties that meet our rigorous energy and water efficiency standards. Our Green Bonds provide investment opportunities that positively impact housing infrastructure and the environment. Our Multifamily Green Financing Business began in 2010, we launched our first green loan product in 2011, and we issued our first Multifamily Green MBS in 2012. In 2020, we took another important step in our commitment to lead and innovate in green finance by issuing our first Single-Family Green MBS.

2020 by the numbers

$76 billion

in multifamily mortgage liquidity provided.

- Enabling the financing of **792,000 rental units;** more than 90% affordable for families earning at or below 120% of Area Median Income (AMI).

$1.4 trillion

in single-family mortgage liquidity provided.

- Enabling **1.5 million single-family home purchases** and 3.4 million single-family refinancings.

[10] As of Dec. 31, 2020.

[11] Fannie Mae's obligation under this guaranty is solely Fannie Mae's and is not backed by the full faith and credit of the U.S. government.

Leading and Innovating in Green Bonds

Housing is an essential need and vital to the economic well-being of individuals and families, yet the environmental footprint of the housing sector — particularly as a result of the energy it uses — is significant. Lowering GHG emissions from residential households by greening the housing supply will make a meaningful contribution to addressing climate change.

When we launched our Multifamily Green Bond Business in 2010, our premise was simple but pioneering: incentivize property owners to improve the energy and water efficiency of their properties while also offering a transparent, high-quality investment opportunity to global investors seeking to accelerate the transition to a low-carbon economy. For more than a decade, Fannie Mae has put that premise into action, generating measurable environmental — as well as social and economic — benefits for property owners, tenants, lenders, and investors.

Building on our deep expertise and a proven track record, we embarked on our next chapter of green leadership by establishing a new market for green bonds. In April 2020, we issued our first Single-Family Green MBS, an innovative offering backed exclusively by loans financing newly constructed homes that are certified as energy efficient. These bonds represent both a significant opportunity for Fannie Mae to create even greater positive impact through our Green Bond offerings, as well as an important milestone in our larger effort to connect our business activities to measurable and positive environmental, social, and governance (ESG) outcomes.

Harnessing the power of our business

Our business model uniquely positions us to harness the power of capital markets to improve the environmental footprint of the housing sector at scale — and our commitment to do so is a natural extension of our mission to make affordable homeownership and rental housing a reality for millions of households in the U.S.

From the outset, we have recognized that leveraging our role in the market to improve energy and water efficiency in housing would generate more than just environmental benefits. The purpose of our Green Bonds is to create positive environmental, social, and economic impacts. For example, when tenants and homeowners use less energy, they spend less money on energy bills. For individuals and families living on tight budgets, these savings can make a real difference in their daily lives. As another example, the well-paid jobs created and supported by the green building sector — solar panel installers; heating, ventilation, and air conditioning (HVAC) technicians; and energy efficiency auditors — provide pathways to economic opportunity for a growing number of workers.[12] In turn, wages paid to these workers contribute to GDP and help fuel broader economic growth.

2020 by the numbers

$13 billion
in Multifamily Green MBS issued and **$1.9 billion** resecuritized into Green GeMS.

$94 million
in Single-Family Green MBS issued.

[12] Alex Bowen, Karlygash Kuralbayeva, and Eileen L. Tipoe, "Characterising green employment: The impacts of 'greening' on workforce composition," *Energy Economics* (May 2018).

Building on our experience to drive future progress

From 2012 through year-end 2020, Fannie Mae issued nearly $88 billion in Green Bonds through 3,933 individual bonds. In the process, we have also taken a leadership role in product integrity, transparency, and impact. This includes publicly disclosing the estimated environmental impact of our Green Bond issuances at the individual bond level. For more on our approach to disclosures, see Providing Confidence and Transparency to Investors on p. 25.

While we are proud of what we have achieved, we continuously challenge ourselves to innovate and increase our positive impact. For example, in 2020 we issued our first Single-Family Green MBS, backed exclusively by loans financing newly constructed single-family homes with ENERGY STAR certifications that meet or exceed the national program requirements for ENERGY STAR Certified Homes, Version 3.0. This new frontier in our Green Bond issuances — while still in its early stages — brings the same level of rigor and transparency Fannie Mae created in the multifamily green bond market. And it provides an opportunity to produce significant cost savings for homeowners through more energy-efficient housing.

Another way we seek to increase our positive impact is by raising the bar for our existing Green Financing products and eligibility requirements. To this end, in 2020 we were the first in the market to introduce standardized requirements for evaluating and quantifying the installation of solar photovoltaic (PV) energy systems as part of our Multifamily Green Rewards Mortgage Loan product. Solar PV is an impactful way that a property can lower energy costs and reduce GHG emissions. However, installing solar panels requires evaluating and navigating a range of building, cost, tax, legal, and regulatory considerations, as well as other factors. Fannie Mae's Technical Solar Assessment standardizes the collection of relevant data to ensure consideration of all these factors, which helps reduce risk for the borrower, lender, and Fannie Mae.

All of these efforts — from our robust disclosures and use of internationally recognized standards to the ways we continually innovate to build and grow the green financing market — speak to Fannie Mae's commitment to issuing credible and high-impact Green Bonds.

Our ESG journey

Creating positive societal impact through our business is in Fannie Mae's DNA. Our ESG strategy builds on this foundation and leverages the strength of over a decade in the green bond business and our long history of developing solutions that drive social and economic progress, advance environmental sustainability, and build on our responsible business practices. Fannie Mae seeks to identify ways we can create even greater positive impact through what we do every day as part of our core business. By doing so, we can advance progress on the issues most aligned to our business and industry, as identified through our 2018 ESG materiality assessment.

In 2019, we formalized our strategic approach to ESG at the corporate level, which included forming a Board-level Community Responsibility and Sustainability Committee to focus on our mission-oriented efforts and to cement our commitment to becoming a top-performing ESG company. Our Green Bonds remain a critical component of our broader ESG strategy.

In November 2020, we took the next step in our ESG journey with the introduction of our Sustainable Bond Framework, which incorporates our Green Bond Frameworks and the rigorous green standards we have developed. Our Sustainable Bond Framework has received a second-party opinion from Sustainalytics. Under our Sustainable Bond Framework, eligible categories for use of proceeds of social bonds include Access to Essential Services, Socio-Economic Advancement and Empowerment, and Affordable Housing, as identified utilizing the International Capital Markets Association (ICMA) Social Bond Principles 2020. Fannie Mae's sustainable bonds are expected to finance assets that align to the following United Nations Sustainable Development Goals: Goal 1 (No Poverty); Goal 7 (Affordable and Clean Energy); Goal 10 (Reduced Inequalities); and Goal 11 (Sustainable Cities and Communities).

Fannie Mae's history of Green Bond leadership

2010

Launches the Multifamily Green Initiative, laying the groundwork to introduce the concept of green financing to the multifamily mortgage market.

2012

Launches first Green Financing product, in partnership with the U.S. Department of Housing and Urban Development (HUD).

2013

Tests new products targeting multiple impacts; launches the Multifamily Property Improvements to Reduce Energy (M-PIRE) product in partnership with the New York City Energy Efficiency Corporation.

2014

Develops standards and streamlined processes, including the ENERGY STAR Score for Multifamily Housing with the U.S. Environmental Protection Agency (EPA) and Fannie Mae's energy and water audit protocol, the High Performance Building Report.

2015

Launches Green Rewards Mortgage Loans, a nationally available financing product that encourages energy and water saving improvements to existing multifamily properties.

2016

Begins providing CUSIP-level multifamily energy- and water-related disclosure data, which heightens the transparency, rigor, and standards of green mortgage financing and bonds.

2017

Receives first recognition as the largest issuer of green bonds in the world by Climate Bonds Initiative.

2019

Earns recognition by GlobalCapital as the Most Impressive Green/SRI ABS Issuer.

2020

Issues the first Agency Single-Family Green MBS in the U.S.

U.S. EPA ENERGY STAR Partner of the Year

2015 – 2021.

World's largest green bond issuer

as recognized by Climate Bonds Initiative, 2017 – 2020.

GREEN BOND SPOTLIGHT

Pax Futura: Passive House building at scale in Seattle

Pax Futura is Seattle, Washington's first certified Passive House apartment project — and a real-world demonstration that ultra-high-performance green building can be done at scale.

The project is the first Fannie Mae green mortgage loan secured by a property with a green building certification in our Towards Zero group (see p. 19).

Pax Futura, developed and built by Cascade Built, has successfully met the Passive House Institute U.S. Plus (PHIUS+) green building certification standard for properties striving for net-zero energy use. The property is a PHIUS+ 2018 certified project. According to Cascade Built, Pax Futura consumes up to 80% less energy to heat and cool the units than standard buildings, while using durable materials and construction techniques that are built to last for future generations.[13]

Pax Futura has 32 apartments, three live/work units, and a 1,100+ square-foot corner commercial space. Half of Pax Futura's apartments are micro-units. The building combines highly efficient construction, deep energy efficiency features, and renewable energy generation.

The building's combination of unique resource conservation, solar thermal hot water system, and durable construction is a great example of how green building certification can provide benefits to both borrower and tenants.

LENDER
JLL Real Estate Capital

BORROWER
Sloan Ritchie

LOAN AMOUNT
$5.95 million

FINANCING
Green Building Certification

80% less energy
to heat and cool the units than standard buildings, according to Cascade Built.

Learn more about this Green Bond by searching CUSIP 3140HYPP7 in **DUS Disclose®**.

This reference is for informational purposes only and is not an offer of securities.
Before buying any Fannie Mae security, potential investors should read and understand the offering documents for such securities.

[13] "Seattle welcomes its first Passive House apartments, Pax Futura," Cascade Built (Feb. 1, 2019).

Delivering Meaningful and Measurable Impact

Fannie Mae's Green Bonds generate positive environmental, social, and economic impacts while continuing to provide a high-quality investment opportunity. To deliver on these objectives, we offer innovative financing solutions that leverage traditional U.S. mortgage lending structures to encourage more sustainable building practices, and we issue Green MBS that are sold to investors in the capital markets.

Retrofitting existing properties with efficiency measures, installing renewable energy systems, and building new green building-certified properties and homes reduces energy and water use as well as GHG emissions. These activities also help lower utility costs for homeowners, multifamily property owners, and tenants while helping to create new jobs and contributing to the broader economy. A key way we catalyze positive impact as part of our Multifamily Green Bond Business is through green mortgage loan products that encourage property owners to invest in renewable energy generation and energy and water efficiency measures and features. In addition, our Single-Family Green Bond Business supports the environmental and community benefits of green building by issuing Green MBS backed by newly constructed ENERGY STAR-certified homes.

Fannie Mae has identified a set of core environmental, social, and economic metrics to assess the estimated impacts generated by our Green Bonds, and we employ a robust methodology to measure and track these impacts (see Impact Methodology, p. 28). We are dedicated to reporting on the estimated impacts of our Green Bonds to provide transparency to investors. Our disclosures offer increased insight into the benefits facilitated by their investments.

This report includes the estimated impacts of our Green Bond issuances in 2020, as well as the estimated impacts of the Green Bonds we issued from 2012 — the year we began issuing Multifamily Green MBS — through 2020. In 2020, we also began issuing Single-Family Green MBS; unless otherwise indicated, 2020 issuance data includes the combined, estimated impacts from both our Multifamily and Single-Family Green MBS issuances. Data prior to 2020 includes only Multifamily Green MBS issuances.

Various factors have caused our Green Bond issuance volume to fluctuate year-over-year. Upward and downward swings in volume reflect conservator and regulatory guidance, as well as the prudent and active management of our mortgage purchase volume required to ensure we continue to be a stable source of liquidity to the housing market in good times and bad. For example, under the terms of our senior preferred stock purchase agreement with the U.S. Department of the Treasury, we are subject to a limit on the amount of multifamily mortgage assets we can acquire in a specified period. For several years, we were allowed to exclude green loans from this purchase cap, which allowed for greater volume growth. This changed in the fourth quarter of 2019, when we received new guidance shifting the focus from enabling green loans as a special category to a more specific focus on affordable and underserved market segments, a social issue already core to our mission. This change was one of several factors impacting our annual Green Bond volumes. Despite the regulatory changes, Fannie Mae remains strongly committed to our Green Bond Business.

SINGLE-FAMILY AND MULTIFAMILY GREEN MBS VOLUME, 2012 – 2020

	2020	2019	2018	2017	2016	2015	2014	2013	2012	Cumulative 2012 – 2020[14]
Issuance unpaid principal balance										
Total	$13,093 M	$22,780 M	$20,168 M	$27,756 M	$3,624 M	$111 M	$20 M	$58 M	$56 M	$87,667 M
Multifamily	$12,999 M	$22,780 M	$20,168 M	$27,756 M	$3,624 M	$111 M	$20 M	$58 M	$56 M	$87,573 M
Single-Family	$94 M	-	-	-	-	-	-	-	-	$94 M
Number of loans										
Total	926	1,020	1,130	1,175	111	6	3	4	4	4,379
Multifamily	580	1,020	1,130	1,175	111	6	3	4	4	4,033
Single-Family	346	-	-	-	-	-	-	-	-	346
Number of properties										
Total	930	1,021	1,159	1,280	110	6	1	2	2	4,511
Multifamily	584	1,021	1,159	1,280	110	6	1	2	2	4,165
Single-Family	346	-	-	-	-	-	-	-	-	346

Environmental impact

According to the United Nations' Intergovernmental Panel on Climate Change (IPCC), to avoid the most significant adverse consequences of climate change, global GHG emissions must be dramatically cut over the next few decades, such that they reach net zero by 2050.[15] Reducing energy use and transitioning to clean energy will be an essential part of achieving that. In the U.S., the energy used to heat, cool, and power residential properties accounts for approximately 20% of GHG emissions each year.[16] Increasing the energy efficiency of single-family and multifamily properties is a critical step to reducing the carbon footprint of the U.S. housing sector — and it can make a meaningful contribution to fighting climate change.

Fannie Mae's analysis of our Green Rewards Mortgage Loan portfolio showed that existing multifamily properties' median potential energy savings is 33%.[17] Additionally, newly constructed single-family homes with ENERGY STAR 3.0 certifications — the minimum criteria for inclusion in Fannie Mae's Single-Family Green MBS offering — are at least 10% more efficient than homes built to code and achieve a 20% improvement on average.[18]

We estimate that Fannie Mae's 2020 Green Bond issuances resulted in 1.7 billion kBtu of annual energy savings, which is equivalent to the amount of energy used to power more than 12,000 U.S. homes for one year. As a result, our 2020 Green Bonds avoided an estimated 106,000 $MTCO_2e$, in GHG emissions, which is equivalent to removing roughly 23,000 passenger vehicles from the road for a year.

In addition, our 2020 Multifamily Green Bonds saved an estimated 0.8 billion gallons of water, which is equivalent to the amount of water consumed by over 7,000 U.S. families in one year. During the year, Fannie Mae provided Green Financing that supported 30,452 units in water-stressed areas,[19] where reducing water usage is especially critical.

[14] Numbers may not foot due to rounding.

[15] "Summary for Policymakers of IPCC Special Report on Global Warming of 1.5°C approved by governments," The Intergovernmental Panel on Climate Change (Oct. 8, 2018).

[16] Goldstein, Gounaridis, and Newell, "Carbon footprint of household energy use."

[17] Based on an internal analysis of Green Rewards Mortgage Loans acquired between 2019 – 2020.

[18] "About the ENERGY STAR Residential New Construction Program," ENERGY STAR (May 17, 2021).

[19] Water-stressed areas have ZIP codes that lie within a geographic area categorized as either "high" or "very high" baseline water stress. "Aqueduct Water Risk Atlas," World Resources Institute (Oct. 6, 2013).

ESTIMATED ENVIRONMENTAL IMPACT

All numbers are based on one-year estimated impacts of loans securitized into Green Bonds issued.

	2020	2012 – 2020
Source energy saved (kBtu)	1.7 billion	9.5 billion
GHG emissions avoided ($MTCO_2e$)	106,000	634,000
Water saved (gallons)*	0.8 billion	8.5 billion

** Includes estimated impacts only from Fannie Mae Multifamily Green Bonds.*

Social impact

In the U.S., low-income households face an average "energy burden" — which is the percentage of gross income spent on energy costs — that is three times greater than non-low-income households.[20] The national average energy burden for low-income households is 8.6%, but for some it can be as high as 30%.[21] Meanwhile, an analysis of 12 U.S. cities showed that household water and sewer bills increased by an average of 80% between 2010 and 2018,[22] placing an even greater cost burden on low-income households. Reducing utility bills through increased energy and water efficiency measures can make a real difference in people's lives, particularly for low-income households where the money saved can be deployed to meet other vital needs — from food and health care to education and transportation — or to help build savings. Estimated annual tenant utility cost savings from Fannie Mae Green Rewards Mortgage Loans in 2020 were an average of $235 per family.

Fannie Mae Green Bonds also generate positive social impacts by creating and supporting jobs for workers hired to install energy- and water-saving property improvements and construct properties with green building certifications. Fannie Mae Green Bond issuances in 2020 created or supported an estimated 43,000 jobs. These green economy jobs are reported to be both fast-growing and well-paying, offering hourly wages 8% to 19% higher than the national average, as well as a $5- to $10-per-hour pay premium for entry-level jobs compared to similarly skilled jobs in other sectors.[23]

[20] "Low-Income Community Energy Solutions," U.S. Department of Energy (accessed May 17, 2021).

[21] "Low-Income Community Energy Solutions," U.S. Department of Energy.

[22] Nina Lakhani, "Millions of Americans Can't Afford Water, as Bills Rise 80% in a Decade," *Consumer Reports* (June 23, 2020).

[23] Mark Muro, Adie Tomer, Ranjitha Shivaram, *et al.*, *Advancing Inclusion Through Clean Energy Jobs* (Washington, D.C.: Metropolitan Policy Program at Brookings, April 2019).

ESTIMATED SOCIAL IMPACT

All numbers are based on one-year estimated impacts of loans securitized into Green Bonds issued.

	2020	2012 – 2020
Units retrofitted or green building-certified*	102,255	872,410
Green building-certified single-family homes**	346	346
Utility costs saved for tenants (total)*	$20 million	$146 million
Utility costs saved for tenants (average per family per year)*	$235	$184
Utility costs saved for homeowners (average per single-family home per year)**	$843	$843
Well-paid jobs created or supported	43,000	224,000

** Includes estimated impacts only from Fannie Mae Multifamily Green Bonds.*
*** Includes estimated impacts only from Fannie Mae Single-Family Green Bonds.*

Economic impact

Fannie Mae Green Bonds can create financial value for investors, lenders, and property owners and also deliver broader economic value. They support jobs and economic activity linked to energy and water efficiency retrofits, green building construction, and green manufacturing supply chains. Wages paid to workers in these jobs contribute to the GDP and help fuel economic growth. In addition, our Green Bonds create indirect economic impacts, including supply-chain-linked jobs and local spending by workers employed to complete green building and retrofitting activities.

All told, Fannie Mae Green Bonds generated an estimated $2.38 of economic output per dollar invested in energy or water efficiency upgrades and green building-certified construction in 2020.

ESTIMATED ECONOMIC IMPACT

All numbers are based on one-year estimated impacts of loans securitized into Green Bonds issued.

	2020	2012 – 2020
Number of properties that made energy and water efficiency measure (EWEM) upgrades*	496	3,696
Borrower investment commitment for EWEM property upgrades*	$75 million	$410 million
Economic output per dollar invested	$2.38	$2.83
Wages	$1.9 billion	$9.5 billion
Contribution to U.S. GDP	$4.3 billion	$19.9 billion

** Includes estimated impacts only from Fannie Mae Multifamily Green Bonds.*

GREEN BOND SPOTLIGHT

Laverock Place: Retrofitting apartments for a greener Philadelphia

Laverock Place is a multifamily rental property in Northwest Philadelphia. Despite its 1960s-era construction, the property has become increasingly energy efficient thanks to owner Chelsea Management's strategic operational and physical improvements.

In 2020, Laverock Place earned an ENERGY STAR certification for existing multifamily housing, making it eligible for Fannie Mae's Green Building Certification program when it came time for its owners to refinance the property.

Green building certifications are awarded by several organizations and available for both existing and newly constructed properties with energy- and water-efficient features — and Laverock Place obtained one of the 40 certifications from 13 different organizations that Fannie Mae currently recognizes.

Chelsea Management made improvements to the building, which helped the property achieve ENERGY STAR certification. Upgrades included the installation of energy-efficient lighting, exterior photo-cell lighting fixtures, low-flow fixtures, and ENERGY STAR-certified appliances.

At Laverock Place, 100% of units are affordable to tenants earning 80% of AMI or below. The building, which houses 66 one- and two-bedroom apartments, is located near public transportation, connecting it to the city center while allowing for a lower cost of living. As the Philadelphia market grows, so too does the importance of preserving energy-efficient affordable rental housing options like Laverock Place.

LENDER
Greystone

BORROWER
Chelsea Management

LOAN AMOUNT
$9.6 million

FINANCING
Green Building Certification

78
ENERGY STAR score for Laverock Place's Existing Multifamily certification. A score of 75 or over indicates a top performer.

Learn more about this Green Bond by searching CUSIP 3140J2DW3 in **DUS Disclose**.

Our Multifamily Green Bond Business

Through our Multifamily Green Bond Business, Fannie Mae offers mortgage loan products that encourage multifamily property owners to make energy and water efficiency improvements and/or install renewable energy generation systems and reward properties that obtain certain green building certifications. As a result, we are able to issue highly impactful Green Bonds backed by mortgage loans that meet our well-established underwriting standards and green loan eligibility criteria.

Fannie Mae's Multifamily Business at a glance

Multifamily housing is an essential part of the U.S. housing supply: There are 44 million renters in the U.S., and 37% of those renters live in multifamily units.[24]

We are a leading provider of financing for multifamily properties in the U.S. We owned or guaranteed approximately 21% of the outstanding debt on multifamily properties in the U.S. as of September 30, 2020.[25] Over the past 30 years, our Multifamily Business has facilitated financing for more than 11 million units of rental housing in a range of communities, including urban, suburban, and rural. Over 90% of the apartments we financed in 2020 were affordable to families earning at or below 120% of AMI.

The cornerstone of our Multifamily Business is our DUS platform.

Unique to the DUS model is our risk-sharing structure, in which lenders share the risk of losses on loans that they sell to Fannie Mae. Fannie Mae retains approximately two-thirds of the underlying credit risk of each loan, while individual lenders typically retain one-third of the risk. This allocation creates shared interest between Fannie Mae and our lending partners and shared accountability for the performance of every loan over the life of the loan.

Subject to our underwriting standards, DUS lenders may sell loans to Fannie Mae to guarantee and securitize in MBS. MBS backed by income-producing multifamily properties are also considered by investors to be agency commercial mortgage-backed securities. These high-quality securities attract private capital to the secondary mortgage market, bringing vital liquidity to the sector and supporting the affordability of multifamily rental housing.

Green Financing products

We currently offer two Multifamily Green Financing products: Green Rewards Mortgage Loans and Green Building Certification Mortgage Loans. These mortgage loans are originated following the same underwriting process and credit standards as all other multifamily DUS loans but also conform to Fannie Mae's robust Multifamily Green Bond Framework, which lays out our requirements and commitment to accountability, transparency, and impact in green financing. Our Multifamily Green Bond Framework is aligned with the ICMA Green Bond Principles and has received a Light Green and Good Governance Second Opinion from CICERO Shades of Green.

What is multifamily housing?

- Five or more residential units.
- Varied types: high-rise apartments; garden-style units; and specialty housing, such as seniors, student, or manufactured housing campuses.
- Home to tenants, both individuals and families, who sign six- to 24-month leases, which support the properties' long-term income stability.
- Rents can be based on market rates or restricted to ensure affordability for tenants earning less than a specified percentage of local AMI.

[24] "Quick Facts: Residential Demographics," National Multifamily Housing Council (accessed May 17, 2021).

[25] Sept. 30, 2020, is the latest date for which information was available in 2020.

We leverage our strong and long-standing network of DUS partners — who serve as the originators of our green loan products — to reach more borrowers and expand our impact. We equip our lender partners with information necessary to educate property owners on our Green Financing options and the benefits of making environmental improvements, including reduced utility costs, improved resiliency, and responsiveness to market demands.

Green Rewards Mortgage Loan

The median age of multifamily rental units in the U.S. is more than 40 years, and older properties are likely to be significantly less efficient than newer properties.[26] As a result, retrofitting existing properties to be more efficient is one of the most impactful ways to conserve energy, decrease water usage, and reduce costs for tenants.

Fannie Mae Green Rewards Mortgage Loans encourage property owners to invest in energy and water efficiency and/or renewable energy generation for existing multifamily properties. Investments can include energy-efficient HVAC; energy-efficient lighting and appliances; water-efficient fixtures, such as low-flow toilets and faucets; and on-site solar PV systems. Fannie Mae requires that all products, fixtures, and appliances be ENERGY STAR- or WaterSense-certified, if available.

- **Eligibility criteria:** Borrower must commit to efficiency improvements projected to reduce the property's energy and water consumption by a combined minimum of 30%, with a minimum of 15% savings from reduced energy consumption or renewable energy generation. This commitment is documented in the loan documents.
    - ***New in 2020:*** We released a first-in-the-market standard for evaluating and quantifying solar PV installations. The new Technical Solar Assessment and accompanying data form help ensure that solar projects will be successful and impactful.
- **Use of proceeds:** Proceeds to make energy and water efficiency improvements and/or install renewable energy generation systems are held in escrow. Improvements must be made within one year of the loan's closing date. The lender will release the escrowed funds after the work is completed by the borrower and verified by the loan servicer.

Green Building Certification Mortgage Loan

Fannie Mae's Green Building Certification program incentivizes new construction property owners and owners contemplating a retrofit of an existing property to design for high standards of efficiency and pursue a third-party certification.

Fannie Mae's Green Building Certification program offers loans secured by a multifamily property that has been awarded a certification recognized by Fannie Mae. We annually re-evaluate these certifications to determine if certifications should be added or removed.

- **Eligibility criteria:** The property must have one of 40 different green building certifications from 13 different issuing organizations that meet our rigorous impact criteria. The borrower must provide evidence of the certification to Fannie Mae.
    - ***New in 2020:*** We worked with one of our DUS lending partners to finance the first Fannie Mae loan in our "Towards Zero" green building certification group, which requires that properties target greater than 50% reduction of energy or water use from the national baselines (see case study on p. 12). In addition, we added new certifications, versions, and certifying organizations to the Green Building Certification program.
- **Use of proceeds:** Proceeds finance properties with green building certifications. The borrower is responsible for costs incurred to obtain the certification.

Prioritizing high-impact green building certifications

We group the certifications recognized under our Green Building Certification Mortgage Loan product based on their minimum energy and water reduction requirements. Currently, the most impactful certifications are for properties in our Towards Zero group, which target energy or water use reductions of 50% or greater. To achieve these reductions, the property might aim for net-zero energy usage, water usage, or carbon emissions through a combination of efficient construction techniques, innovative design, and renewable energy generation.

[26] America's Rental Housing 2020 (Cambridge, MA: Joint Center for Housing Studies of Harvard University), p. 18.

Green Bonds

Loans that use our Multifamily Green Financing Mortgage Loan products are eligible to be securitized as a Fannie Mae Green Bond. We issue Multifamily Green Bonds through two types of securities: Multifamily Green MBS and Green GeMS. Our Green Bonds benefit from the same features as all our Multifamily MBS offerings, including certain prepayment protections, conservative credit policies, and guarantees of timely principal and interest payments.

Investors can identify the estimated impact of each Green MBS or GeMS tranche on an individual security basis by searching for each security's unique CUSIP number on Fannie Mae's Green Bonds webpage. For more information, see Providing Confidence and Transparency to Investors on p. 25.

Nearly $88 billion
of Multifamily Green MBS since 2012.

$13 billion
of Multifamily Green MBS in 2020.

$1.9 billion
in Green GeMS tranches in 2020.

Green MBS

The Fannie Mae Green MBS is a unique type of Multifamily MBS, which is a fixed-income security generally backed by one loan and one property, providing the investor insight into both the environmental and financial attributes of the asset.

The lender enters into a locked interest rate with the borrower for each loan, with the rate determined through solicitation of bids from the general investor community for the lowest coupon on the MBS. Our lenders then have 30 to 60 days after the rate-lock to complete the loan closing and deliver the loan to Fannie Mae, where the loan is then securitized with the Fannie Mae guaranty and delivered to the investor as a Fannie Mae MBS.

For loans to be included in Multifamily Fannie Mae Green MBS, the underlying loan must be either a Green Rewards Mortgage Loan or a Green Building Certification Mortgage Loan, conforming to the Fannie Mae Green Bond Framework. Additionally, properties undergo an energy and water audit or Fannie Mae is provided the eligible Green Building Certification before the loan is acquired by Fannie Mae.

Fannie Mae Green GeMS

Our Green Bond offering also includes Green GeMS, which are pools of Green MBS that are resecuritized in a structured product known as a REMIC. All of the loans in the Green MBS backing a Green GeMS transaction are Green Rewards Mortgage Loans or a Green Building Certification Mortgage Loan.

The intended audience for Green GeMS is investors looking for a more diversified investment product than a Green MBS backed by a single loan, whether that is property-type diversity or geographic diversity, and who are interested in larger, block-sized transactions. Green GeMS also serve investors looking for specific payment structures. MBS aggregated into a REMIC structure such as Green GeMS are typically segmented into sequential-pay tranches and interest-only tranches to meet investors' different cash-flow demands.

Fannie Mae began issuing Green MBS-backed GeMS deals in 2017, and we now issue approximately three Green GeMS securities every year. These GeMS deals range in size from $500 million to $1.1 billion, are U.S. dollar-denominated, and are backed by the same Fannie Mae guarantee as the underlying DUS MBS pools.

GREEN BOND SPOTLIGHT

Chandler Village: Investing in solar for affordable housing in Arizona

In the Phoenix suburb of Chandler, Arizona, an existing multifamily affordable housing property is making substantial improvements that will result in long-term energy savings.

Chandler Village is an 11-building, garden-style property. The 127-unit property was built in 1972 and renovated in 2004 as a Section 42 Low-Income Housing Tax Credit (LIHTC) project with a Land Use Restriction Agreement (LURA), under which 100% of the units are affordable for tenants earning 50% of AMI.

In 2020, the property was acquired by LEDG Capital, LLC, an investment company that exclusively focuses on the acquisition and preservation of affordable housing across the U.S. With KeyBank, LEDG secured a Green Rewards Mortgage Loan and leveraged the MBS as Tax-Exempt Bond Collateral (MTEB) product, available to Multifamily Affordable Housing properties with new or recent rehabilitation. LEDG is funding renovations at Chandler Village with a LIHTC equity investment and project-based Housing Assistance Payments contract. As part of the deal, the Arizona Department of Housing will continue to restrict all units to tenants earning no more than 50% of AMI.

A portion of the Green Rewards proceeds will go toward the installation of an 850 kW solar PV system on the roof and carports, a renewable energy improvement. Green Rewards Mortgage Loans receive a pricing incentive, a free High-Performance Building Report (energy and water audit), and a complimentary Technical Solar Assessment at qualifying properties that elect to install a solar PV system. In addition, a portion of the estimated energy and water savings can be underwritten to increase the total loan amount.

In addition to solar, the rehabilitation will include major renovations to cover the installation of energy-efficient windows, ENERGY STAR appliances, low-flow faucets and showerheads, new energy-efficient HVAC systems, and LED lighting upgrades.

LENDER
KeyBank

BORROWER
LEDG Capital, LLC

LOAN AMOUNT
$25 million

FINANCING
Green Rewards Mortgage Loan

72.3%
estimated total energy savings when Chandler Village's solar PV system is installed.

Learn more about this Green Bond by searching CUSIP 3140J0DD9 in **DUS Disclose**.

This reference is for informational purposes only and is not an offer of securities.
Before buying any Fannie Mae security, potential investors should read and understand the offering documents for such securities.

Our Single-Family Green Bond Business

In 2020, Fannie Mae expanded its Green Bonds Business with the issuance of our first Single-Family Green MBS. This marked an important milestone in Fannie Mae's long-standing track record of pioneering solutions to reduce the environmental impacts associated with housing and creating more sustainable communities. While still a small part of our overall Single-Family Business, our intention is to build the green bond market through our Single-Family issuances and increase our positive impacts.

Fannie Mae's Single-Family Business at a glance

Our Single-Family Business provides liquidity to the mortgage market primarily by acquiring single-family loans from a large network of over 1,000 lenders. Our funding makes products such as the 30-year, fixed-rate mortgage possible, providing U.S. homeowners with predictable and sustainable mortgage payments over the life of the loan. Those loans are then pooled and securitized into Fannie Mae Single-Family MBS that carry a guarantee of timely payment of principal and interest.

A single-family loan is secured by a property with at least one and up to four residential dwelling units. Each unit may be occupied by the owner or rented to other individuals and families. Our Single-Family Business purchases and securitizes primarily conventional (not federally insured or guaranteed), single-family, fixed-rate or adjustable-rate first-lien mortgage loans.

Single-Family Green MBS

Fannie Mae began issuing Single-Family Green MBS in 2020. These Green Bonds include mortgage loans backed exclusively by single-family homes with ENERGY STAR certifications that meet or exceed the national program requirements for ENERGY STAR Certified Homes, Version 3.0, which are, on average, 20% more efficient than single-family homes built to code. To be eligible, the properties must be newly constructed with one to four single-family residential units, and they must be awarded the green building certification at the time construction is completed.

Fannie Mae has engaged PEG, LLC, an industry leader in residential energy efficiency and engineering, to provide independent validation of ENERGY STAR green certifications of the properties backing the loans included in our Single-Family Green Bonds. We have taken this extra step to ensure the highest levels of accountability and rigor.

Our Single-Family Green Bond Framework is aligned with the ICMA Green Bond Principles and has received a Light Green and Good Governance Second Opinion from CICERO Shades of Green. See Providing Confidence and Transparency to Investors on p. 25 for more information.

In 2020, Fannie Mae:

- Was the largest issuer of 30-year single-family mortgage loan-backed securities in the U.S.
- Provided $1.4 trillion in mortgage market liquidity, enabling 1.5 million single-family home purchase loans and 3.4 million single-family refinancings.

In the initial phase of issuing Single-Family Green MBS, we focused on partnering with a small number of our long-standing lender/builder partners with experience financing and constructing ENERGY STAR-certified properties. We are working to expand to include additional lenders, which will help broaden the geographic diversity of the loans pooled in these offerings. Over time, our aspiration is to drive demand for more green building by generating data and communicating the value to additional lenders, builders, and homeowners.

Innovating solutions to drive expanded impact

Today, the U.S. lacks a centralized source of information on single-family properties that have a green building certification. To address this pressing need for green bond issuers, investors, and lenders for transparent and consistent information on green buildings, we are supporting the development of a database to enable more efficient identification of properties across the U.S. with green building certifications. The database, paired with performance data on the loans backing the green bonds, will provide valuable insight into the environmental and financial benefits of green building certifications. We believe these insights will help drive borrower and investor demand, which will be foundational to expanding our Single-Family Green MBS to include additional lenders and different types of certifications.

Fannie Mae started with a focus on ENERGY STAR certification as a baseline because these requirements are easily identifiable and transparent; they also provide savings for homes built to these certifications. We engaged a third party to evaluate the green building certifications available and applicable to single-family homes in the U.S. ENERGY STAR Certified Homes, Version 3.0, was recommended to serve as the minimum requirement, based on its average efficiency improvements.

In the future, we plan to accept other green building certifications, as outlined in our Single-Family Green Bond Framework, that are equivalent to or higher than the standards of ENERGY STAR Certified Homes, Version 3.0. In addition, we are evaluating appropriate solutions to support existing homes that are in need of energy and water efficiency renovations.

Our 2020 Single-Family Green MBS issuances

- $94 million in Single-Family Green MBS issuances.
- 12 offerings, with transaction sizes ranging from approximately $3.6 million to $15.4 million.
- Included loans originated by:
  - DHI Mortgage Company, the mortgage finance arm of homebuilder D.R. Horton, Inc.
  - Lennar Mortgage, the mortgage finance arm of homebuilder Lennar Corp.
  - NVR Mortgage Finance, Inc., a wholly owned subsidiary of NVR, Inc.
- 346 loans included on properties primarily in Arizona and Texas, plus Colorado, Maryland, New Jersey, and North Carolina.
  - 44% of borrowers were first-time homebuyers.

GREEN BOND SPOTLIGHT

Building greener homes in Arizona

In Arizona, builder D.R. Horton is constructing new, efficient homes that contribute to more sustainable communities and a cleaner future.

These new homes help owners save on energy and water with environmentally friendly features, which may include energy-efficient appliances, tightly sealed windows and doors, more efficient air-conditioning units, and tankless water heaters. Not only do these features reduce environmental impact, they also help homeowners to lower their utility bills.

D.R. Horton is the largest homebuilder in the U.S., and DHI is its mortgage finance arm. When we launched our Single-Family Green Bond Business (see p. 22) in 2020, DHI/D.R. Horton was our first lender/builder partner.

In 2020, DHI delivered eligible mortgage loans to Fannie Mae backed by newly constructed single-family homes in Arizona built by D.R. Horton. Each of these mortgage loans was collateralized with a property that has been verified by a Home Energy Rater as meeting or exceeding the requirements of ENERGY STAR Certified Homes, Version 3.0. Fannie Mae uses ENERGY STAR certifications as the baseline for our Single-Family Green MBS because the requirements for homes built to these certifications — and the savings gained — are easily identifiable and transparent. This ENERGY STAR certification for D.R. Horton-built homes was granted by an independent third party, Leading Raters of America.

As DHI and D.R. Horton were our first lender/builder partner, the unique subsidiary relationship between them enabled a streamlined and transparent process.

In 2020, DHI delivered 219 loans eligible to be included in our Single-Family Green Bond issuances, totaling $60.8 million in unpaid principal balance (UPB) at issuance.

LENDER

DHI Mortgage Company

BUILDER

D.R. Horton

UPB AT ISSUANCE

$60.8 million

20%

average efficiency improvement of ENERGY STAR Certified Homes, Version 3.0, compared to single-family homes built to code.

Providing Confidence and Transparency to Investors

Rigorous standards, transparency, and accountability to investors are the foundations of Fannie Mae Green Bonds — and are critical to our goal of advancing an active and growing global green bond market. That is why we are committed to providing comprehensive, best-in-class disclosures about our securitization process and the estimated environmental, social, and economic impacts of our Green Bonds. Our objective is to supply investors with the information and data they need to evaluate and have full confidence in the quality, rigor, and impact of Fannie Mae Green Bonds.

High alignment with trusted global frameworks

One of the key ways we demonstrate our commitment to high-quality and high-impact green bonds is by aligning with the ICMA Green Bond Principles, which are voluntary guidelines designed to promote transparency, disclosure, and integrity in the global green bond market.

We have also obtained independent, research-based evaluations from CICERO Shades of Green, a leading global provider of green ratings for bonds. CICERO evaluates green bond investment frameworks to offer investors better insight into the environmental quality of green bonds. In 2020, both our Multifamily and Single-Family Green Bond Frameworks received an overall Light Green rating and a Governance score of Good. In addition, CICERO gave our Green Rewards Mortgage Loan product a Light to Medium Green rating. CICERO also affirmed that Fannie Mae's Green Bond Frameworks are in alignment with ICMA's Green Bond Principles.

CICERO specifically recognized Fannie Mae for:

- **Strong incentives,** for introducing the first pricing break for green building certifications and water and energy efficiency improvements in the U.S. multifamily rental market, thereby encouraging and raising awareness of these initiatives.
- **Expanding the market** by introducing Green Bonds backed by single-family properties, which is expected to help improve the environmental performance of properties in this market.
- **Raising the level of ambition** of our eligible multifamily green building certifications and eligibility standards for our Green Rewards Mortgage Loan product over time, including mandatory energy efficiency improvements. In addition, for having an explicit energy efficiency requirement for our Single-Family Green Bonds that goes beyond the national building baseline.
- **Credible verification,** for engaging a third party to verify efficiency improvement installations on-site for our Multifamily Green Bonds.
- **Robust eligibility screening** by investing in tools and in-house technical expertise to inform eligibility screening.

Frameworks and Second Opinions

Both our Multifamily and Single-Family Green Bond Frameworks received a Light Green Second Opinion from CICERO Shades of Green in 2020.

Links:

Fannie Mae Multifamily Green Bond Framework

CICERO Fannie Mae Multifamily Green Bond Second Opinion

Fannie Mae Single-Family Green Bond Framework

CICERO Fannie Mae Single-Family Green Bond Second Opinion

- **Assessing flood risk** of single-family properties. CICERO cited this as an effective first assessment of physical climate change risk.

CICERO's Second Opinions are available on our Fannie Mae Green Bonds webpage.

To provide confidence in the quality and rigor of our Green Bonds and eligibility requirements, we align them with highly regarded industry standards and bodies, such as ENERGY STAR, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), U.S. Green Building Council Leadership in Energy and Environmental Design (USGBC LEED), Passive House Institute U.S. (PHIUS), and others. In preparation for issuing our first Single-Family Green MBS in 2020, we engaged a third-party expert to evaluate the green building certifications applicable to single-family homes in the U.S. This informed our decision to establish ENERGY STAR Certified Homes, Version 3.0, as our baseline. And we annually reassess our Single-Family and Multifamily Green products and their eligibility criteria to assess opportunities to raise the bar and increase our impact.

Best-in-class, transparent, and consistent reporting

We leverage multiple platforms and communications channels to deliver transparency to investors. Fannie Mae's Green Bonds webpage serves as a centralized source of key information for investors on our Green Bond products and green data impact metrics. We consider our disclosures to be best-in-class because we report loan and impact data at the CUSIP level.

For our Single-Family and Multifamily Green MBS, investors can access the estimated environmental impact per CUSIP in a downloadable Excel format.
These data points include:

- Annual estimated energy savings (kBtu).
- Annual estimated water savings (gallons) — Multifamily Green Bonds only.
- Annual estimated GHG emissions savings ($MTCO_2e$).

Leading the market in disclosures: Multifamily Green MBS

Fannie Mae discloses information for both types of Green Bonds issued by the Multifamily Business: Green MBS and Green GeMS.

As part of our standard multifamily loan securitization process, we share detailed information on each MBS, including the security, loan, and property-level information in DUS Disclose. In addition, for each Green MBS, we publicly disclose energy and water performance metrics. Depending on the loan type and security issuance date, investors and the public can search by the CUSIP identifier for each property to learn the type of Green Financing product used and, where applicable, the:

- Type of green building certification.
- ENERGY STAR Score at issuance.
- Source Energy Use Intensity at issuance.
- EPA Water Score at issuance.
- Water-Use Intensity at issuance.
- Ongoing annual energy and water performance metrics (beginning in 2019).

Enhanced reporting: Single-Family Green MBS

We publish at-issuance and ongoing data for all Single-Family MBS through a web-based system called PoolTalk®. Through PoolTalk, investors can obtain comprehensive information about single-family securities and the underlying loans.

Through Data Dynamics®, investors can easily evaluate and analyze Fannie Mae's data, including Single-Family MBS data such as Benchmark CPR™, Cohort Analyzer, Forbearance and Delinquency, Pool Details, and more.

Investors can also find information about our Single-Family Green MBS, including a list of issuances and the CUSIP identifier for each, on our Green Bonds webpage.

Expanding global transparency through third-party sites

In addition to providing information to investors via our Green Bonds webpage and DUS Disclose, PoolTalk, and Data Dynamics platforms, Fannie Mae issues a number of disclosure files that feed third parties, such as Bloomberg. Many third-party data providers are also working to improve their green-related disclosures.

In the Bloomberg system, for example, Fannie Mae Multifamily MBS carry a green bond flag on their description pages, enabling investors to quickly determine if a bond falls under the Green Bond Business. In addition, Green GeMS deals disclose the nature of their underlying assets on Bloomberg. Bloomberg has also updated its description (DES) screen to identify Single-Family Green MBS with the same notation that is shown for Fannie Mae Multifamily Green MBS.

Fannie Mae partners with these data providers in order to help investors with green, social, and/or sustainability mandates determine the appropriateness of Green MBS as a part of their investment portfolios. Third-party data providers have differing criteria for how investments may be labeled as green. Investors' independent evaluation of these criteria is important in order to determine if the securities meet their own investment standards.

Impact Methodology

Introduction

This section explains how Fannie Mae estimates the environmental, social, and economic impacts of our Green Bond Business. It includes the data sources, analysis methods, and applied assumptions. The ex-ante quantification of each security's impact is based on projections and estimations calibrated to industry standards.

The methodology described in this section applies to the Green Bonds Fannie Mae issued from January 1, 2020, through December 31, 2020. For all metrics, estimated impacts are reported for the year in which the loan was issued in a security by Fannie Mae. Economic impacts are not inflation-adjusted. There have been minor changes to the impact methodology from year to year; please refer to the previous **Fannie Mae Green Bond Impact Reports** for methodology details for bonds issued in those years. Impacts have not been recalculated for prior-year issuances, as some inputs and conversion factors change over time.

Fannie Mae reports impact as a one-year impact occurring in the first year of the Green Bond, even though, in reality, many of the benefits of green mortgage loans may be realized later in the life of the loan and to some degree will repeat every year throughout the life of the loan. Only one-year impacts are reported, because impacts may change over time or they may not be realized until a later date when property improvements have been completed and because Fannie Mae cannot predict the duration of each security.

The single-year impacts for Multifamily Green Rewards Mortgage Loans are based on the type and installation cost of energy- and water-saving capital improvements selected for each property, and those improvements' estimated annual energy and water savings compared to the property's historical 12-month consumption, regardless of whether those improvements were completed by the end of 2020. The single-year impact for loans on properties with GBCs represents the estimated cost of construction of the building and the estimated impact of the property's green construction and operation compared to a modeled equivalent non-green property.

2020 population	Cumulative population[27]
557 Multifamily Green Bonds issued in 2020	3,921 Multifamily Green Bonds issued 2012 – 2020
12 Single-Family Green Bonds issued in 2020	12 Single-Family Green Bonds issued in 2020

Impact data sources

The impacts were calculated by Ernst & Young (EY) and the Integral Group based on their analysis of Fannie Mae data and additional data as defined below.

Inputs	Securities backed by Green Rewards Mortgage Loans*	Securities backed by mortgage loans on properties with GBCs
Energy consumption reductions	EY tabulation of Fannie Mae High Performance Building Report data	Integral Group analysis of green building certifications and Fannie Mae loan data
Greenhouse gas emissions reductions	EY tabulation of Fannie Mae High Performance Building Report data	Integral Group analysis of green building certifications and Fannie Mae loan data
Water consumption reductions	EY tabulation of Fannie Mae High Performance Building Report data	Integral Group analysis of green building certifications and Fannie Mae loan data*
Cost savings associated with energy and water consumption reductions	EY tabulation of Fannie Mae High Performance Building Report data	Integral Group analysis of green building certifications and Fannie Mae loan data*
Installation cost of energy and water saving improvements	EY analysis of Fannie Mae High Performance Building Report data	N/A
Unit-level affordability, property location, and valuation data	EY analysis of Fannie Mae loan data and external supporting metrics	EY analysis of Fannie Mae loan data and external supporting metrics
Economic, social, and economic impact calculations	EY analysis of Fannie Mae loan data and external supporting metrics	EY analysis of Fannie Mae loan data and external supporting metrics

** Multifamily loans only.*

[27] There may be minor variations between the set of securities in this analysis and the full list of Green MBS listed on the Green Bonds webpages or on DUS Disclose. In the course of normal business operations, data may be corrected after delivery of the loan to Fannie Mae.

Data source: High Performance Building Report data for Multifamily Green Rewards Mortgage Loans

The primary data source for a Green Rewards Mortgage Loan analysis is our **High Performance Building (HPB) Report**, which includes an ASHRAE Level 2-equivalent energy audit.[27] This is prepared by third-party consultants (HPB consultants) who are engaged by the DUS lender. As part of the energy and water audit, the HPB consultants:

- Gather cost data for the property, including historic utility consumption.
- Establish a baseline of 12-month energy and water consumption.
- Conduct a site visit.
- Model energy and water usage.
- Identify and quantify EWEMs, as well as investment opportunities based on the property's equipment age, energy or water efficiency, or other factors. HPB consultants generally recommend 10 to 20 EWEMs. All recommended EWEMs must be capital investments that require the installation of equipment, fixtures, or appliances.[28]

For each recommended energy- or water-saving property improvement, the consultant assesses environmental and cost metrics, including:

- Total implementation cost to install the improvements.
- Annual estimated energy and water cost savings for the borrower.
- Annual estimated energy and water cost savings for the tenants.
- Annual estimated energy and water consumption savings for the property.

Baseline energy and water consumption data, recommendations for improvements, and cost and consumption savings data from the HPB consultants' analyses are input into Fannie Mae's Form 4099.H, an Excel workbook. Form 4099.H is a required part of the HPB Report and has been developed with support from Bright Power, an independent energy management consulting firm. The Form 4099.H calculates metrics such as:

- Source energy baseline and estimated savings from site energy inputs.
- Projected source energy and water consumption savings as a percentage of the whole-property annual historical baseline consumption.
- Projected GHG emissions reductions using the ENERGY STAR methodology, based on the annual estimated source energy consumption savings for the property as determined by the HPB consultants.

In order to calculate GHG reductions, energy savings projections provided by consultants in the HPB Reports are converted from native units (kWh, therms, etc.) into source energy (kBtu) and associated GHG emissions reductions in accordance with the **ENERGY STAR**[29] Portfolio Manager methodology. Reductions calculations include conversion factors, which we reflect in Form 4099.H for each loan.[30] Loans that used a Form 4099.H published before August 2018 use thermal conversion factors from the **EPA Quick Converter tool**.[31]

After the DUS lender (and, in some cases, Fannie Mae) thoroughly reviews the HPB Report for accuracy and completeness, the lender reviews the report with the borrower. From the list of energy- and/or water-saving capital investments recommended by the consultant, the borrower selects capital investments that meet or exceed the Green Rewards Mortgage Loan program eligibility requirements. Fannie Mae requires the lender to escrow the full cost of all selected investments, with the escrow being released to the borrower as the work is completed and verified by the lender. All selected investments are documented in the loan agreement signed by the borrower, and the borrower must complete the investments within one year of loan closing.

Integral Group multifamily green building certification analysis

The primary data source for the estimated impact of multifamily loans on properties with eligible GBCs is the Fannie Mae Green Building Certification Impact Calculator (Impact Calculator), developed by Integral Group, an engineering and green building consulting firm. The Impact Calculator uses the type, year, level, and version of each GBC to estimate energy and water savings and, in turn, cost and GHG savings for each GBC property.

The Impact Calculator is based on a detailed analysis conducted by Integral Group of the program requirements for each multifamily certification. Integral Group reviewed each GBC program to identify minimum requirements for each type of certification. For example, if a specific type of certification requires a minimum energy performance of 15% above code, then all loans on properties with that type of certification were assumed to meet that minimum performance level. Integral Group took the following approach to measure energy savings and GHG emission reductions:

1. **Identify the baseline performance standard based on the property's location and age.** The U.S. does not have a national building energy code; instead most states have residential and commercial energy code requirements that specify which standard applies for new construction and renovations (ASHRAE 90.1-2010, for example). For new construction in states where there is no statewide energy code, ASHRAE 90.1-2004 is used as the baseline, which is equivalent to the national median level of energy performance in multifamily buildings.

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[27] The HPB Report instructions and methodology are included within Section 5 of our Instructions for Performing a Multifamily Property Condition Assessment (Form 4099).

[28] Improvements that require solely changing operations and maintenance procedures or plans cannot be an EWEM that counts toward Green Rewards Mortgage Loan eligibility, since the projected energy and water cost and consumptions savings are anticipated to be less durable than savings resulting from capital investments.

[29] "How Portfolio Manager Calculates Greenhouse Gas Emissions," energystar.gov, U.S. Environmental Protection Agency and U.S. Department of Energy (accessed May 17, 2021).

[30] See ENERGY STAR Portfolio Manager Technical Reference guides: "Portfolio Manager Technical Reference: Greenhouse Gas Emissions," "Portfolio Manager Technical Reference: Source Energy," and "Portfolio Manager Technical Reference: Thermal Conversion Factors."

[31] "ENERGY STAR Quick Converter" (Excel file download), energystar.gov, U.S. Environmental Protection Agency and U.S. Department of Energy (accessed May 17, 2021).

- Properties with New Construction GBCs use the U.S. Department of Energy determination of standard equivalency at the time of construction, or the national median level of performance (ASHRAE 90.1-2004) in cases where the building was constructed prior to 2012 — the earliest year of our current database of energy codes.
- Properties with Existing Building GBCs use ASHRAE 90.1-2004 as the baseline.

2. **Estimate the property's baseline site energy use** using reference energy models published by Pacific Northwest National Laboratory (PNNL). Using the PNNL reference energy models, Integral estimated the energy performance of different types of multifamily residential properties around the county by climate zone and by energy standard. All energy use estimates account for regional climate and property type/size (either gross floor area or, if not available, number of units) differences. This metric represents the property's baseline energy use.
3. **Determine the minimum energy performance required by the property's GBC** for the applicable performance standard. (The minimum requirement is that the property performs 10% better than ASHRAE 90.1-2004 standards.)
4. **Estimate the property's site energy use,** using reference energy models published by PNNL along with data from the EPA, the California Energy Commission, and/or PHIUS.
5. **Calculate estimated savings.**
    - **Site energy savings** estimated by subtracting the property's anticipated energy use from the property's baseline energy use.
    - **Carbon emissions savings** estimated based on the energy savings combined with the EPA's Emissions and Generation Resource Integrated Database (eGRID), which contains grid electricity emissions factors by region (at the ZIP code level), derived from the fuels used for generation (e.g., coal, gas, nuclear). The emissions factors for natural gas came from the EPA.
    - **Utility cost savings** estimated based on the energy savings and the residential rates for energy at the state level, using cost data from the U.S. Energy Information Administration (EIA).

To estimate projected water savings, Integral Group used a similar approach:

1. **Estimate the property's baseline water use** using an assumption of 30 kgal per 1,000 ft^2 per year.[32]
2. **Determine the minimum water performance** required by the property's GBC. Not all GBCs have water prerequisites; therefore, water savings from baseline was not assumed for all properties. For those GBCs that did have water saving requirements, savings were based on prescriptive fixture requirements, EPA Water Score, or modeled water savings. Integral converted all three of these methodologies to a percent savings reduction.
3. **Estimate the property's water use** by applying the applicable percent savings reduction to the property's estimated baseline water use.

To ensure impact estimates are conservative, all calculations are based on the minimum energy and water savings of each GBC. For example, many GBCs use a points-based scoring system and award points for non-energy- or -water-related sustainability measures. For these GBCs, a building could theoretically achieve a higher level of certification (e.g., Gold, Platinum) without substantial improvements to energy or water efficiency. Therefore, the analysis only recognizes the minimum level of required energy or water savings of the program, regardless of the level of certification.[33] In addition, if a GBC does not have a minimum performance threshold for energy or water, it is assumed that there was no energy or water impact for securities collateralized by loans on properties with that certification, and therefore none are reported. These are represented by "N/A" in the "Environmental Impact per CUSIP" spreadsheet. Fannie Mae no longer recognizes GBCs that do not meet minimum requirements for energy efficiency.

Integral Group single-family green building certification analysis

Impact calculations for single-family properties with green building certifications were also performed using a Fannie Mae Green Building Certification Impact Calculator for single-family properties (Impact Calculator), developed by Integral Group, which uses the type, level, and version of each GBC to estimate energy savings and, in turn, cost and GHG savings for each single-family GBC property.

Analysis of green building certification systems for single-family homes involved a comprehensive review of the requirements for each certification system and a comparison of their relative impacts on building energy performance. Since the certification systems reference different energy code standards, a baseline code standard was established in order to level-set comparisons and set a minimum performance threshold.

1. **Establish baseline.**

The International Energy Conservation Code (IECC) 2006 was selected as the baseline for two reasons:

- The Energy Use Intensity (EUI) of IECC 2006-compliant single-family homes, as modeled by PNNL, maps closely to the national median EUI from the Residential Energy Consumption Survey (RECS) database. Since Integral used the national median as the baseline for the multifamily green building study, we felt that the single-family study should use a similar approach.
- Most states in the country have adopted codes either comparable to or better than IECC 2006, and thus the baseline would be relevant in most U.S. states.

2. **Estimate the property's baseline site energy use.**

After establishing the baseline, PNNL models were used to derive site EUI values for IECC 2009-, IECC 2012-, and IECC 2015-compliant homes.

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[32] This estimate was developed by Integral analyzing results from the Fannie Mae Multifamily Energy and Water Market Research Survey, a 2012 nationwide survey of over 1,000 multifamily properties, and comparing this to other models of multifamily water use, including Bright Power's EnergyScoreCards tool.

[33] In 2021, Green Building Initiative's Green Globes Multifamily certifications moved from allowing water or energy as a minimum requirement to requiring all projects to meet an energy minimum requirement. For properties certified prior to 2021 that pursued the water pathway, Integral estimated energy impacts by analyzing energy-related environmental assessment areas achieved by the project.

3. Set the minimum performance threshold.

Nearly all the green building certification systems considered by Fannie Mae for single-family homes require ENERGY STAR certification or reference ENERGY STAR compliance as a pathway to certification. Leadership in Energy and Environmental Design (LEED) for Homes, for example, requires projects to complete all mandatory measures for ENERGY STAR Certified Homes, Version 3.0. Enterprise Green Communities requires ENERGY STAR Homes certification, as well. PHIUS and Living Building Challenge were the only two certification systems included in our review that did not, in some way, reference or require ENERGY STAR, but their performance is far beyond that of the ENERGY STAR program.

Based on Integral's analysis, ENERGY STAR Certified Homes, Version 3.0, represents a 27% national average savings in site energy use compared to the IECC 2006 baseline. This is roughly comparable to the performance of IECC 2012 and nearly as stringent as IECC 2015, which has been incorporated into the residential construction code by at least 15 states. PHIUS and Living Building Challenge certifications are significantly more stringent, representing a 76% national average and 100% reduction in site energy use from the IECC 2006 baseline, respectively.

Since ENERGY STAR Certified Homes, Version 3.0, is referenced by nearly all green building certification systems and is comparable to stringent energy codes such as IECC 2012 and IECC 2015, we selected ENERGY STAR Certified Homes, Version 3.0, as the minimum performance threshold for the Fannie Mae Single-Family Green MBS program.

4. Estimate the property's site energy use.

PNNL energy models, in conjunction with published studies evaluating the impact of various green building certification systems, were then used to develop EUI projections for the green building standards. For example, a 2018 ENERGY STAR cost savings report[34] references IECC 2009. Using the IECC 2009 models, along with the estimated savings indicated in the report, we calculated the EUI of an ENERGY STAR Certified Home, Version 3.0-compliant single-family home.

5. Calculate estimated savings.

a. **Site energy savings** estimated by subtracting the property's anticipated energy use from the property's state code baseline energy use.

b. **Carbon emissions savings** estimated based on the energy savings combined with the EPA's eGRID, which contains grid electricity emissions factors by region (at the ZIP code level), derived from the fuels used for generation (e.g., coal, gas, nuclear). The emissions factors for natural gas came from the EPA.

c. **Utility cost savings** estimated based on the energy savings and the residential rates for energy at the state level, using cost data from the EIA.

EY analysis

EY tabulated or estimated the economic, environmental, and social impacts of each security based on the energy and water consumption reductions and associated cost savings, as well as the installation costs of energy- and water-saving equipment and construction costs associated with the underlying green mortgage loans. Impacts such as nationwide employment, personal income, GDP, and gross economic output were estimated using the U.S. IMPLAN economic model.[35] Environmental and cost savings benefits associated with loans reflect estimates produced by Integral Group and HPB consultants for each loan, which were tabulated by security and other dimensions by EY.

Economic impacts

- **Direct impacts** account for jobs and economic contribution directly linked to construction, renovation, and installation activities and the related supply of components. For Green Rewards Mortgage Loans, this includes plumbers and other tradespeople, as well as U.S. factory workers who manufactured the components.
- **Indirect impacts** account for supply-chain-linked jobs and economic contributions, such as the manufacturing of materials and components.
- **Induced impacts** account for the economic activity supported by employee consumption. For example, local spending of plumbers and construction workers.

Direct, indirect, and induced economic impacts are summarized as key metrics, as follows:

- **Employment impact** is measured in terms of the number of worker-years-of-activity supported by the spending. Instead of reflecting the number of full-time equivalents for each year, it includes a mix of full-time and part-time workers for each year based on the mix of those worker types commonly found in each industry related to installation or construction activities.
- **Employee compensation/income supported** reflects the total salaries, tips, and other cash and non-cash compensation earned by employees as a result of their employment.
- **U.S. GDP** reflects the industry's value-add, which is equivalent to the sum of payments to labor and capital for each category of economic activity.
- **Contribution to gross economic output** is a measure of the value of the goods and services sold by domestic industries. Economic output includes GDP as well as the industry's cost of operating inputs (intermediate demand).

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[34] *Cost and Savings Estimates: ENERGY STAR Certified Homes, Version 3 (Rev. 09)* (ENERGY STAR, Dec. 20, 2018).

[35] Economic metrics presented in the report generally refer to total economic impacts, which include supply-chain (indirect) and consumption-related (induced) economic effects. Unless otherwise noted, all estimates are based on national averages for the relevant metrics. Ernst & Young estimated cost savings periods and selected other economic metrics using information provided by Fannie Mae, its consultants, and relevant third-party data sources as noted in this methodology.

- **Construction cost of GBC buildings** is the sum of the appraised property value, adjusted to remove developer profit, market appreciation, and land value. Values were reduced by 15% to reflect expected developer profit and risk on the project. An amount for land value was removed equal to 18% of the property value.[36] The value as stated in the property value year was deflated to the construction year for existing building certifications and to certification year for new buildings to remove overall real estate market appreciation over the period between the construction/renovation/certification activity and the year in which the property value was recorded/provided. The real estate market value deflator is based on Real Capital Analytics' market index.
- **Installation cost** is the aggregate of the cost estimated for each Multifamily Green Rewards Mortgage Loan property improvement by the HPB consultant and includes both installation services costs (e.g., plumbing, electrical, carpentry) as well as component costs (e.g., faucet, light fixture, window).
    - **Installation service and component costs** include labor and installation materials and the cost of components.[37] For example, for the installation of low-flow toilets, the service cost would be the cost of basic materials and the plumber's labor.

ESTIMATED INSTALLATION SERVICE COST AND COMPONENT COST OF MAJOR IMPROVEMENT CATEGORIES

Category	EY estimated % installation service cost	EY estimated % component cost
Water and sewer conservation	45%	55%
Lighting	50%	50%
Heating, ventilating, and air conditioning	33%	67%
Building envelope	30%	70%
Appliances and plug load reductions	20%	80%
Renewable energy systems	40%	60%
Domestic hot water heating	48%	52%
Water and steam distribution	50%	50%
Boiler plant improvements	50%	50%
Advanced controls and metering	50%	50%
Chiller plant improvements	50%	50%
Electric motors and drives	50%	50%

Environmental impacts

- **Energy savings and efficiency** represent the amount of energy savings in kBtu ascribed to the properties underlying Green MBS. For Green Rewards Mortgage Loans, this represents the difference between the property's energy usage prior to the energy-saving improvements associated with the loan and the estimated energy usage after those improvements are completed. For properties with GBCs, this represents the estimated difference in energy usage between the certified property and the property if it were built to the state minimum energy code.[38] Energy includes electricity, natural gas, propane, steam, and fuel oil, whether metered or delivered.
- **Water savings** represents the amount of water in kgal ascribed to properties underlying Green MBS. For Green Rewards Mortgage Loans, this represents the difference between the property's water usage prior to the water-saving improvements associated with the Green Rewards Mortgage Loan and the estimated water usage after those improvements are completed.
- **GHG emissions avoided** are reported in $MTCO_2e$ associated with the energy savings ascribed to the properties underlying Green MBS.
- **Water-stressed areas** are those with ZIP codes situated in areas categorized as having "high" or "very high" baseline water stress in the *Aqueduct Global Maps 2.1: Constructing Decision-Relevant Global Water Risk Indicators, World Resources Institute, April 2015*. Baseline water stress measures the ratio of total annual water withdrawal to average annual available blue water, a commonly used indicator also known as "relative water demand."

Social impacts

- **Number of units** retrofitted or green building-certified is the cumulative number of units in the properties underlying Green MBS.
- **Tenant cost savings** are the estimated utility cost savings expected to reach tenants of a property with a Green Rewards Mortgage Loan in the aggregate, due to the installation of energy- and water-saving improvements. These may represent reductions in direct billing or utility expenses where tenants reimburse property owners for utility costs through Ratio Utility Billing or flat fees. Tenant cost savings are not calculated for mortgage loans on properties with GBCs.

[36] David Geltner and Sheharyar Bokhari, *Commercial Buildings Capital Consumption in the United States: Final Report* (MIT Center for Real Estate, November 2015), p. 20.

[37] Sources include the National Renewable Energy Laboratory; Plumbing, Heating, Cooling Contractors Association; National Kitchen and Bath Association; National Electrical Contractors Association; American Institute of Architects; American Society of Professional Estimating; websites of major building materials suppliers. Much of the data was accessed through homewyse.com.

[38] For new construction in states where there is no statewide energy code, ASHRAE 90.1-2004 is used as the baseline, which is equivalent to the national median energy use intensity for multifamily buildings.

- **Homeowner utility cost savings** are estimated based on the energy savings and the residential rates for electricity at the state level, using cost data from the EIA. Average annual utility cost savings per single-family home is calculated as the sum of utility cost savings for GBC homes divided by the number of homes.
- Total tenant annual income for multifamily units is estimated using two approaches. The approach used varies by loan and depends on what information is available regarding the number of units at different levels of income.
    a. For loans that provide the number of units with income limits at various percentages of AMI, the total tenant annual income is estimated as the number of units at each income level multiplied by the relevant percentage of AMI multiplied by the AMI per the 2017 HUD Section 8 income amounts for the relevant county. This approach assumes that tenants of units at a specified income threshold earn the maximum allowable income for that unit (e.g., tenants of 50% of AMI units are assumed to earn 50% of AMI). All remaining units (those not shown with an AMI maximum) are assumed to have income level equivalent to the top maximum level of 120% of AMI.
    b. For loans that do not provide information about income tests for units, all tenants are assumed to earn 120% of AMI per the HUD Section 8 income amounts for the relevant county and year. The total annual tenant income for these loans is the product of the number of units and the county AMI by year.
- Increase in disposable income reflects the total tenant cost savings divided by the total income of all tenants in the affected buildings.
- Very low-income units are defined as units affordable to tenants earning 50% or less of AMI.
- Low-income units are defined as units affordable to tenants earning 60% or less of AMI.
- Affordable units are defined as units affordable to tenants earning 80% or less of AMI.

Notes and definitions

Refinanced loans are loans where the initial mortgage loan has been liquidated and subsequent financing has been issued for the property. There is one refinanced loan included in the analysis of the 2020 Green Bond issuances for which the 2020 Green Bond issuance is backed by a green mortgage loan that was a refinancing of a previous green mortgage loan. For these loans, impacts are reported for both the security containing the original loan and the security containing the refinanced loan and are calculated against the baseline for each loan. Refinanced Green Rewards loans must meet the eligibility requirements with an entirely different set of improvements to ensure new, additional impacts are achieved; there can be no overlap with the previously completed scope of work.

GeMS are a resecuritization of a pool of DUS MBS into a REMIC structured product. The environmental, social, and economic impacts of Green GeMS can be calculated by summing the impacts of the underlying securities. The population of Green GeMS is presented by CUSIP on our **Green Bonds webpage**.

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