



GREEN AFFORDABLE HOUSING FINANCE

INSTRUMENT ANALYSIS
SEPTEMBER 2022



Driving Sustainable Investment

Green Affordable Housing Finance

LAB INSTRUMENT ANALYSIS

September 2022

DESCRIPTION & GOAL —

A two-pronged Guarantee Facility and supporting Enabling Environment Facility that unlock local finance for the construction and ownership of green affordable homes, facilitating a self-sustaining housing finance ecosystem.

SECTOR —

Sustainable Cities

FINANCE TARGET —

USD 15 million pilot funded by concessional and donor capital to mobilize over USD 48 million in local, private loans. Expected long-term mobilization of over USD 400 million in private construction and mortgage lending.

GEOGRAPHY —

Pilot: Kenya

Scale-up: Nigeria, Uganda, India & Pakistan

The Lab identifies, develops, and launches sustainable finance instruments that can drive billions to a low-carbon economy. The 2022 Lab cycle targets four thematic areas: sustainable food systems, nature-based solutions, zero-carbon buildings, and adaptation, in addition to three geographic regions: Brazil, India and Southern Africa.

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SUMMARY

Demographic trends in Africa and Asia will necessitate massive investment in new housing construction as the number of people living in sub-standard housing continues to grow, resulting in a global housing gap of approximately 300 million homes by 2030. This housing gap represents a multi-trillion-dollar investment opportunity in an untapped market for affordable housing.

However, as buildings currently account for 37% of energy related greenhouse gas emissions globally, it is imperative that this housing gap is met with homes which are more sustainable than those which exist today to avoid the worst consequences of climate change. Despite this, a lack of access to finance for developers and prospective homeowners constrains the construction of affordable homes, while climate-smart buildings have yet to penetrate the mainstream.

Green Affordable Housing Finance aims to support the development of robust and self-sustaining housing finance ecosystems through its Guarantee Facility and Enabling Environment Facility, which efficiently leverage concessional finance to catalyze lending by local financial institutions into the value chain for green affordable homes. The instrument will be piloted in Kenya in 2023 before expanding throughout Sub-Saharan Africa and South Asia.

The proposed instrument addresses the Lab's four endorsement criteria:

- **Innovative:** Deployment of construction and mortgage loan guarantees to local financial institutions is unique in addressing a coordination problem between supply and demand-side actors.
- **Financially Sustainable:** Integration of alternative credit assessment technology into guarantee criteria enables the instrument to price risk more effectively than the market, allowing fee revenue to exceed net payouts on guaranteed loans.
- **Catalytic:** Guarantee finance to spur local, private-sector construction and mortgage lending into an untapped multi-trillion-dollar global market for affordable housing.
- **Actionable:** The proponent, Reall, has over ten years of experience deploying construction loans for affordable housing in the instrument's target markets. In advance of pilot launch in Kenya, Reall and its alternative credit assessment partner, Syntellect, are in the process of scaling operations in Kenya.

Next steps: The next steps in the development process are to fundraise and launch a country-specific Enabling Environment Facility in Kenya, identify and secure agreements with Guarantee Facility implementation partners in preparation for launch in Kenya, and establish a legal structure for the pilot that will also allow for replication in other countries.

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CONTEXT

Expanding access to green affordable housing is needed to meet climate goals and the Sustainable Development Goals while representing a major market opportunity.

Rapid urbanization and population growth will require the development of approximately 300 million new homes globally by 2030 (World Bank 2016). Additionally, almost 30% of urban households globally live in sub-standard housing characterized by non-durable construction materials, overcrowding, insecure tenure, and a lack of access to safe drinking water and sanitation. Substandard housing also intersects with climate risk to compound impacts on the poor. In Sub-Saharan Africa, the share of urban households living in sub-standard housing rises to over half (UN Habitat 2022). Although the rate of homes in sub-standard urban housing is expected to fall to 25% by 2030 given current housing development trends, urban population growth is set to outpace these gains, leading to an increase in the absolute number of households lacking decent housing (UNSD 2022).

Currently, buildings account for 37% of energy related GHG emissions globally (UNEP, 2021), resulting from both the embodied energy in construction materials and emissions from energy use in existing buildings. Adopting green building strategies which reduce greenhouse gas (GHG) emissions from housing is therefore necessary to meet the goals set out under the Paris Agreement. Well-built, energy- and water-efficient housing can also help households adapt to climate-linked disasters, including extreme heat, flooding, drought, and tropical cyclones, while secure tenure and low energy bills provide a route to long-term financial independence and resilience (Relf 2018, Nwadike et al. 2019, and Caron et al. 2014).

Green building certifications can support design and construction practices that reduce embodied energy and increase energy efficiency, thereby reducing household energy expenditures.¹ The International Finance Corporation's Excellence in Design for Greater Efficiencies (EDGE) certification is the industry standard for green building certification in emerging markets. EDGE certification requires that building designs reflect improvements of at least 20% in energy efficiency, water efficiency and embodied energy. Designs with energy savings of at least 40% are eligible for EDGE Advanced certification, while those reporting actual energy use and incorporating renewable energy or carbon offsets to achieve 100% energy savings qualify for Zero Carbon certification.

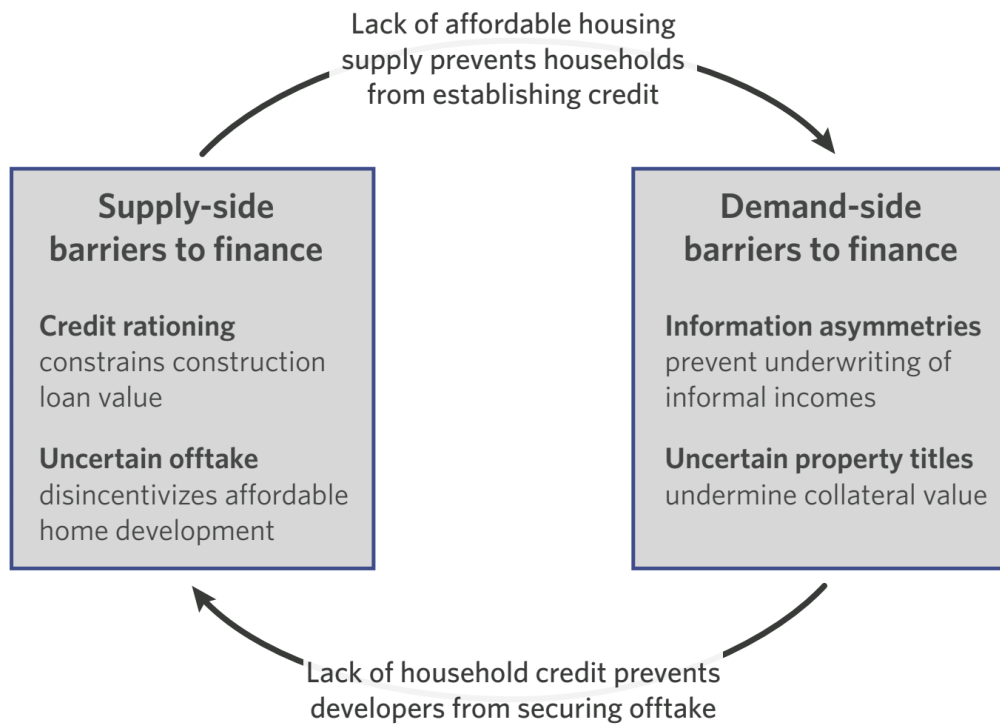
In addition to meeting social and environmental needs, green affordable housing also represents an estimated global investment opportunity of USD 15.7 trillion, of which USD 510 billion is in Sub-Saharan Africa and USD 1.5 trillion is in South Asia (IFC 2019). Despite this opportunity, a lack of access to finance constrains both the supply of green homes from developers and demand from households, particularly those with low or informal incomes. The lack of end-user finance, especially the low utilization of mortgages, further exacerbates the housing supply shortfall as offtake risk prevents developers from undertaking projects targeted at lower-income households. This chicken-and-egg problem leads to several negative effects:

- **Local financial institutions overlook borrowers with low and informal incomes**, missing out on a significant market opportunity and constraining offtake for housing developers

¹ Energy and water costs are a significant financial burden on lower income households, which spend up to 40% of their incomes on water and electricity, compared to 5% for high income households (World Bank 2016).

- **Housing developers cannot secure conventional financing to scale affordable housing production**, exacerbating the housing shortage.
- **Construction of new units funded using cash advance purchases**, requiring households to save large sums and pushing home ownership out of the reach of most households.
- **Households with low and informal incomes are left to rent informal housing**, resulting in substandard living conditions without access to water, electricity, and sanitation (World Bank 2015).

Figure 1: Barriers to housing finance



CONCEPT

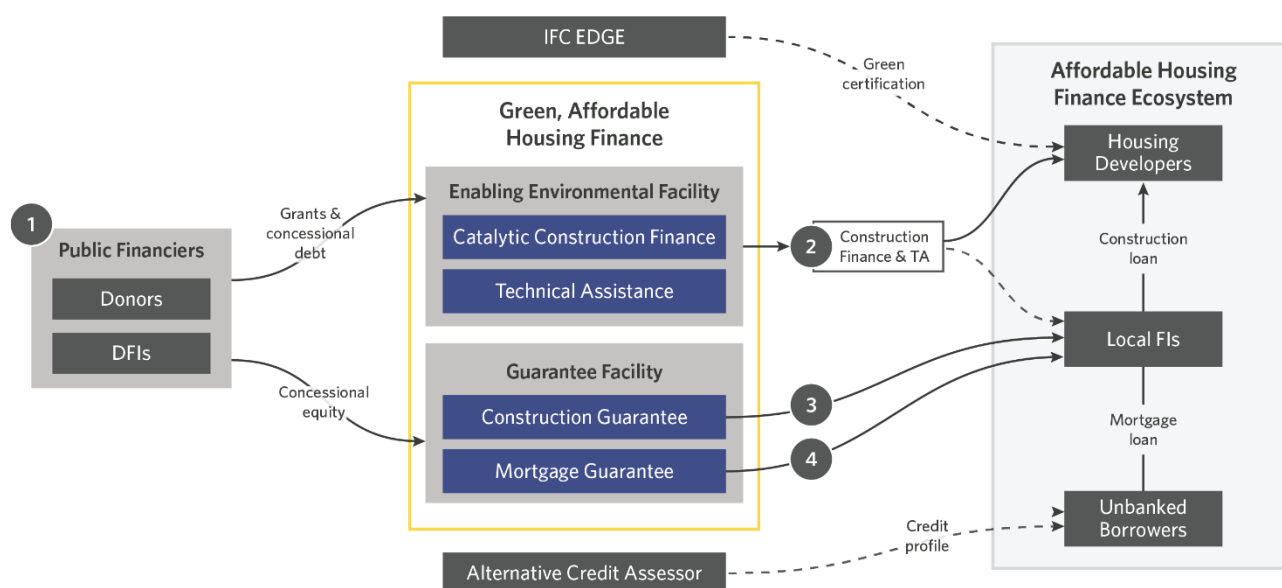
1. INSTRUMENT MECHANICS

Green Affordable Housing Finance deploys decentralized credit enhancement to local financial institutions to catalyze, normalize, and scale private construction and mortgage lending for green, affordable homes

Proposed to the Lab by Reall, Green Affordable Housing Finance (the Instrument) aims to facilitate a self-sustaining affordable housing finance ecosystem by supporting the construction of affordable green homes and the long-term ownership of those homes by households unserved by available housing finance solutions. To do so, it will efficiently leverage public finance to catalyze lending by local financial institutions for the construction of green affordable homes into the rental and ownership markets, while also supporting home ownership by expanding access to mortgages.

1.1 INSTRUMENT STRUCTURE

Figure 2: Instrument mechanics



(1) The Instrument will partner with donors and development finance institutions to capitalize an Enabling Environment Facility (EEF) and a Guarantee Facility. The EEF will be capitalized by non-refundable grants and concessional debt, while the Guarantee Facility will be capitalized using an up-front refundable grant to fund the Kenya pilot, followed by long-term concessional equity to scale operations and enter new markets.

(2) To directly catalyze supply, the Instrument will deploy targeted construction finance and technical assistance through its EEF. The debt raised from development finance institutions (DFIs) will be managed by Reall and re-deployed as construction finance to highly innovative local developers at concessional rates to spur construction of high-impact green home designs which are affordable for the bottom half of the income distribution.²

² Construction finance support provided through both the EEF and Construction Guarantee will support development of units available for rent, tenant purchase (TPS), and mortgage offtake.

Grants for the EEF will be used to further support these efforts by funding technical assistance (TA) to inform, influence and broker necessary connections between local stakeholders to build a long-term, self-sustaining ecosystem for the construction of green homes. Advisory services provided by Reall's team of build environment and sustainable cities specialists will build capacity among local developers in green building techniques in compliance with IFC's EDGE standard. Meanwhile, the EEF will provide support to local financial institutions' around the integration of alternative credit assessments, enabling them to underwrite households with low and informal incomes.³

Finally, the Instrument will collate and disseminate data on green building performance and mortgage repayments, building out the evidence base essential for further scale and impact. As an investor and innovator in climate-smart affordable housing in urban Africa and Asia, Reall is well positioned to efficiently operate both the technical assistance and construction lending components of the EEF. Reall will draw on 30 years' experience in affordable housing across Asian and African cities, including the establishment and growth of a blended finance investment portfolio, green and tech innovation and EDGE-certified housing developments.

(3) The Guarantee Facility provides broad-based support for supply-side housing finance by de-risking construction loans for EDGE-certified green homes. Construction guarantees allow local financial institutions to offload partial credit risk to the Guarantee Facility, thereby enabling increased loan volume while limiting lenders' balance sheet exposure in the event of default. Construction guarantees will be released once loans are repaid after construction cycles of 6 to 18 months, allowing the Guarantee Facility to recycle capital and increase private finance mobilization. By providing guarantees to local financial institutions, the Instrument aims to increase the availability of capital for green affordable home construction by incentivizing local lenders to gain comfort with green building technologies and deepen relationships with affordable housing developers. Beyond alleviating the acute need for near-term construction finance, this broad-based approach supports the Instrument's long-term strategy of supporting a self-sustaining and locally driven housing finance ecosystem.

(4) In parallel, the Guarantee Facility will stimulate demand for affordable green homes by guaranteeing mortgages for borrowers with low and informal incomes. By enhancing credit of low and informal income borrowers, the Guarantee Facility will allow lenders to increase loan volume by expanding into an untapped market while minimizing downside risk. Mortgages backed by the guarantee facility will be issued via a deed of trust, whereby home titles will be held with a trustee before transferring to the borrower upon repayment. Mortgage guarantees will then be released once loans have become sufficiently de-risked as mortgage amortization reduces loan-to-value ratios (LTV). Mortgage guarantees are underpinned by an alternative credit assessment platform that uses conventional data (e.g., bank statements, credit records) and unconventional data (e.g., demographic information, residence stability, geotagged photos) to evaluate both formal and informal incomes.⁴ As with the construction guarantee, the mortgage guarantee supports the development of a long-term housing finance ecosystem by allowing lenders to gain confidence in a new class of borrowers.

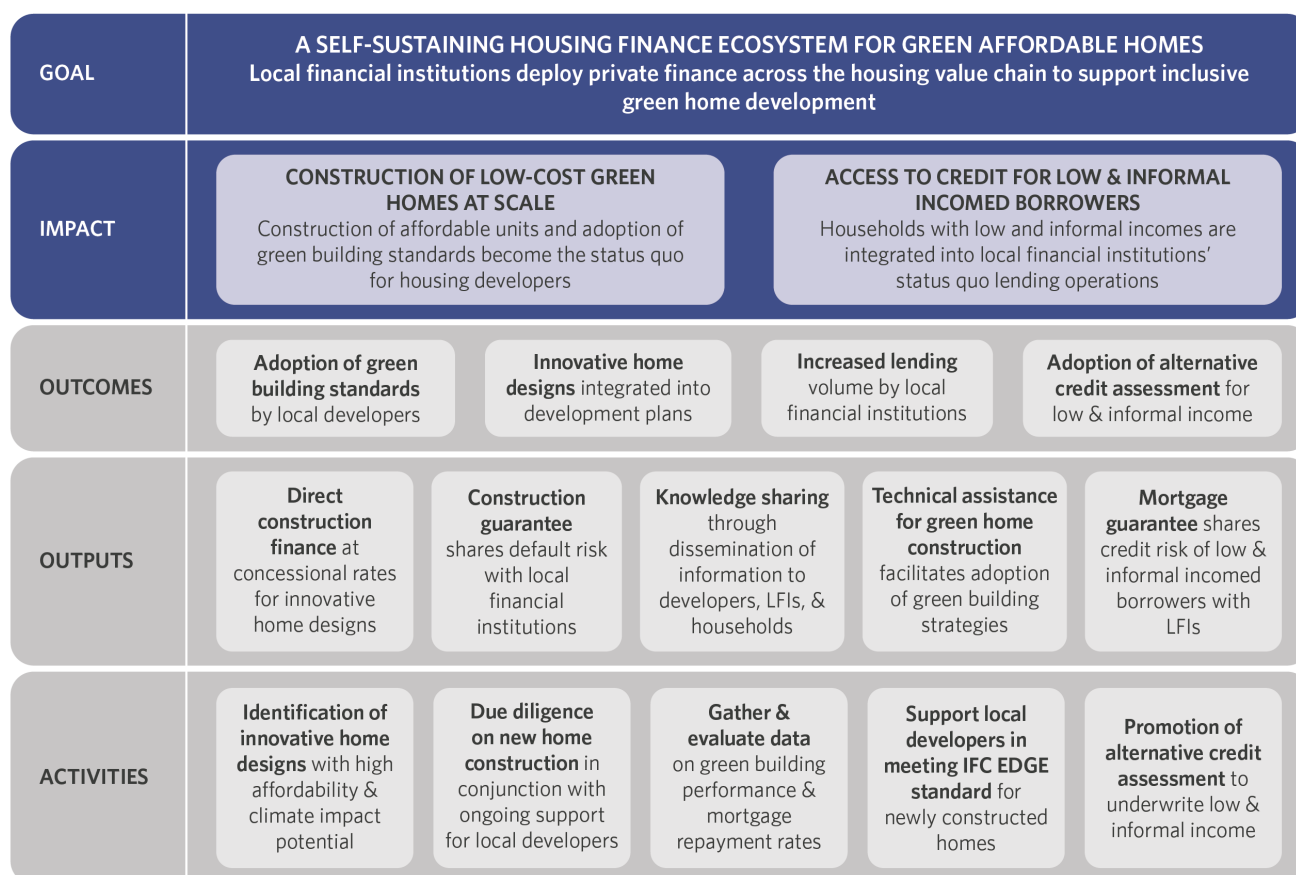
³ The Instrument will leverage alternative credit assessment software developed by Reall's partner, Syntellect. Syntellect is in process of launching RightProfile with partner banks in Kenya.

⁴ Credit profiles generated using the RightProfile tool can also be leveraged by property managers to assess creditworthiness of prospective tenants.

1.2 THEORY OF CHANGE

The combined deployment of technical assistance and direct construction finance via the EEF alongside construction and mortgage guarantees via the Guarantee Facility provides a value chain approach to accelerating the development of a self-sustaining housing finance ecosystem.

Figure 3: Theory of Change



2. INNOVATION

Coordinated deployment of construction and mortgage loan guarantees address the chicken-and-egg problem constraining housing finance supply and demand

2.1 BARRIERS ADDRESSED: INTERLINKED BARRIERS TO SUPPLY AND DEMAND FOR GREEN HOMES REQUIRE AN END-TO-END SOLUTION

The market for green, affordable homes is constrained by a lack of finance across the value chain. Crucially, low- and informal-income populations lack the credit required to secure housing finance, thereby constraining demand for affordable homes. Lacking demand, housing developers are disincentivized from constructing affordable homes, further limiting supply, and preventing vulnerable populations from establishing formal payment histories used in traditional credit assessments. The below table summarizes these and other barriers currently constraining affordable housing finance in the target markets, as well as the strategies deployed to overcome each barrier.

Table 1: Barriers Addressed

Barrier	Description	Strategy
Housing Supply Barriers		
Lack of familiarity with green buildings	Green building techniques and technologies are underutilized in Kenya and other African and Asian markets, resulting in uncertainty regarding building quality and perceptions that green buildings are more costly than conventional alternatives.	The EEF operated by Reall will provide TA to housing developers, facilitating the adoption of green building techniques and ensuring that quality standards are met. Data gathering and knowledge sharing will reduce perceptions of heightened costs.
Credit rationing	Construction lenders avoid risk by constraining maximum loan sizes relative to total construction costs. ⁵ This lack of available debt finance increases developer reliance on presales and limits the scale and pace of home construction.	By guaranteeing 40-50% of principal and interest lost in the event of default, the Guarantee Facility will enable lenders to increase the proportion of project costs being financed without bearing increased risk.
Uncertain offtake	Unwillingness of lenders and property owners to underwrite borrowers with low and informal incomes limits offtake to a fraction of the total population, disincentivizing developers from scaling operations and building affordable homes.	Mortgage guarantees for borrowers with low and informal income expands offtake for affordable homes. Adoption of alternative credit assessment by rental and tenant purchase scheme (TPS) property managers further expanding offtake.
Housing Demand Barriers		
Information asymmetries	Reliance on formal paystubs used in traditional credit assessment methodologies results in a high perceived credit risk for informal sector workers, making most households unratable.	The alternative credit assessment platform deploys machine learning to assess the creditworthiness of borrowers with informal incomes, enabling the Guarantee Facility to bear the associated credit risk.
Administrative and legal risks	Mortgage lending is constrained in the Instrument's target markets due to the administrative and legal challenges associated with title surety and monetizing collateral in the event of foreclosure.	By guaranteeing construction loans prior to eventual mortgage loans, the facility will have unique insight into the land title dynamics for each underlying asset in its mortgage guarantee portfolio, mitigating risks associated with land title disputes. To mitigate risks associated with foreclosure, all loans guaranteed by the facility will be structured as "deeds of trust," whereby a trustee will hold property titles for the guarantee term.

⁵ In Kenya, for example, local lenders are willing to lend against only ~60% of hard construction costs, necessitating that developers contribute ~50% equity at the project level (Shah, 2019)

2.2 INNOVATION: TWO-PRONGED GUARANTEE PROVIDES HOLISTIC HOUSING FINANCE SOLUTION

Green Affordable Housing Finance's core innovation lies in its capacity to incentivize local lenders to finance both construction of affordable green homes and the purchase of those homes by households with low and informal incomes. It does this through the coordinated deployment of construction and mortgage loan guarantees which support supply-side and demand-side housing finance simultaneously and proportionately. In doing so, the instrument aims to build the foundation for an eventual self-sustaining housing finance ecosystem for climate-smart, affordable homes by catalyzing private sector lending into the nascent affordable housing sector.

Unlike alternative guarantee products, the Instrument's Guarantee Facility is intentionally decentralized, deploying a broad-based guarantee product to local financial institutions. Rather than enhancing the credit of individual developers on a one-off basis, the approach centers around local financial institutions to directly address the upstream barriers to affordable housing finance. By incentivizing local financial institutions to scale up their lending, the instrument aims to catalyze – and ultimately normalize – construction and mortgage lending for climate-smart, affordable homes.

Underpinning the instrument is its integration of an alternative credit assessment platform into the mortgage guarantee model. By digitizing alternative data sources on informal incomes and leveraging machine learning, lenders can rate the creditworthiness of borrowers more holistically than using conventional methods, which rely on paystubs and formal credit histories. This enables the Guarantee Facility to share mortgage credit risk with local lenders while maintaining a cost-effective fee structure.

Beyond evaluating household creditworthiness for mortgage lending, property managers can also leverage alternative credit assessments to assess low and informal income households' ability to afford monthly rental payments, allowing them to secure housing via rental and tenant purchase scheme (TPS) agreements. In addition to improving demand-side access to housing finance, adoption of alternative credit assessments by mortgage lenders and property managers also mitigates offtake risk for local developers.

Meanwhile, green-certified home construction guarantees issued by the Guarantee Facility alleviate the credit risk that local construction lenders bear, improving developers' access to construction finance. Together, the reduced offtake risk and improved access to finance facilitated by the instrument will enable local developers to scale up and enter the untapped market for affordable housing.

To ensure that the market for affordable housing develops in an environmentally just and sustainable way, the EEF will deploy direct construction finance and technical assistance to spur the development of innovative new home designs with high affordability and climate impact potential. Operating at the intersection of housing supply and demand, the EEF is well positioned to gather and disseminate information on long-term green building performance to spur continued innovation in green building design.

2.3 CHALLENGES TO INSTRUMENT SUCCESS

The table below presents a summary of the challenges faced by Reall in implementing and scaling the Guarantee Facility.

Table 2: Implementation Challenges and Mitigation Strategies

Challenge	Management Strategy
<p>High mortgage default rates: Despite being available for only high-income borrowers, mortgages in Kenya are characterized by high default rates. Meanwhile, the strategy for mitigating credit risk of low and informal income borrowers relies on two as yet unproven hypotheses: (i) the alternative credit assessment platform will accurately assess borrower risk, and (ii) utility savings reductions associated with increased energy efficiency will improve the creditworthiness of borrowers.</p>	<p>Reall's credit assessment partner, Syntellect, has an established track record in the Indian market and will have launched in Kenya prior to issuance of the first guarantees.</p> <p>Though not yet proven in the African context, there is evidence suggesting that energy efficiency can reduce probability of default in developed countries (EC 2021).</p> <p>The instrument will maintain a conservative 1:1 leverage ratio for three years of the pilot.⁶</p>
<p>Lack of developer track-record: Systemic underdevelopment of affordable homes to date has constrained housing developers' ability to establish credit histories, constraining uptake of construction guarantees.</p>	<p>The EEF is positioned to deploy direct construction finance to new, innovative housing developers, allowing them to develop operating track records and credit histories.</p>
<p>Local financial institutions' lack of long-term funds: Banks lack sufficient long-term deposits to scale issuance of long-term mortgages, constraining uptake of mortgage guarantees.</p>	<p>The instrument will leverage existing programs that offer refinance solutions for subsidized mortgage lending (e.g., KMRC in Kenya and NMRC in Nigeria)</p>
<p>Moral hazard: The instrument relies on LFI's capacity to monetize collateral and recover funds in the event of a default. Local financial institutions may de-prioritize guaranteed loan recovery as exposure to loss is limited.</p>	<p>Construction and mortgage guarantees will be capped at 50% and 60% of total loan value, respectively.</p> <p>Pari-passu structure aligns' incentive of lenders with those of the Instrument.</p>
<p>Land tenure: Difficulties sourcing and registering title to viable development sites may constrain supply of new developments, while difficulty registering titles for individual units may constrain mortgage demand</p>	<p>TA deployed by the EEF will assist developers in conducting due diligence on prospective sites and engaging with local government officials.</p> <p>Promotion of alternative credit assessments for rental and TPS offtake further supports demand for affordable units.</p>
<p>High materials and land costs: Mismatch between home prices and households' incomes limits affordability impact.</p>	<p>Increased access to construction financing will enable economies of scale, reducing cost of locally sourced green materials in line with EDGE certification standards.</p>
<p>Lack of public transport: Locations with land prices low enough to meet the Instrument's affordability impact goals have limited access to jobs and education.</p>	<p>The EEF will work developers to lower construction costs to the greatest extent possible, offsetting high land prices in areas with access to public transport.</p>
<p>Collateral monetization risk: Legal and regulatory structures make monetizing collateral challenging in the event of default.</p>	<p>Deed of trust mortgage structure requires that formal deeds be held by a trustee prior to loan repayment, easing the foreclosure process.</p>
<p>High operating and transaction costs: Up-front diligence and ongoing monitoring costs may further erode already lean margins, limiting financial sustainability.</p>	<p>EEF provides embedded monitoring capacity for new construction.</p> <p>The Guarantee Facility strategy of backing both construction loans and mortgages allows the instrument to underwrite the same collateral twice, minimizing due diligence costs.</p>

⁶ Guarantee leverage ratio refers to the value of outstanding guarantee liability divided by the cash and equivalents available to issue guarantee pay-outs.

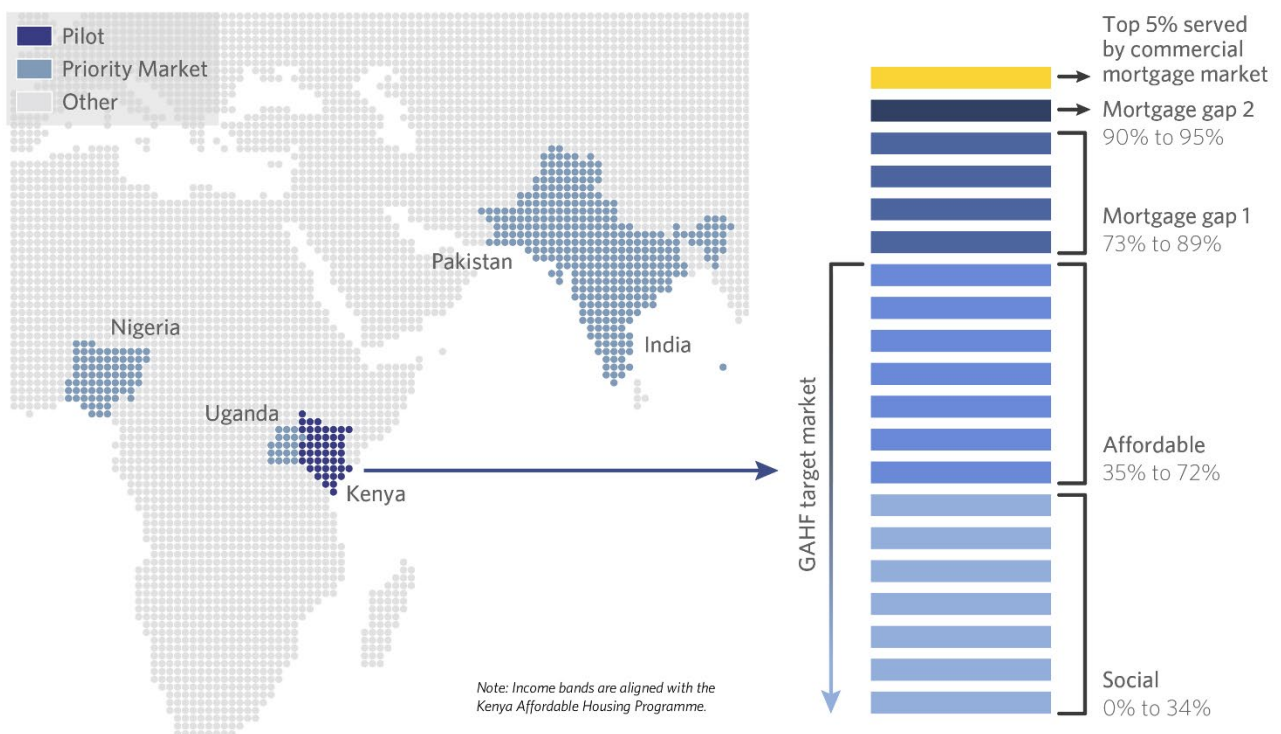
MARKET TEST AND BEYOND

3. IMPLEMENTATION PATHWAY AND REPLICATION

Pilot implementation in Kenya lays groundwork for future scale in Reall's priority markets across Sub-Saharan Africa and South Asia

Reall intends to pilot the instrument in Kenya before expanding to its additional markets in Sub-Saharan Africa and South Asia where Reall has an existing presence and relationships with local developers. The instrument will target new markets facing similar market dynamics as Kenya, including small or non-existent green building industries, low mortgage uptake, large informal economies, and a pathway to alternative credit assessment adoption by local financial institutions.

Figure 4: Market Segmentation & Target Geography



3.1 PILOT CONTEXT

Kenya is a microcosm of the global challenges and opportunities which characterize the market for climate-smart affordable homes. Kenya has a housing shortage of 2 million housing units growing by approximately 200,000 units per year. Nearly half of the urban population lives in substandard housing, as only 14% of all households can afford the cheapest available formally built home (Reall 2022). The utilization of mortgage finance is very low, with just 27,993 mortgages outstanding in 2019, representing just 0.7% of properties. Further, mortgage affordability bands defined by Kenya's Affordable Housing Programme (AHP) indicate that mortgage finance is only affordable for households in the top 5% of the income distribution, as shown in Figure 4. As a result, urban homeownership rates are also low – just 21.3% of urban households own their own home.

The Kenyan government has recognized this challenge and implemented two major initiatives to expand access to affordable housing and mortgage finance, the Kenya Mortgage Refinance Company (KMRC) and Boma Yangu. Established in 2018, KMRC refinances local financial institutions at concessional rates that originate mortgages with lower interest rates and longer loan terms. Boma Yangu works alongside KMRC to aggregate demand from households with formal employment and links them to privately developed projects that meet certain design and price criteria, supporting financing through salary deductions that capitalize a Housing Fund (Boma Yangu 2022).

Three key factors limit these initiatives. First, KMRC and Boma Yangu are demand-side initiatives that are not designed to directly address the lack of construction finance, leaving the housing construction pipeline as a limiting factor. Second, local lenders' inability to systemically underwrite informal incomes largely constrains the reach of both initiatives to the 17% of households with formal employment (Reall 2022). Finally, KMRC does not bear credit risk and requires that loan-to-value ratios (LTVs) be no higher than 90% for refinancing eligibility. As a result, the local mortgage market has yet to materialize as planned. After KMRC disbursed KES 2.75 billion in 2020, disbursements fell to KES 1.7 billion in 2021, leaving KMRC with almost KES 7 billion in cash and equivalents and over KES 30 billion in undrawn capital commitments from the World Bank and AfDB at the end of 2021 (KMRC 2022).

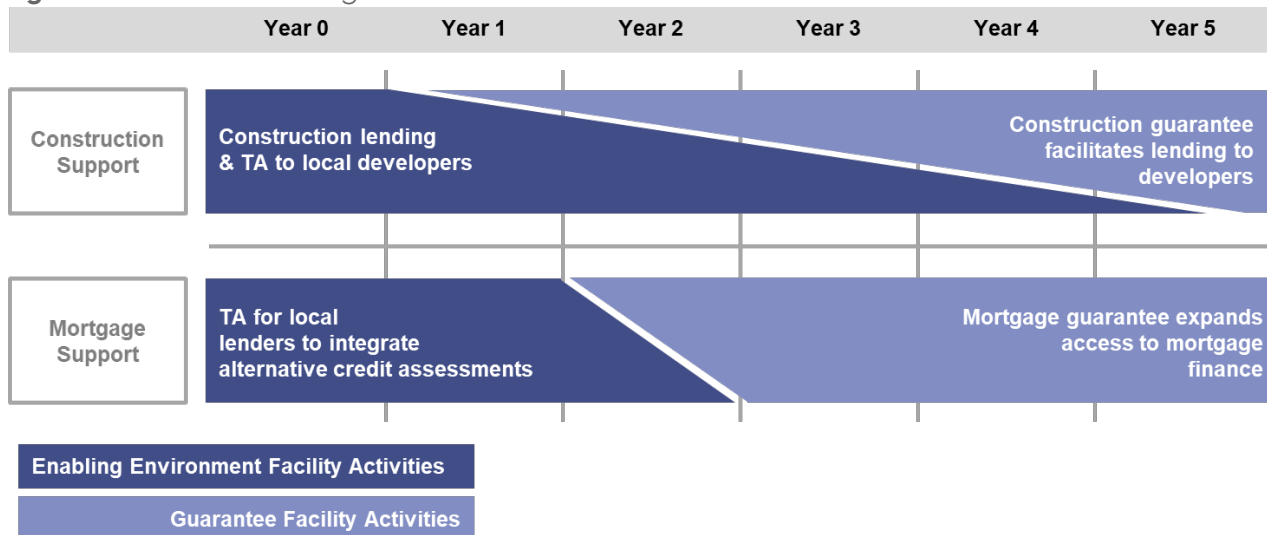
3.2 PILOT IMPLEMENTATION AND SCALE-UP

Though applicable across Reall's priority markets, Green Affordable Housing Finance has been specifically designed for a successful pilot launch within the Kenyan context. It is positioned to alleviate credit risk for lenders and incentivize mortgage origination with loan-to-value ratios below 90% prior to eligibility for refinancing by KMRC. The pilot will support construction loans and mortgages for new one- to three-bedroom homes with sales prices ranging from KES 0.7 million to KES 3.5 million (USD 6k to USD 30k), 20% to 80% cheaper than the average price of similarly sized homes in the Nairobi metro area.⁷

Laying the groundwork for a successful launch of its Guarantee Facility, Reall will deploy direct construction finance and technical assistance to developers and lenders via its Enabling Environment Facility (EEF). With continued EEF support, local developers will continue to strengthen both their credit history and their track record of green, affordable home development over the duration of the pilot period. The direct support provided by the EEF paired with credit enhancement offered by the Guarantee Facility will enable local lenders to extend increasing lines of credit to local developers for the duration of the pilot period. Meanwhile, the EEF will support local lenders' integration of the alternative credit assessment platform, enabling mortgage lending to low and informally incomeed borrowers beginning in the second year of the Guarantee Facility's operations.

⁷ Calculated using an average price per square meter of KSH 103k for apartment-style homes in the Nairobi metro area (Cyttonn 2021)

Figure 5: Pilot launch timing



All homes supported by the instrument during the pilot phase will be affordable for purchase by households identified as lacking access to mortgage finance by the Kenyan Affordable Housing Programme (AHP), as shown in Figure 4 above. The total addressable mortgage market for this population is approximately 2.6 million urban households (Shah 2019). Of the homes supported during the pilot phase, 60% will be affordable for purchase by households with incomes ranging from the 35th income percentile to the 72nd percentile.⁸ The remaining units will be affordable for purchase by middle- to upper-middle income groups who lack access to mortgage finance as defined by the Kenyan AHP, thus allowing for cross-subsidization of units for lower income households.⁹

Due to the nascency of the Kenyan mortgage market, the majority of new homes supported during the pilot phase are expected to be filled by rental and TPS offtake. All rental units supported by the Instrument will be affordable for households in the bottom 72% of the income distribution, including units which will be affordable for rent by households in the bottom 34% of the income distribution.

Upon scale-up, the instrument will phase out support for units targeting middle- to upper-middle income households as informal income underwriting becomes increasingly normalized and the mortgage market begins to mature. The Instrument’s long-term operations will therefore support homeownership of increasingly innovative and high-impact units at the frontier of green affordable housing.

Once proven in Kenya, the structure is replicable across Reall’s priority markets, following a similar trajectory: First, launching a country-specific Enabling Environment Facility to support both developers’ early operations and local financial institutions’ integration of the alternative credit assessment platform their underwriting systems. Second, expansion of the Guarantee Facility into the country to de-risk construction and mortgage lending by local financial institutions.

⁸ Households with incomes ranging from the 35th to the 72nd percentiles comprise the AHP’s “Affordable” housing market, as shown in Figure 4

⁹ Households with incomes ranging from the 73rd to the 95th percentiles comprise the AHP’s “Mortgage Gap” housing market, as shown in Figure 4

4. FINANCIAL IMPACT AND SUSTAINABILITY

4.1 QUANTITATIVE MODELING

The Lab conducted illustrative financial modeling of the Green Affordable Housing Finance Guarantee Facility in Africa over a 15-year time horizon to demonstrate the level of capital investment required for pilot launch in Kenya and scale-up in Reall's priority African markets and the potential to catalyze local lending. As the goal is to accelerate the development of a self-sustaining housing finance ecosystem driven by local financial institutions, the instrument itself was modeled to maximize lending activity undertaken by local financial institutions to deploy donor and concessional capital using a capital preservation strategy. The five-year pilot phase of the Guarantee Facility is assumed to be wholly capitalized by refundable grants, with concessional equity capitalizing the instrument's scale into new markets.

Construction guarantees issued by the Guarantee Facility are assumed to de-risk [40%] of total construction loan principal and interest on a pari passu basis for assumed construction loan terms of 6 to 188 months. Construction guarantee terms are modeled to alleviate credit rationing by ensuring that LFI's risk-adjusted returns are maintained should default rates rise above the modelled amount. Construction guarantee values and timelines are based on representative 56- and 137-unit housing developments that Reall's development partners have constructed in recent years, details for which can be found in Annex I. Guarantee values are then released upon construction loan repayment, net of guarantee payouts.

After launch of the mortgage guarantee in year two of the pilot, guarantee-backed mortgages are assumed to comprise 20% of total offtake for newly constructed homes before scaling up to 50% of total offtake after five years as adoption of alternative credit assessments increases and the mortgage market matures. Mortgage guarantees are assumed to de-risk 60% of principal value on a pari passu basis until homeowner equity rises to 20% of the initial sales price.¹⁰ Mortgage guarantee terms are modeled to ensure that LFI's are kept economically whole under the baseline default scenario to optimize uptake and increase scale.

Table 3: Summary guarantee assumptions

Base Case Assumptions	Construction guarantee	Mortgage guarantee
Guarantee value (% of loan)	40%	60%
Guarantee origination fee (% of guarantee value)	1.5%	1.0%
Guarantee premium (% of guarantee value)	4%	4%

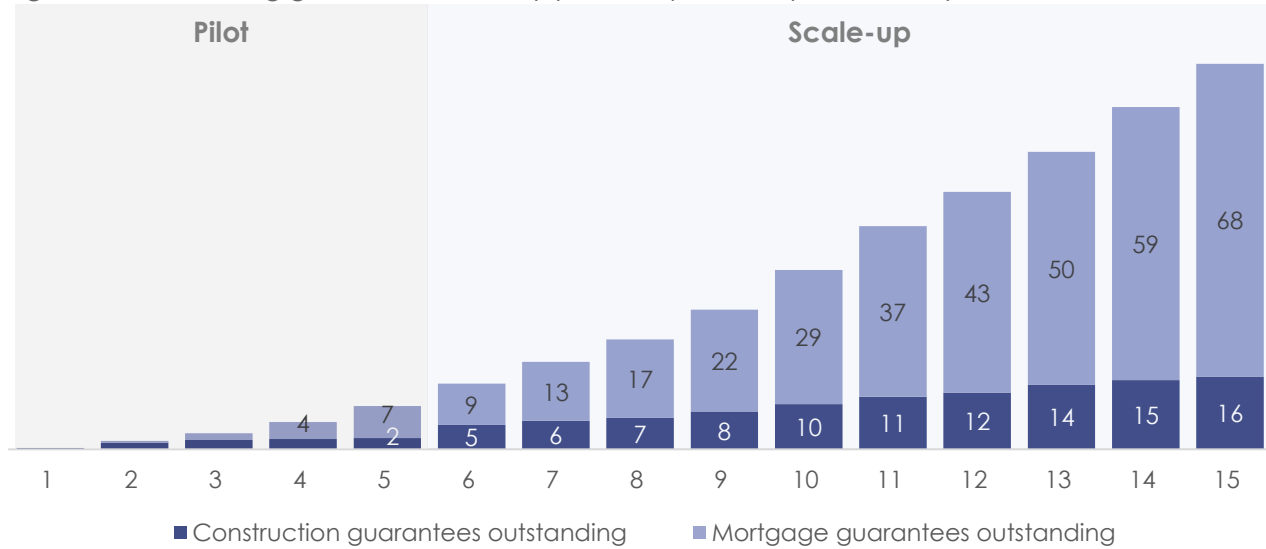
During the pilot phase, construction guarantees are expected to comprise a majority of the instrument's guarantee operations due to a conservative mortgage guarantee rollout timeline and rapid recycling of construction guarantee finance due to short construction timelines. With few construction guarantees outstanding at any given time and limited mortgage guarantee penetration, the instrument will be exposed to portfolio concentration risk during the initial years of the pilot phase. As such the guarantee facility will maintain a conservative leverage ratio of 1.0x during the first three years of the pilot, ensuring that maximum guarantee liabilities do not exceed cash on hand.

As the portfolio grows in scale and diversity, guarantee leverage is assumed to grow to a maximum 4.0x ratio by year 6 following the pilot phase, allowing the instrument to gradually

¹⁰ Assumed amortization schedule results in 80% LTV after 9.8 years when calculated using the initial sales price.

scale pilot operations as it establishes a credit history. Following the pilot phase, the instrument is assumed to raise additional concessional equity to fund expansion into new markets while maintaining a 4.0x guarantee leverage ratio in perpetuity.

Figure 5: Outstanding guarantee value by year of operation (USD millions)



To launch the Kenya pilot, the Guarantee Facility will require an estimated USD 1 million of non-refundable grant capital to fund development and start-up costs and USD 4 million in refundable grants to serve as equity capital during the five-year pilot phase. Upon graduation from the pilot phase, the Guarantee Facility will require incremental equity investment of USD 15 million in years 6-15 to expand and stabilize operations across Reall's priority African markets of Nigeria and Uganda.

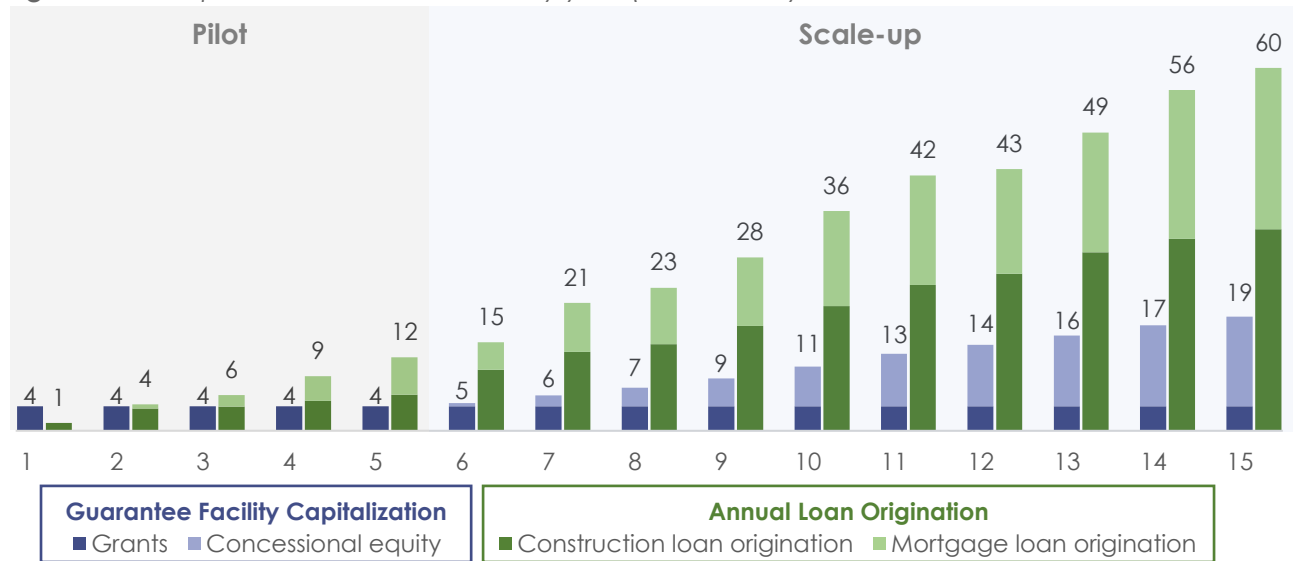
In the model's base case scenario, a maximum of 27% of refundable grant capital is exhausted after year 7 of operations before being fully recovered by year 15 of the modeled term. In this scenario, concessional equity investment made between years 6 and 15 sees an average annual return on equity of 4% in the base case scenario.

4.2 PRIVATE FINANCE MOBILIZATION AND REPLICATION POTENTIAL

The guarantee model efficiently leverages grant and concessional equity to catalyze finance from local financial institutions into EDGE-certified green home construction. Therefore, the Instrument aims to maximize local lending activity while required capitalization from catalytic investors. Once scaled, each dollar of catalytic investment in the Guarantee Facility is expected to mobilize at least 3x its value in *annual* construction and mortgage loan origination, resulting in total private finance leverage of 22x during the modelled period.

During the five-year pilot phase, the Guarantee Facility is expected to mobilize USD 20 million in local construction lending and USD 18 million in local mortgage origination, totaling USD 48 million in lending activity for green, affordable homes. Upon scale-up, the instrument is expected to mobilize a further USD 220 million in construction lending and USD 150 million in mortgage lending across Africa, totaling over USD 400 million in local private finance mobilization during the 15-year modelled period.

Figure 6: Local private loan mobilization by year (USD millions)



Due to their short tenors, construction loans serve as a highly efficient mechanism through which guarantees can mobilize high levels of private finance through rapid redeployment of capital into new projects. As such, construction loans account for 60% of the aggregate loan value guaranteed by the facility over 15 years, despite comprising a minority of total outstanding guarantee value held by the facility in each year following the pilot phase.

5. ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACT

Green Affordable Housing Finance places local developers and financial institutions at the center of a new, sustainable housing finance ecosystem

In providing decentralized guarantee finance to support local stakeholders across the housing finance value chain, the fundamental value proposition of Green Affordable Housing Finance is to support the long-term development of self-sustaining housing finance ecosystems which support local economic growth across Africa and South Asia. If successful, the instrument's impact will extend far beyond the homes directly supported by changing the business-as-usual operations of entire housing finance ecosystems.

Specifically, the instrument will contribute to progress on six sustainable development goals:

1. **No Poverty:** The Instrument will improve access to housing finance and quality housing tenure for communities that the local banking sector has marginalized, increasing climate resilience for the poor through access to energy and water efficient high quality affordable housing.
5. **Gender Equality:** Women often occupy the most vulnerable categories of informal sector work which will be rated using alternative credit assessments. In underwriting these incomes, the Instrument will increase women's access to housing finance and secure tenure.
6. **Clean Water and Sanitation:** The Instrument will expand access to housing with adequate water and sanitation for informal income households and increase the water-use efficiency of homes by a minimum of 20%.

8. **Decent Work and Economic Growth:** The Instrument will foster construction sector job growth among vulnerable communities, expand the market for locally produced construction materials with lower energy footprints, reduce the energy use required to manufacture construction materials, and increase access to construction and mortgage financing.
11. **Sustainable Cities and Communities:** The Instrument will expand access to adequate, safe, and affordable housing and basic services to households with informal incomes, expand access to housing that is resilient to disasters due to quality construction and efficient energy and water use, and reduce the environmental impact of materials used to construct new homes and their operational energy and water use.
13. **Climate Action:** The Instrument will expand access to improved housing for low and informal-income households building their resilience to climate-related disasters through higher quality construction. At the same time, the instrument will reduce greenhouse gas emissions generated from housing through efficient energy and water use. EDGE certification ensures that new buildings will reduce embodied and operating emissions by at least 20% relative to the local baseline construction practices. The support provided by the Instrument will help to strengthen the supply chains for green buildings, easing an industry-wide shift to lower carbon and energy-efficient construction.



5.1 ENVIRONMENTAL IMPACT¹¹

By requiring EDGE certification for all homes supported by the Instrument, the homes produced will have at least 20% less embodied energy and at least 20% higher energy and water efficiency than conventional alternatives. As feasibility and cost effectiveness is demonstrated, the instrument will target energy savings in excess of 40% to secure EDGE Advanced certification. Reall will draw on a depth of experience working with and investing in pioneering climate-smart developers and tech companies across its' portfolio, driving towards net-zero buildings. Proven deployment of green design and materials include passive design features for cooling, cross-laminated timber, low-carbon modular technology, solar energy and water circularity. Conservative environmental impact modeling using specifications from past developments built by Reall's partners implies that the pilot phase will avoid over **8,000 tCO₂** in embodied carbon emissions, reduce energy consumption by **13 GWh** per year through energy efficiency and save **340,000 m³** of water per year through water efficiency relative to conventionally built homes.

The Instrument will also have indirect environmental impacts by mainstreaming green building practices and using EDGE certification, shifting business as usual design and construction practices beyond the developers directly supported by the Instrument. Beyond housing, incorporation of green techniques and technologies into the broader building sector through support for value chains and increased expertise in green construction. The IFC estimates a market opportunity for green commercial construction of USD 258 billion in Sub-Saharan Africa and USD 281 billion in South Asia by 2030 (IFC 2019). This market opportunity could be expanded through the faster adoption of EDGE as a design standard.

¹¹ See Annex II for detailed calculations and methodology

5.2 SOCIAL AND ECONOMIC IMPACT

The modelled the direct social and economic impacts that the Guarantee Facility is expected to have during the Kenya pilot. In total, the Instrument is expected to improve the living conditions for approximately **4,000** households living in newly built homes. Of these households, an estimated **1,380** will have secured first-time homeownership via mortgages backed by the mortgage guarantee, with the remaining **2,620** households living in improved rental conditions. As the instrument scales and the mortgage market matures, the proportion of new homeowners is expected to increase. In addition to the environmental benefits of supporting IFC-EDGE certified green homes, households will realize average annual utility cost savings of **KES 47,000** (or USD 390).

Table 4: Offtake of homes supported by the Kenya pilot by household income

Kenya AHP Category	Social Housing	Affordable Housing	Mortgage Gap 1	Mortgage Gap 2	
Household Income (KSH '000)	0-20	20-48	48-91	91-158	Total
Number of mortgages	-	815	480	85	1,380
Number of rental units	810	1,315	495	-	2,620
Total units	810	2,130	975	85	4,000

Decent affordable housing also unlocks positive social and economic spillover effects, including improvements in health, education, and dignity, creates jobs, and can lead to generational benefits.¹² In total, new housing supported by the instrument will create nearly **20,000 new jobs**.¹³ It will also lead to the wider adoption of alternative credit assessment by local finance institutions, increasing access to credit for informally employed households beyond mortgages.

NEXT STEPS

The next steps in the development process are to fundraise and launch a country-specific Enabling Environment Facility in Kenya, identify and secure agreements with Guarantee Facility implementation partners in preparation for launch in Kenya, and establish a legal structure for the pilot that will also allow for replication in other countries. Total estimated fundraising needs are outlined in Table 5.

Table 5: Pilot fundraising requirements

Capital Type	Use of Funds	Value (USD)
Non-refundable grant	Technical assistance for housing developers and LFI's	2M
Concessional debt	Construction loans for innovative green home designs	8M
Enabling Environment Facility		10M
Non-refundable grant	Start-up costs, including fund formation and associated legal fees	1M
Refundable grant	Capitalization of Guarantee Facility	4M
Guarantee Facility		5M

¹² <https://reall.net/about-reall/our-mission/the-opportunity/>

¹³ Reall KPIs: Number of completed units multiplied by 5 in line with World Bank jobs multiplier

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ANNEX I: KENYA PILOT PIPELINE OVERVIEW

In its financial and impact modeling, the Lab has used illustrative housing types based on data provided by Reall via their development partners in Kenya. All unit typologies are based on recent project developments in Kenya, representing a proposed pipeline for the instrument. Table A1 shows a summary of illustrative housing developments which the instrument will support. To estimate the affordability of unit typologies in the supply pipeline, the Lab has utilized the Kenya Affordable Housing Program (AHP) categorizations shown in table A2 below (Shah 2019).

Table A1: Illustrative project developments supported by the pilot in Kenya

	Basic Development			Affordable Development		
Location	Kawangware, Nairobi County			Wangige, Kiambu County		
Unit type	3 Bed	2 Bed	1 Bed	2 Bed	1 Bed	Studio
Unit size (M ²)	67	46	27	42	31	20
Number of units per development	14	14	12	40	81	16
Rental price per unit (KES '000 per month)	11	7	4	24	18	11
Sales price per unit (KES '000)	1,600	1,025	670	3,475	2,550	1,700
Mortgage Affordability (AHP Category)	Mortgage Gap 1	Affordable	Affordable	Mortgage Gap 2	Mortgage Gap 1	Mortgage Gap 1
Rental AHP Category (AHP Category)	Affordable	Affordable	Social	Mortgage Gap 1	Mortgage Gap 1	Affordable

Table A2: Kenya AHP affordability classifications

AHP Category	Monthly household income range (KSH '000)	Household Percentiles
Social	0 to 20	0% to 34%
Affordable	20 to 48	35% to 72%
Mortgage Gap 1	48 to 91	73% to 89%
Mortgage Gap 2	91 to 158	90% to 95%
Mid/High Income	Over 158	95% to 100%

ANNEX II: ENVIRONMENTAL AND SOCIAL IMPACT METHODOLOGY

The environmental, social, and economic impacts of the instrument were modeled using information from previous Reall supported housing projects, Reall Key Performance Indicators (KPIs). These were combined with the financial model to estimate the impacts of the portfolio of homes that will be developed.

Environmental Impact Methodology:

1. Reall collected information on the characteristics of housing unit from their partner developers that were used in the financial model.
2. Those units were then modeled in the EDGE app using information from the developers when available and energy efficient lighting, solar hot water, and water efficient fixtures to meet the minimum EDGE energy, water, and embodied energy savings requirements.

- Embodied energy savings were estimated using embodied energy savings modeled by the EDGE App multiplied by the average carbon intensity of energy for Kenya from Our World in Data (104 gCO₂/kWh).¹⁴
- After modeling the per unit impacts, shown in Table X, the overall instrument impacts were estimated using the composition of the portfolio of units in the financial model.

Socioeconomic impact methodology:

- Household sizes were estimated for each unit using a 2 people + 1 person per bedroom formula. The same bottom-up approach used for the environmental impacts was used to calculate the total number of beneficiaries from the instrument.
- The social and economic impacts were modeled using Reall's KPIs to get the share of households or individuals from previous Reall supported projects.
- Cost savings were estimated for each unit type with the EDGE App and scaled up to the portfolio level with the same method used for the environmental impacts.

Table A3: Environmental Impact of project developments supported by the pilot in Kenya

		Basic Development	Affordable Development
	Development Location	Kawangware, Nairobi County	Wangige, Kiambu County
	Units Per Development	56	137
Baseline Specifications	Baseline Energy Use (kWh/Month)	29,854	56,597
	Baseline Water Use (m³/Month)	1,010	1,877
	Baseline Operational CO₂ Emissions (tCO₂/Month)	10.4	17.7
	Baseline Embodied Energy (MJ)	224,668	45,239
	Baseline Utility Cost (KES/Month/Unit)	7,993	6,193
Final Specifications	Final Energy Use (kWh/Month)	14,026	25,657
	Final Water Use (m³/Month)	592	1,047
	Final Operational CO₂ Emissions (tCO₂/Month)	5.6	12.1
	Final Embodied Energy (MJ/m²)	133,514	20,593
	Final Utility Cost (KES/Month/Unit)	3,909	2,919
Impact	Annual Energy Savings (kWh)	189,768	370,858
	Annual Water Savings (m³)	4,990	9,884
	Annual CO₂ Emissions Savings - EDGE (KgCO₂)	57,600	67,200
	Embodied CO₂ Emissions Savings (KgCO₂)	145,118	17,210
	Annual Utility Cost Savings (KES/unit)	48,998	39,299
	Annual CO₂ Emissions Savings - Intensity (KgCO₂)	19,752	38,592

¹⁴ [Our World in Data \(from Ember Climate\)](#)