



Freddie Mac Single-Family Green Bond Second Opinion

25 November 2021

Freddie Mac is a US government-sponsored enterprise whose mission is to provide liquidity, stability, and affordability to the US housing market. It does this principally by purchasing mortgages and securitizing them into bonds that are sold to investors.

Freddie Mac Single-Family's green bond framework outlines eligible investments in "Homes with renewable energy" and "Homes with an energy efficiency rating." This includes the purchase of GreenCHOICE mortgages for existing homes with solar or geothermal energy, mortgages on new homes with solar or geothermal energy, and new energy efficient homes. The latter includes newly built homes with a HERS Index Score of 60 or better, which corresponds to a home that is 40% more energy efficient than a home built to the 2006 International Energy Conservation Code (IECC).

The framework importantly supports the scaling of on-site renewable energy in the US single-family housing market. Allowing home owners to finance renewable energy sources with mortgage proceeds helps overcome upfront installation costs and could reduce the cost of capital compared to consumer loans. On-site renewable energy is key to achieving net zero in the building sector and must be scaled exponentially between now and 2050.

A HERS Index Score of 60 implies an improvement upon energy efficiency codes in 38 of 39 US states with IECC-based codes, but the ambition level falls short of a Paris Agreement-aligned target. The issuer is committed to reviewing this threshold every three years. By indirectly incentivizing homebuilders to obtain a HERS rating, the framework will indirectly help build a database on energy efficiency. The framework allows for investments in fossil fuel-based equipment often included in home construction, e.g. water heaters and boilers. Other pitfalls include rebound effects and possible leaks of GHGs from geothermal heat pumps.

The issuer has shared that it will report on Single-Family green bond impacts, e.g. avoided emissions, but its framework lacks detail on its future reporting approach, and as with many other issuers, physical climate risk management is a challenge. Freddie Mac is still developing its climate risk framework and Freddie Mac Single-Family assesses natural disaster and flood risks in its portfolio, but does not disclose the findings. Climate risk mitigation is currently limited to flood, fire and windstorm insurance requirements for exposed properties.

Based on the overall assessment of the eligible assets under this framework, and governance and transparency considerations, Freddie Mac Single-Family's green bond framework receives a **CICERO Light Green** shading and a governance score of **Fair**. The shading assumes an even allocation across project categories. GBP alignment is contingent upon the issuer reporting on allocation of proceeds to project categories—it has shared that it expects to do so but has not explicitly committed to this in its framework.

SHADES OF GREEN

Based on our review, we rate the Freddie Mac Single-Family's green bond framework **CICERO Light Green**.

Included in the overall shading is an assessment of the governance structure of the green bond framework. CICERO Shades of Green finds the governance procedures in Freddie Mac Single-Family's framework to be **Fair**.



GREEN BOND PRINCIPLES

Based on this review, this Framework is found in alignment with the principles.





Contents

| | | |
|----------|---|-----------|
| 1 | Terms and methodology | 3 |
| | Expressing concerns with 'Shades of Green' | 3 |
| 2 | Brief description of Freddie Mac Single-Family's green bond framework and related policies | 4 |
| | Environmental Strategies and Policies | 4 |
| | Use of proceeds | 5 |
| | Selection | 6 |
| | Management of proceeds | 7 |
| | Reporting | 7 |
| 3 | Assessment of Freddie Mac's green bond framework and policies | 9 |
| | Overall shading | 9 |
| | Eligible projects under the Freddie Mac's green bond framework | 9 |
| | Background | 11 |
| | <i>Decarbonizing the building sector</i> | 11 |
| | <i>Physical climate risks in the US housing market</i> | 12 |
| | Governance Assessment | 12 |
| | Strengths | 13 |
| | Weaknesses | 13 |
| | Pitfalls | 14 |
| | Appendix 1: Referenced Documents List | 16 |
| | Appendix 2: About CICERO Shades of Green | 17 |



1 Terms and methodology

This note provides CICERO Shades of Green's (CICERO Green) second opinion of the client's framework dated November 2021. This second opinion remains relevant to all green bonds and/or loans issued under this framework for the duration of three years from publication of this second opinion, as long as the framework remains unchanged. Any amendments or updates to the framework require a revised second opinion. CICERO Green encourages the client to make this second opinion publicly available. If any part of the second opinion is quoted, the full report must be made available.

The second opinion is based on a review of the framework and documentation of the client's policies and processes, as well as information gathered during meetings, teleconferences and email correspondence.

Expressing concerns with 'Shades of Green'

CICERO Green second opinions are graded dark green, medium green or light green, reflecting a broad, qualitative review of the climate and environmental risks and ambitions. The shading methodology aims to provide transparency to investors that seek to understand and act upon potential exposure to climate risks and impacts. Investments in all shades of green projects are necessary in order to successfully implement the ambition of the Paris agreement. The shades are intended to communicate the following:

CICERO Shades of Green



Dark green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Ideally, exposure to transitional and physical climate risk is considered or mitigated.



Medium green is allocated to projects and solutions that represent steps towards the long-term vision, but are not quite there yet. Fossil-fueled technologies that lock in long-term emissions do not qualify for financing. Physical and transition climate risks might be considered.



Light green is allocated to projects and solutions that are climate friendly but do not represent or contribute to the long-term vision. These represent necessary and potentially significant short-term GHG emission reductions, but need to be managed to avoid extension of equipment lifetime that can lock-in fossil fuel elements. Projects may be exposed to the physical and transitional climate risk without appropriate strategies in place to protect them.

Examples



Wind energy projects with a strong governance structure that integrates environmental concerns



Bridging technologies such as plug-in hybrid buses



Efficiency investments for fossil fuel technologies where clean alternatives are not available

Sound governance and transparent processes facilitate delivery of the client's climate and environmental ambitions laid out in the framework. Hence, key governance aspects that can influence the implementation of the green bond framework are carefully considered and reflected in the overall shading. CICERO Green considers four factors in its review of the client's governance processes: 1) the policies and goals of relevance to the green bond framework; 2) the selection process used to identify and approve eligible projects under the framework, 3) the management of proceeds and 4) the reporting on the projects to investors. Based on these factors, we assign an overall governance grade: Fair, Good or Excellent. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.



2 Brief description of Freddie Mac Single-Family's green bond framework and related policies

Freddie Mac is a US government-sponsored enterprise that supports the US housing market by providing liquidity, stability, and affordability through the secondary market for residential mortgages. Specifically, Freddie Mac purchases mortgage loans originated by approved lenders and packages them into mortgage-backed securities (MBS) that carry Freddie Mac's guarantee. These MBS are then sold in the global capital markets to investors who receive timely payments of principal and interest from the underlying mortgages in each MBS. Freddie Mac does not originate loans or lend money directly to mortgage borrowers. With this model, Freddie Mac increases the willingness of lenders to make long-term, fixed rate mortgages to both individual and commercial buyers, thereby increasing the affordability of housing to homeowners and renters.

Freddie Mac's Single-Family business purchases mortgages for single-family homes from lenders and securitizes the majority of them into MBS. With its green bond framework, it aims to leverage this process and securitize eligible loans into green MBS ("green bonds" for the purposes of this document). As of 30 September 2021, Freddie Mac's single-family mortgage portfolio was USD 2.7 trillion.

Environmental Strategies and Policies

Freddie Mac developed a sustainability strategy in 2020 based on consultation with internal and external stakeholders, including a materiality assessment and research on relevant industry standards and frameworks. From this process, Freddie Mac identified four pillars for its strategy: Purpose, Planet, People and Practices. Freddie Mac has not disclosed sustainability targets, such as reduced emissions associated with its operations or investments. Freddie Mac is developing a climate risk management framework that considers the recommendations of the Task Force on Climate-Related Financial Disclosure (TCFD) and other frameworks and best practices.

The Planet pillar of Freddie Mac's sustainability strategy involves reducing climate-related risk and housing costs to enhance affordability and resilience. Freddie Mac works towards these goals by leveraging its MBS programs to incentivize investments that improve the climate performance of the US housing stock, such as certified green construction and retrofits that improve water and energy efficiency. This began with Freddie Mac's Multifamily green bonds program in 2019, under which it has securitized over USD 4.1 billion of its Green Advantage loans.¹ In 2019, Freddie Mac Single-Family launched its GreenCHOICE mortgage program, which supports homeowners making water and/or energy efficiency improvements. Specifically, proceeds from GreenCHOICE mortgages can be used to pay for these improvements or refinance debt originally taken on by homeowners to pay for them. This allows borrowers to lower their cost of borrowing since they are likely to have taken on more expensive regular consumer loans to pay for such improvements, thereby creating a financial incentive for these improvements.

In April 2021, Freddie Mac Single-Family launched its Green MBS Program, which supports Freddie Mac's strategy of leveraging its MBS programs to drive sustainability in the US housing market. This involves developing and overseeing its Single-Family green MBS offerings and issuances. Both the program leadership team and

¹ Freddie Mac's Multifamily Green Advantage[®] program was launched in 2016, offering loans to owners of multifamily and workforce housing that incentivize water and energy efficiency retrofits.



steering committee are cross-departmental in nature and include representatives from across Freddie Mac Single-Family's business, including its sustainability team. In April 2021, Freddie Mac issued its first Single-Family Green MBS, backed by GreenCHOICE mortgages, and has issued USD 523 million in Single-Family Green MBS as of end October 2021.²

Freddie Mac's standard due diligence includes elements of climate risk mitigation by requiring borrowers to maintain hazard insurance for the underlying properties, which may include insurance for fire, floods, and earthquakes, depending on exposure. Flood insurance is required for any properties that are fully or partially located in Special Flood Hazard Area (SFHA) "A" or "V" Zones, as defined by the Federal Emergency Management Agency (FEMA).³ Freddie Mac also requires mortgage insurance on certain loans. When borrowers are affected by FEMA-declared natural disasters, Freddie Mac offers payment relief and other forms of assistance.

Lastly, Freddie Mac Single-Family is also conducting and reviewing research on both the climate risks to its portfolio and the wider linkages between climate change and the housing market. According to Freddie Mac Single-Family, it assesses exposure to and loss estimates from hurricanes and earthquakes on an ongoing basis. In 2020, it published a research note linking greater reductions in home sales prices to higher perception and awareness of flood risks resulting from 2017's Hurricane Harvey.⁴ Freddie Mac Single-Family's research has also identified how energy efficiency efforts translate into better financial performance, for instance in a 2019 white paper showing how homes with better energy efficiency ratings sold for 3-5% more than those with lesser ratings.⁵ The white paper also found that mortgages backed by homes with better energy efficiency ratings tended to have better mortgage profiles and lower delinquency rates than those backed by unrated homes.⁶

Use of proceeds

Proceeds raised from issuances under the framework are in effect used to purchase eligible mortgages under Freddie Mac's Single-Family Green MBS program, including those in the categories of "Homes with Renewable Energy" and "Homes with an Energy Efficiency Rating."

The program originally involved the purchase of GreenCHOICE mortgages used to refinance existing homes and pay off existing debt that funded renewable energy systems for these homes. This framework increases the number of mortgages eligible for purchase by expanding the eligibility criteria. Freddie Mac deems the purchase of these eligible mortgages to align with the renewable energy and energy efficiency project categories as categorized by the ICMA in its Green Bond Principles.

It should be noted that Freddie Mac Single-Family's use of proceeds differs from the typical use and management of proceeds associated with green bond issuances, in that Freddie Mac Single-Family has already made the eligible investments prior to issuance – i.e. purchased the eligible mortgages – and uses proceeds to recoup the funds. For this reason, net cash proceeds can be used for general corporate purposes and the purchase of additional mortgages that do not need to meet the framework's or any other criteria.

According to Freddie Mac Single-Family, cash proceeds can also be used to pay its partner lenders higher prices (known as "pay ups") for future green mortgages, though the size of these pay ups (if any) will vary depending on

² This issuance was not subject to a second-party opinion on its alignment with ICMA's Green Bond Principles or any other standards regarding the environmental sustainability of the underlying framework.

³ During a 30-year mortgage, homes in these zones have a 25% or higher risk of flooding. See <https://rnm.gov/DocumentCenter/View/66104/FEMAInfo-LearnAboutSFHAs>

⁴ <http://www.freddiemac.com/fmac-resources/research/pdf/202006-Note-16.pdf>

⁵ https://sf.freddiemac.com/content/assets/resources/pdf/fact-sheet/energy_efficiency_white_paper.pdf

⁶ Ibid.



market conditions. It has also shared that the proportion going to general corporate purposes will depend on individual issuance size and offering price.

Selection

The selection process is a key governance factor to consider in CICERO Green's assessment. CICERO Green typically looks at how climate and environmental considerations are considered when evaluating whether projects can qualify for green finance funding. The broader the project categories, the more importance CICERO Green places on the governance process.

For mortgages to be eligible for inclusion in Freddie Mac's Single-Family Green MBS program, the underlying homes must be either 1) "Homes with Renewable Energy" or 2) "Homes with an Energy Efficiency Rating."

- "Homes with Renewable Energy" are newly constructed homes⁷ with a renewable energy source, or existing homes refinanced with Freddie Mac GreenCHOICE Mortgages that were used to pay off existing debt taken on to fund renewable energy systems for these homes. Renewable energy is defined to include solar and geothermal energy. Freddie Mac Single-Family has clarified that it is currently sourcing only mortgages backed by homes with installed solar energy systems, and that there is no cutoff on the age of the renewable energy system.
- "Homes with an Energy Efficiency Rating" are newly constructed homes with a score of 60 or less on the Home Energy Rating System (HERS) Index.⁸

Freddie Mac Single-Family has committed to reviewing the HERS Index score threshold at least every three years to determine if the threshold should be adjusted. It anticipates that the review would likely consider a number of factors, including, without limitation, (i) changes in the average HERS scores of newly-constructed homes, (ii) changes in the average energy efficiency standards of comparable certifications, (iii) new versions of the International Energy Conservation Code, and (iv) updates to the reference home used for the HERS Index.

Besides the specific criteria outlined above, there are no additional sustainability criteria for mortgages to be eligible for purchase, such as climate resiliency and life cycle considerations, e.g. the sustainability of building construction materials or impacts from the manufacturing, distribution, and end-of-life for renewable energy systems.

Freddie Mac Single-Family checks the eligibility of mortgages for inclusion by confirming the presence of an installed renewable energy source at the properties or the required HERS Index score using the RESNET database.

⁷ Defined as follows: The improvements have been recently constructed and have not been previously occupied. The entire structure and all components are new and the dwelling features no physical depreciation. Note: Newly constructed improvements that feature recycled or previously used materials and/or components can be considered new dwellings provided that the dwelling is placed on a 100 percent new foundation and the recycled materials and the recycled components have been rehabilitated/remanufactured into like-new condition. Improvements that have not been previously occupied are not considered "new" if they have any significant physical depreciation (that is, newly constructed dwellings that have been vacant for an extended period of time without adequate maintenance or upkeep).

⁸ HERS is a standard for measuring energy efficiency created and maintained by the Residential Energy Services Network (RESNET) and recognized by the US Department of Energy (DOE) and Environmental Protection Agency (EPA). A score of 100 on the HERS Index corresponds to RESNET's reference home, built according to the 2006 International Energy Conservation Code. The typical resale home scores 130, according to DOE estimates. A lower score indicates higher energy efficiency, and mortgages eligible for purchase under this framework correspond to homes that are roughly 40% more energy efficient than the reference home. Over three million homes in the US have been issued a HERS index score as of July 2021.



Freddie Mac Single-Family's procedure for confirming the renewable energy source is formalized in an appraisal review procedure. Under the procedure Freddie Mac Single-Family confirms the presence of the renewable energy source for each loan. If the presence of a renewable energy source cannot be confirmed, the loan will not be included in a green MBS issuance. According to Freddie Mac Single-Family, it is still formalizing the procedure that it will use to confirm that properties meet the required HERS Index score.

The originators of the mortgages must represent to Freddie Mac that mortgages delivered meet one or more of the eligibility criteria, as well as make representations and warranties that the mortgages meet other more general minimum requirements identified in the Freddie Mac Single-Family Seller/Servicer Guide, including underwriting requirements and data delivery requirements. For GreenCHOICE mortgages, these include a requirement that the cost of renewable energy systems, or debt incurred for their installation, not exceed 15% of the as completed property value. The requirements also specify that an appraiser verify the installation of the renewable energy systems in a report to the mortgage seller/servicer, which must include photographs of newly purchased renewable energy systems.

However, the Guide does not outline requirements for mortgage sellers/servicers with regards to determining eligibility of mortgages under this framework's other criteria, i.e. new homes with renewable energy systems backed by non-GreenCHOICE mortgages and new homes with a HERS Index score of 60 or less. Instead, Freddie Mac Single-Family communicates about its intention to purchase these qualifying mortgages on its website and engages directly with mortgage sellers who are interested in participating to ensure they fully understand the criteria.

Management of proceeds

The management of proceeds for Freddie Mac Single-Family green MBS is consistent with the management of proceeds across Freddie Mac Single-Family's Uniform Mortgage-Backed Security (UMBS). According to Freddie Mac Single-Family, 100% of green MBS will be issued via its UMBS Cash Window Program (sold for cash), as opposed to via its Guarantor Swap Program (sold in direct exchange for mortgages).⁹

Given the difference between Freddie Mac Single-Family's use of proceeds and a typical green bond issuance (see section on use of proceeds), net cash proceeds are not placed in a separate account for management.

Reporting

Transparency, reporting, and verification of impacts are key to enable investors to follow the implementation of green finance programs. Procedures for reporting and disclosure of green finance investments are also vital to build confidence that green finance is contributing towards a sustainable and climate-friendly future, both among investors and in society.

Freddie Mac will report on Single-Family Green MBS issuances by publishing security and loan-level data on its website, including data such as security/loan identifiers, issue date, unpaid principal balance, mortgage terms, etc. The Securitization Team is responsible for this process. The same team is also responsible for saving supporting documentation, including final collateral files with determination of mortgage eligibility, and where relevant, email communications with lenders confirming the use of mortgage proceeds for paying off debt related to the purchase and installation of renewable energy sources.

⁹ For further details of the Cash Window Program, see pg 55 of the June 2021 offering circular (http://www.freddiemac.com/mbs/docs/umbs_mbs_oc_06012021.pdf)



Freddie Mac Single-Family's framework indicates that it intends to publish an annual impact report summarizing the environmental impacts of its Single-Family Green MBS program, which will aim to include quantitative measures and aggregate program results. Beyond this, it is still developing its approach to reporting, and the framework does not specify the type of information that will be reported or the level of detail that will be provided. Freddie Mac Single-Family has shared that it is consulting ICMA and Climate Bonds Initiative (CBI) best practices as it develops its reporting approach and that it expects to outline the type of collateral included, but it has not yet determined the exact metrics and level of detail it will provide. According to Freddie Mac Single-Family it will eventually aim to report on energy savings and efficiency gains from the securitized mortgages, as well as the emissions avoided as a result. However, no indicative reporting indicators are provided in the framework and it has yet to develop a process for collecting these data.



3 Assessment of Freddie Mac’s green bond framework and policies

The framework and procedures for Freddie Mac’s green bond investments are assessed and their strengths and weaknesses are discussed in this section. The strengths of an investment framework with respect to environmental impact are areas where it clearly supports low-carbon projects; weaknesses are typically areas that are unclear or too general. Pitfalls are also raised in this section to note areas where Freddie Mac should be aware of potential macro-level impacts of investment projects.

Overall shading

Based on the project category shadings detailed below, and consideration of environmental ambitions and governance structure reflected in Freddie Mac’s green bond framework, we rate the framework **CICERO Light Green**.

Eligible projects under the Freddie Mac’s green bond framework

At the basic level, the selection of eligible project categories is the primary mechanism to ensure that projects deliver environmental benefits. Through selection of project categories with clear environmental benefits, green bonds aim to provide investors with certainty that their investments deliver environmental returns as well as financial returns. The Green Bonds Principles (GBP) state that the “overall environmental profile” of a project should be assessed and that the selection process should be “well defined”.

| Category | Eligible project types | Green Shading and some concerns |
|--|---|--|
| Homes with Renewable Energy  (GBP Category: Renewable energy) | <ul style="list-style-type: none"> Freddie Mac GreenCHOICE mortgages used to refinance existing single-family homes with installed renewable energy sources, including solar and geothermal Mortgages backed by newly constructed single-family homes with installed renewable energy sources, including solar and geothermal | Dark Green <ul style="list-style-type: none"> ✓ Renewable energy, including solar and geothermal energy, is key to a low-carbon transition. ✓ Solar panels may contain heavy metals such as silver, lead, arsenic and cadmium that may be classified as hazardous waste. ✓ Heat pumps in geothermal heating systems may be rely on fossil fuel-based electricity. ✓ Geothermal systems commonly rely on hydrofluorocarbon (HFC) refrigerants, which are potent GHGs, and/or antifreeze solution, which can be toxic. Leakage may contribute to climate warming and groundwater pollution, |



respectively.^{10,11} Use of climate-friendly refrigerants and non-toxic antifreeze should be prioritized.

- ✓ Proper decommissioning of solar and geothermal systems is required to avoid end of life impacts.
- ✓ The issuer has clarified that there is no limit on the age of the renewable energy system that can be refinanced; while unlikely, it is possible that older and more inefficient, malfunctioning, or broken systems can be financed.
- ✓ New home construction can have direct land use impacts and indirect impacts via the emissions and supply chains for building materials.
- ✓ This category may entail indirect support for fossil fuels depending on regional grids and choice of residential technologies such as natural gas furnaces and water heaters.

Homes with an Energy Efficiency Rating



(GBP Category: Energy efficiency)

- Mortgages backed by newly constructed homes with a minimum energy efficiency rating, as defined by a HERS Index score of 60 or less

Light Green

- ✓ Improving building energy efficiency is an important aspect of the low carbon transition.
- ✓ New construction should have state-of-the-art performance levels to avoid locking in sub-optimal outcomes.
- ✓ The selection criterion implies a greater level of energy efficiency than that of residential building codes in the majority of US states.¹² However, it is roughly in line with the 2020 US average HERS Index Score of 58¹³ and falls short of levels that align with a 1.5-degree scenario.¹⁴
- ✓ New construction can have direct land use impacts and indirect impacts via the

¹⁰ <https://www.sciencedirect.com/science/article/abs/pii/S0140700718301865?via%3Dihub>

¹¹ <https://www.ideals.illinois.edu/bitstream/handle/2142/55935/ofs2004-02.pdf?sequence=2>

¹² <https://www.energycodes.gov/status/residential>

¹³ This is the average HERS Index Score of the 299,755 homes rated in 2020, of which 77% were one- and two-family dwellings. See <https://www.resnet.us/wp-content/uploads/2021-Data-Trends-Report-of-HERS-Rated-Homes.pdf>

¹⁴ See information on Zero Energy Ready homes in [Background section](#).



emissions and supply chains of building materials.

- ✓ This category may entail indirect support for fossil fuels depending on regional grids and use of technologies such as gas-fired furnaces and water heaters.

Table 1. Eligible project categories

Background

Decarbonizing the building sector

The August 2021 report from IPCC's Working Group I¹⁵ has found it "unequivocal" that climate change is human driven and warns that climate change is the main driver of extreme weather events including heatwaves, storms, floods and droughts. This century will see global warming exceed both the 1.5 and 2 degree targets, with total temperature rise of 3.6 to 4.4 degrees in high and very high emission scenarios, unless deep emissions reductions are made.

The buildings and building construction sectors combined are responsible for over one-third of global final energy consumption and nearly 40% of total direct and indirect CO₂ emissions.¹⁶ Appliances (excluding heating, cooking and cooling appliances) are responsible for one quarter of final electricity use by buildings.¹⁷ The potential for energy and emissions savings remains largely untapped because of continued use of less efficient technologies, lack of effective policies and inadequate investments in sustainable buildings. Alongside electrification, energy efficiency improvements will be the most important measure for decarbonizing the building sector. In IEA's Net Zero by 2050 scenario (NZE), 29% of the emissions reductions needed in the building sector over 2020-2030 come from energy efficiency improvements. On-site renewable energy capacity also needs to increase exponentially in the NZE scenario, with a further 13% of building sector emissions reductions over 2020-2030 coming from use of renewable energy other than bioenergy and hydrogen.¹⁸ This includes a nearly seven-fold increase in distributed solar panel electricity generation, from 320 TWh to 2,200 TWh globally.

Distributed renewable energy and energy efficiency measures, alongside decarbonized grid and heating systems, reductions in buildings' embodied emissions, and implementation of smart grid solutions, are core features of zero-carbon-ready buildings. Accordingly, the IEA's NZE scenario calls for the implementation of zero-carbon-ready buildings codes by 2030 at the latest.¹⁹ The US Department of Energy has developed a Zero Energy Ready certification for a zero energy home, defined as "an energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy."²⁰ Depending on home size and geography, Zero Energy Ready Homes are at least 40-50% more energy efficient than typical new homes, corresponding to a HERS Index score in the low to mid-50s.²¹ This roughly corresponds to the minimum

¹⁵ https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

¹⁶ <https://www.iea.org/topics/buildings>

¹⁷ <https://www.iea.org/reports/tracking-buildings-2020/appliances-and-equipment>

¹⁸ <https://www.iea.org/reports/net-zero-by-2050>

¹⁹ Ibid.

²⁰ https://www.energy.gov/sites/prod/files/2015/09/f26/bto_common_definition_zero_energy_buildings_093015.pdf

²¹ <https://www.energy.gov/eere/buildings/guidelines-participating-doe-zero-energy-ready-home-program>



level of energy efficiency needed for single-family, low-rise residential housing before it will be cost effective to achieve net zero, i.e. for on-site renewable energy generation to offset power use.²²

Physical climate risks in the US housing market

Unabated climate change will accelerate physical climate impacts, including more extreme storms, accelerated sea level rise, droughts, wildfires and flooding.²³ These risks are already being experienced due to historical emissions, which have already contributed to average global temperature rise of around 1 degree since the pre-industrial era.²⁴ For near-term physical risk, investors and companies must consider the probabilities of physical events and resiliency measures to plan for and protect against the worst impacts. Research on physical climate risks to the US mortgage market suggests that extreme weather events, including floods, storms and wildfires, can increase delinquency, forbearance and prepayment rates, as well as increase the number of risky mortgages being sold into the secondary market.²⁵ A lack of information about property exposure to such risks is a contributing factor to their likely mispricing, evidenced for example by research showing that three times more Americans live in 100-year flood areas (SFHAs “A” Zones) than estimated by FEMA. This suggests many Americans are underinsured against floods.

The Federal Housing Finance Agency (FHFA), which regulates Freddie Mac, Fannie Mae and the Federal Home Loan Banks, launched a request for input in January 2021 to better identify and assess physical climate and natural disaster risks and improve its supervisory and regulatory approach.²⁶ The FHFA Office of Inspector General also released a white paper in March 2021 outlining how Freddie Mac and Fannie Mae manage climate and natural disaster risks through instruments such as mortgage insurance, property insurance (including flood and earthquake coverage), and credit risk transfers.²⁷ The paper concludes that other market participants, i.e. insurers and reinsurers, bear some of the climate and natural disaster risk associated with Freddie Mac and Fannie Mae’s mortgages. In this context, it is important to note that insurance premiums for coverage against climate-related weather events will continue rising, with the possibility that high-risk properties will become uninsurable in the near future.²⁸

Governance Assessment

Four aspects are studied when assessing the Freddie Mac’s governance procedures: 1) the policies and goals of relevance to the green bond framework; 2) the selection process used to identify eligible projects under the framework; 3) the management of proceeds; and 4) the reporting on the projects to investors. Based on these aspects, an overall grading is given on governance strength falling into one of three classes: Fair, Good or Excellent. Please note this is not a substitute for a full evaluation of the governance of the issuing institution, and does not cover, e.g., corruption.

Freddie Mac has developed a sustainability strategy, which includes leveraging its securitization programs to enhance the climate resilience of the US housing market. The company is developing its climate risk management framework. It does not disclose according to the TCFD and has not reported on its carbon footprint or on any emissions reduction or other climate-related targets for its portfolio. It should however be noted that Freddie Mac

²² <https://www.iccsafe.org/building-safety-journal/bsj-technical/zero-energy-buildings-in-context-with-todays-codes/>

²³ https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM.pdf

²⁴ Ibid.

²⁵ <https://sites.law.duke.edu/thefinregblog/2021/02/11/burning-down-the-house-how-inadequate-climate-risk-disclosures-and-information-asymmetries-threaten-to-disrupt-the-u-s-mortgage-market/>

²⁶ <https://www.fhfa.gov/Media/PublicAffairs/Documents/Climate-and-Natural-Disaster-RFI.pdf>

²⁷ <https://www.fhfaog.gov/sites/default/files/WPR-2021-004.pdf>

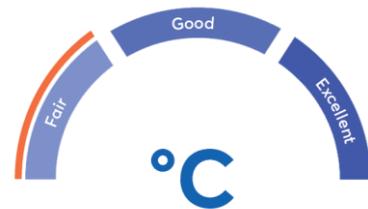
²⁸ https://minerva-access.unimelb.edu.au/bitstream/handle/11343/243218/WarrenMyersHurlimann_2020_PropertyClimateChangeRisk_Minerva.pdf



Single-Family does require flood insurance for properties in vulnerable areas. Additionally, Freddie Mac Single-Family assesses natural disaster risks to its portfolio on an ongoing basis and via specific efforts, e.g. to identify loans with high physical risk exposure, but does not disclose information about such assessments or their findings. More generally, Freddie Mac has not published a corporate sustainability report as of the date of this opinion.

The governance of proceeds outlined in the framework is sound and transparent. There is a clear definition and process for selecting eligible investments. A formal procedure for confirming eligibility has been established for the Homes with Renewable Energy project category; this involves checks on the collateral files by Freddie Mac Single-Family and photo verification of the installed renewable energy systems by the mortgage seller/originators. For “Homes with Energy Efficiency,” each property’s HERS Index Score must be checked via RESNET’s database, but there is no formalized procedure for doing so—Freddie Mac Single-Family informs us that it is working on this. Beyond the eligibility criteria and insurance requirements mentioned above, there are no further sustainability criteria required for mortgages to be eligible, e.g. pertaining to life-cycle impacts, supply chains, or climate resilience.

Freddie Mac Single-Family will report on the use of proceeds by publishing security and loan-level data on its website for each of its green MBS and the securitized mortgages. However, its framework does not specify that it will publish the allocation of proceeds to the project categories; Freddie Mac Single-Family has clarified that it expects its reporting to outline the type of collateral included but that it has not yet determined the exact metrics and level of detail it will provide. The framework does indicate that Freddie Mac Single-Family will report on environmental impacts, but does not list specific indicators that it will use to report on impacts. Freddie Mac Single-Family has clarified that this will eventually include data such as avoided emissions, but that it is still determining the specific details that will be reported. Further, Freddie Mac Single-Family shared that it has not yet established the mechanism by which it will collect impact data.



The overall assessment of Freddie Mac’s governance structure and processes gives it a rating of **Fair**.

Strengths

The framework supports investment in new and existing homes with installed renewable energy systems, which are a key aspect of improving the net zero readiness of residential buildings, helping to align the US housing stock’s energy usage with a 1.5-degree climate scenario. Allowing consumers to use mortgage proceeds to pay for or refinance renewable energy systems helps them overcome the barrier of upfront costs. Consumers’ alternative would be to finance renewable energy systems with personal loans or through leasing arrangements, which could be inaccessible or very expensive if consumers do not have high enough credit ratings.

Similarly, the framework supports the construction of new energy efficient homes, which is also an important step towards aligning the US housing stock’s energy usage with a 1.5-degree climate scenario provided their level of energy efficiency is sufficiently high (see pitfalls). Further, by indirectly incentivizing homebuilders to commission a HERS rating, Freddie Mac Single-Family will indirectly contribute to the development of a database on energy efficiency standards that can be used to inform future reporting. Such data could also further support research that informs the development of further initiatives to incentivize energy efficiency improvements, as exemplified by Freddie Mac Single-Family’s white paper on energy efficiency.

Weaknesses

There are no material weaknesses perceived at this time.



Pitfalls

Freddie Mac Single-Family's framework could use additional details on its future approach to proceeds and impacts reporting. Although it has clarified to us that it intends to outline the types of collateral included in its green MBS, which we interpret as allocation across project categories, and that it intends to report on impacts like avoided emissions, it has not committed to providing these details by specifying them in the framework. Freddie Mac Single-Family has also shared it is consulting CBI and ICMA best practices as it develops its reporting approach; this is positive and we encourage Freddie Mac Single-Family to align its reporting with such best practices.

Given the long useful life of buildings, all new construction must be state-of-the-art and zero-carbon-ready by 2030 in order to align with a 1.5-degree climate scenario. According to the US Department of Energy, net zero ready homes have HERS Index scores in the low to mid-50s.²⁹ Overall, the required HERS Index Score of 60 for "Homes with an Energy Efficiency Rating" means that this project category does not support an ambitious enough level of energy efficiency to support a 1.5-degree future.

The required HERS Index Score does not improve upon the US average score for HERS-rated homes, which was 58 for nearly 300,000 homes rated during 2020, according to RESNET analysis.³⁰ The same analysis also indicates that since 2013, the average HERS Index score has come down by five points.³¹ The framework will likely have limited impact in terms of improving the energy efficiency of newly built HERS-rated homes in the US.

Instead, the potential for impact depends on the extent to which the required HERS Index Score represents an improvement in energy efficiency over the typical newly built home. This in turn depends on the states in which the mortgaged properties are located and the energy efficiency of residential building codes in each state. US DOE analysis³² indicates that US states' adoption of IECC standards in residential building codes lags the IECC's three-year updates, which happen every three years.³³ The US DOE has also analyzed the energy efficiency of 39 states' building codes and compared them to the 2006 IECC code, finding that 38 states had codes which are <40% more energy efficient than the 2006 IEC.³⁴ In other words, the framework's required HERS Index Score of 60 would represent an improvement upon residential building codes in at least these 38 US states, with a median improvement of around 24% and a range of 10% to 38%. It is however a pitfall that the impact of the framework in these states is potentially constrained by the number of newly built homes with a HERS rating. In this respect, impact will also depend on the future growth of homes with a HERS rating, in addition to the location of the underlying properties. Freddie Mac Single-Family is unable to target investments in specific regions due to its mandate.

As state building codes advance over time, it will be important for Freddie Mac Single-Family to monitor trends in order to maintain and improve its level of ambition. In this regard, it is positive that Freddie Mac Single-Family has committed to reviewing its HERS Index Score threshold every three years to determine if it should be adjusted. This will be important for ensuring that this category of investments continues to generate impact. We also recommend that Freddie Mac Single-Family provide transparency around baselines, e.g. by reporting on average HERS Index Scores and the energy efficiency of state codes where underlying properties are located.

²⁹ <https://www.energy.gov/eere/buildings/doe-zero-energy-ready-home-program-requirements>

³⁰ <https://www.resnet.us/wp-content/uploads/2021-Data-Trends-Report-of-HERS-Rated-Homes.pdf>

³¹ Ibid.

³² <https://www.energycodes.gov/status/residential>

³³ The 2012 IECC is estimated to be 30% more energy efficient than the 2006 version; see https://www.resnet.us/wp-content/uploads/archive/resblog/2014/06/EnergyRatings_FactSheet1_Final.pdf

³⁴ https://www.energycodes.gov/sites/default/files/2021-09/StateLevelResidentialCodesEnergyUseIndex_FY2021Q4.xlsx



The emissions reduction potential of energy efficient homes may be eroded if occupants are wasteful with energy consumption. Further, rebound effects are always a risk that may further erode energy efficiency gains. It is possible that tenants spend a portion of the savings from living in a more energy efficient home to consume more water and energy, or by buying other goods and services with adverse climate and environmental impacts.

As mortgages for new homes are eligible under both project categories, it is possible that the proceeds are used to finance fossil fuel technologies, e.g. gas-fired boilers and central heating systems, that are installed during home construction. As such, these investments may extend the useful life of fossil fuel-based equipment and technology and delay transition to cleaner, lower carbon technology. The likely unintended effect is locking in additional greenhouse gas emissions in the near to mid-term.

While an important renewable energy source, home geothermal energy systems require electric heat pumps for circulating the antifreeze solution and/or refrigerants used for heat transfer. Electricity used for these pumps could come from a fossil fuel intensive grid. Further, refrigerants are made from hydrofluorocarbons (HFCs), which are highly potent greenhouse gases, and leakage would contribute to climate change. Leakage of potentially toxic antifreeze solution is also a potential risk that would contaminate groundwater. Use of climate-friendly refrigerants and non-toxic antifreeze solution is strongly recommended, though it should be noted that the US EPA is moving to regulate HFCs.³⁵

The building sector is particularly vulnerable to the physical impacts of climate change, such as rising sea levels, more frequent and extreme storms, and flooding. Stronger hurricanes in combination with sea level rise in coastal areas, in addition to increases in heavy precipitation and flooding in urban areas, have already been observed and are expected to increase in the US by mid-century across the range of IPCC climate scenarios.³⁶ In this respect we note that Freddie Mac is still in the process of developing its climate risk management framework, and we encourage additional transparency around how Freddie Mac is assessing and mitigating these risks to improve portfolio resilience and better protect its customers, assets, and investors. At the time of this review, Freddie Mac has not measured or reported on greenhouse gas emissions nor set reduction targets for itself or its portfolio. We encourage Freddie Mac to consider including portfolio emissions as a reporting metric in its reporting to investors and to set ambitious emissions reductions targets that are in line with a 1.5-degree climate warming scenario.

³⁵ <https://www.epa.gov/newsreleases/epa-moves-forward-phase-down-climate-damaging-hydrofluorocarbons>

³⁶ https://www.ipcc.ch/report/ar6/wg1/downloads/factsheets/IPCC_AR6_WGI_Regional_Fact_Sheet_North_and_Central_America.pdf



Appendix 1: Referenced Documents List

| Document Number | Document Name | Description |
|-----------------|--|--|
| 1 | Freddie Mac Single-Family Green Bond Framework (August 2021) | Overview of Freddie Mac’s Single-Family Green MBS program |
| 2 | Single-Family Affordable Lending & Access to Credit Appraisal Review Process for Single-Family Green MBS (internal document) | Defines the Freddie Mac process for confirming the presence of solar panels on each property included in each Freddie Mac Single-Family Green MBS issuance |
| 3 | Green MBS Disclosure Procedure 2021 (internal document) | Defines the reporting-related activities that support Freddie Mac’s existing Single-Family Green MBS offering. |
| 4 | Freddie Mac Energy Efficiency White Paper (Oct 2019) | Outlines findings from a Freddie Mac Single-Family study of how energy efficiency ratings impact housing prices. |
| 5 | Unravelling Perceptions of Flood Risk: Examining Changes in Home Prices in Harris County, Texas in the Aftermath of Hurricane Harvey (Sept 2020) | Outlines findings from a Freddie Mac Single-Family study of how awareness and perceptions of flood risk impact housing prices. |



Appendix 2: About CICERO Shades of Green

CICERO Green is a subsidiary of the climate research institute CICERO. CICERO is Norway's foremost institute for interdisciplinary climate research. We deliver new insight that helps solve the climate challenge and strengthen international cooperation. CICERO has garnered attention for its work on the effects of manmade emissions on the climate and has played an active role in the UN's IPCC since 1995. CICERO staff provide quality control and methodological development for CICERO Green.

CICERO Green provides second opinions on institutions' frameworks and guidance for assessing and selecting eligible projects for green bond investments. CICERO Green is internationally recognized as a leading provider of independent reviews of green bonds, since the market's inception in 2008. CICERO Green is independent of the entity issuing the bond, its directors, senior management and advisers, and is remunerated in a way that prevents any conflicts of interests arising as a result of the fee structure. CICERO Green operates independently from the financial sector and other stakeholders to preserve the unbiased nature and high quality of second opinions.

We work with both international and domestic issuers, drawing on the global expertise of the Expert Network on Second Opinions (ENSO). Led by CICERO Green, ENSO contributes expertise to the second opinions, and is comprised of a network of trusted, independent research institutions and reputable experts on climate change and other environmental issues, including the Basque Center for Climate Change (BC3), the Stockholm Environment Institute, the Institute of Energy, Environment and Economy at Tsinghua University, the International Institute for Sustainable Development (IISD) and the School for Environment and Sustainability (SEAS) at the University of Michigan.

