KARANDAAZ

Climate-smart Low-income Housing in Pakistan

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Climate-smart Low-income Housing in Pakistan

ARANDAAZ

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Acronyms and Abbreviations

AKAH	Aga Khan Agency for Habitat
AKDN	Aga Khan Development Network
AMC	Ansaar Management Company
B40	Bottom 40%
BACIP	Building and Construction Improvement Programme
BREEAM	Building Research Establishment Environmental Assessment Method
CA EPBD	Concerted Action Energy Performance of Buildings
CDA	Capital Development Authority (Islamabad)
CO2e	Carbon dioxide equivalent
ECBC	(Pakistan) Energy Conservation Building Code
EDGE	Excellence in Design for Greater Efficiencies
EE&CBC	Energy Efficiency and Conservation Building Code (Punjab)
EPBD	Energy performance of buildings
EPL	Entertainment Pakistan Ltd.
ESG	Environmental, social, and governance
EU	European Union
GCF	Green Climate Fund
GDP	Gross domestic product
HBFC	Housing Building Finance Company
IFC	International Finance Corporation
KDA	Karachi Development Authority
KP	Khyber Pakhtunkhwa
LDA	Lahore Development Authority
LEED	Leadership in Energy and Environmental Design
LPG	Liquid petroleum gas
MPMG	Mera Pakistan Mera Ghar
NAPHDA	Naya Pakistan Housing and Development Authority
NBFI	Non-banking financial institution
NCCP	National Climate Change Policy
NDC	Nationally determined contribution
NDMA	National Disaster Management Authority
NEECA	National Energy Efficiency and Conservation Agency
NEPRA	National Electric Power Regulatory Authority
NOC	No-objection certificate
NRSP	National Rural Support Programme

PEC	Pakistan Engineering Council
PEDO	Pakhtunkhwa Environment Development Organisation
PEECA	Punjab Energy Efficiency and Conservation Agency
PHTF	Pakistan Housing Task Force
PkGBC	Pakistan Green Building Council
PKR	Pakistani rupee
PMRC	Pakistan Mortgage Refinance Company
ROI	Return on investment
SBP	State Bank of Pakistan
SEED	Sustainability in Energy and Environmental Development
UHI	Urban heat island
USD	United States dollar
WASIP	Water and Sanitation Improvement Programme
WWF	Workers Welfare Foundation

EXECUTIVE SUMMARY

Introduction and background

The restricted housing supply in Pakistan has been compounded by rapid urbanisation in recent decades, leading to a current nationwide shortage of 12 million[1] homes. Approximately 40% of the urban population resides in informal settlements, with inhabitants experiencing heightened vulnerability to climate change-related events such as global temperature rises. In these instances, even otherwise durable, standard constructed homes in Pakistan offer little resistance to increased heat, seismic activity, air pollution, or flooding, which, in turn, increases poor health and adverse safety outcomes. In urban areas, rising temperatures are further compounded by the urban heat island (UHI) effect, whereby developments absorb and re-emit the sun's rays, increasing heat levels further.

With an ever-increasing frequency of severe climate-related events (as demonstrated by the 2022 flooding), changing crop patterns, depleting energy resources, and a population growth rate that far outpaces the provision of housing, the advent of climate-change presents Pakistan with two crippling dilemmas:

1. How can the resilience of lower-income communities be strengthened against climate-related events and their long-term impacts?

2. How can the nationwide housing crisis be solved?

This report explores the potential of 'climate-smart low-income housing' as a solution to these two problems. The need and status of climate-smart housing are explored alongside the roles of the stakeholders in its provision. The ultimate aim is to inform where and how commercially and financially viable interventions are needed to promote sector activity.

Methods/stakeholder mapping

This report is the culmination of primary and secondary qualitative research, supported by quantitative data where necessary. Industry leaders and key stakeholders were engaged through semi-structured interviews to provide insights and evidence on Pakistan's housing landscape. The stakeholder engagement evolved from these expert interviews, enabling wider data collection from other stakeholders in relevant industries, including architecture, construction, banking, and housing finance. The first-hand information gathered through the stakeholder consultation process was supplemented with desk research undertaken throughout the project. The research findings obtained were synthesised to provide a multidimensional understanding of the key issues underlying the extent of (under) development in the landscape.

[1] *State Bank of Pakistan. 2020. "Promoting Housing and Construction Finance: Key statistics." https://www.sbp.org.pk/hcf/index.html.*

Findings and recommendations

Overall, the findings indicated that the landscape for climate-smart housing in the country is neither market-driven nor developed. Findings on the uptake of climate-smart housing in Pakistan supported the notion that demand for such homes is relatively low, as is its supply. This low demand is in part due to a lack of incentives for value chain actors, which has hindered the development of the climate-smart low-income housing value chain.

Industry insights revealed the existence of several stakeholders engaged in the landscape, but only three developers were identified during the research as actively working to address the supply of climate-smart homes in Pakistan. To date, efforts to provide such housing in a commercially viable manner have been led by private sector developers, including the Ansaar Management Company (AMC), Entertainment Pakistan Ltd. (EPL), and ModulusTech.

The concept of 'climate smartness' can be thought of as a spectrum, with standard homes (with no efficiencies) on one end and carbon-neutral or net-zero homes (producing as much energy as they consume) on the other. There is no single methodology for building climate-smart homes. However, there is consensus among the stakeholders interviewed that the extent to which interventions to increase energy efficiency and decrease water consumption and embodied carbon have been used to contribute towards homes' climate smartness. This is evidenced in the homes delivered by each of the three developers listed above, which differ significantly in their construction techniques and materials.

Carbon-neutral vs. net-zero

As a result, the houses built by these developers fall at different points on the 'climate-smart' spectrum. ModulusTech's homes aspire to be carbon-neutral or possess up to 90% of energy savings. AMC's homes possess more than 20% of savings in energy use. Climate smartness is, therefore, defined less by the construction methods used and more by the quantifiable savings in energy, water, or carbon—compared to a 'standard' home. Additionally, homes located in disaster-prone areas may also possess features that strengthen their resilience. For instance, homes in earthquake-prone areas may possess features to strengthen their resilience to seismic events. These homes may also be considered 'climate smart'.

End-user (dwellers and/or homeowners) insights showed that there is a lack of awareness among lower- and middle-income families on the negative effects of climate change, as well as the existence and/or benefits of climate-smart/green housing.

This contributes to low demand when coupled with the cultural importance placed on pride, the desire to own a 'standard' house (made of clay bricks, concrete, and mortar), and price (rather than climate) sensitivity. Additionally, low demand also results from difficulties in accessing housing finance. Without readily available financing, the purchase of homes, let alone climate-smart homes, is not affordable for low-income families.

Similarly, evidence on housing supply reveals that there are supply chain issues for several climate-smart innovations—e.g., low-impact cement, high-performance glass, aerated taps, etc. For developers, even in the case where the ambition to build climate-smart housing exists, indigenous value chains for these products are scarce, and the costs of importing these products pass the cost onto the customer. This can raise the cost of a climate-smart home beyond the means of a lower-income family.

Further insights into the building and construction sector from the stakeholders engaged for this project showed that developers do not have sufficient financial incentives to build affordable, climate-resilient homes. Green subsidies or financing at favourable interest rates to cover the high costs of climate-smart innovations are needed to encourage the construction of climate-smart homes at scale. Additionally, building model climate-smart homes at subsidised rates may contribute to increased demand for these homes.

Several such issues exist for developers in Pakistan—the primary disincentive is the treatment of land as a commodity. In the absence of government regulations on the treatment of land as a commodity and lengthy processes for obtaining government-issued authorisation documents, developers are, in fact, perversely incentivised toward taking the 'low-risk, high-reward' pathway to profit, i.e., to sell empty plots within large-scale housing societies for the affluent. This is true despite the large market for affordable homes (evidenced by the housing shortage), because the sale of undeveloped plots of land in Pakistan can be a far more profitable venture in comparison to constructing affordable housing.

These challenges are further amplified by knowledge gaps and the lack of technical expertise that persist across the public sector and government units, as well as the private sector. The concept of climate-smart housing is relatively unheard of among city planning and development authorities, and the capacity needed to evaluate climate-smart housing projects has not yet been built. Authorities' ability to evaluate building design is limited to basic zoning requirements. In addition, there is a lack of clarity between provincial bodies on roles and responsibilities in regulatory structures. This lack of clarity, along with deficiencies in technical capacities, has resulted in the neglect of green construction codes for residential homes and even glaring gaps in the 'green' regulation of buildings.

While favourable policy measures may have facilitated mortgage uptake, many lower-income families still face difficulties in obtaining housing finance. Commercial banks remain highly conservative and avoid extending housing finance to lower-income families. The minimum income and documentation requirements to assess borrower eligibility may differ between banks, but each maintains organisational cultures that favour risk-averse lending. As a result, many lower- and middle-income households are excluded from formal financing as they cannot meet the requirements of commercial banks due to informal employment.

Conclusion

Low awareness of climate risks translates into low demand for such housing from low-income housing beneficiaries. Furthermore, aside from demand-side issues, a lack of proper incentives results in supply-side issues, and these render the climate-smart low-income housing value chain in Pakistan critically underdeveloped. On the supply side, efforts to provide climate-smart housing do exist across Pakistan, albeit in small proportions. Work in this regard has been mostly private sector-led and conducted in silos with little knowledge-sharing or collaboration across industries and sectors.

It is important to note, however, that the existence of demand- and supply-side issues do not mean that there is no business case for climate-smart housing. On the contrary, lower-income communities in Pakistan are in dire need of affordable, climate-smart housing that can strengthen their resilience to the adverse impacts of climate change. This is due to the global market for affordable housing being expected to swell to almost USD 600 billion by 2050, an increasing frequency of climate-related events, and a population growth rate that far outpaces the provision of housing.

The potential to create deepening and disruption through financial intervention within the housing value chain will entail adopting an ecosystem development approach to sustainably promote sector activity. This will require working alongside value chain actors such as banks, housing financiers, developers, policymakers, and construction and manufacturing giants. Furthermore, building an understanding of the barriers to scale is crucial at an organisational or project level across all aspects of the landscape. This will involve addressing disincentives and barriers to sector activity, several of which are described in the recommendations provided.

1. THE NEED FOR CLIMATE-SMART LOW-INCOME HOUSING IN PAKISTAN

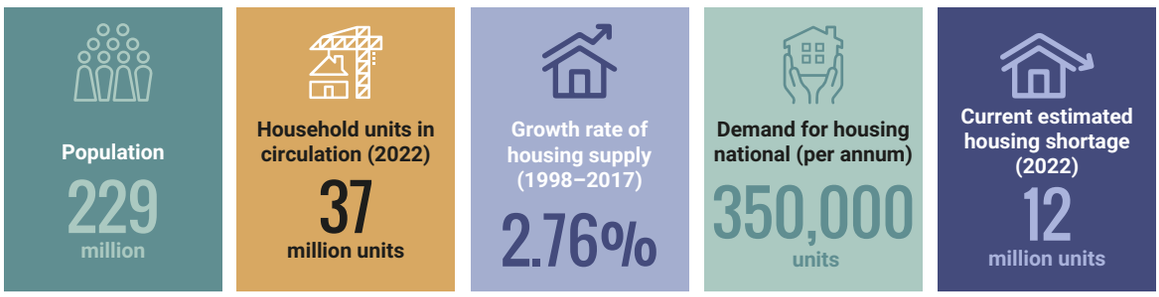
1.1 The demand and supply gap for housing in Pakistan

Pakistan is expected to be one of nine countries that will house more than half of the world's population by 2050. In line with this estimate, over the next three decades, Pakistan's population of ~230 million in May 2022 is expected to almost double to ~403 million by 2050. Alongside this, the country stands to be severely affected by the negative impacts of climate change as the population continues to grow without interventions to improve the supply of climate-resilient and affordable housing.

Part of the issue stems from the fact that Pakistan's population is increasing at a rate with which the housing market cannot currently keep up. The most recent population census conducted in 2017 noted an existing supply of only 32.19 million household units. The same census noted that approximately ten million of these household units had just one room. This is indicative of severe overcrowding, which is likely to worsen over time without significant increases in housing supply.

If the growth rate for housing supply witnessed over the 19-year-period between 1998 and 2017 (2.76%) is applied to the supply of household units noted in 2017 (32.19 million), the current housing supply in 2022 is estimated to be ~37 million homes. In contrast, this same 19-year period gave rise to a 57% increase in total population size, with an even higher rate of increase for the urban population (75.6%), underscoring the severity of Pakistan's ongoing housing crisis (Table 1).

Table 1: Pakistan's housing crisis - key statistics



The nationwide housing shortage of ~12 million homes in Pakistan is disproportionately felt by the country's burgeoning urban population, many of whom are from middle- and lower-income backgrounds.

[2] *News, The. 2019. "Pakistan's Population to Reach 403 Million by 2050." The News. 18 June. https://www.thenews.com.pk/latest/486498-pakistans-population-to-reach-403-million-by-2050-un.*
[3] *Ibid.*
[4] *https://www.pbs.gov.pk/sites/default/files//population_census/census_2017_tables/pakistan/Table27n.pdf.*
[5] *https://www.pbs.gov.pk/sites/default/files//population_census/census_2017_tables/pakistan/Table29n.pdf.*
[6] *Haider, M. 2019. "Property Valuation Rates, Market Rates to be Equal." The News. 9 June. https://www.thenews.com.pk/print/481932-property-valuation-rates-market-rates-to-be-equal.*

While the demand for housing can be quantified at ~350,000 houses per annum (p.a.), the supply of urban housing is limited to only 150,000 houses p.a., creating a shortfall of 200,000 houses p.a. This is further compounded year-on-year,[7] resulting in exorbitant inflationary pressures that directly impact housing affordability. Without an adequate supply of housing, it is these groups that are at the highest risk of an array of adverse health outcomes and displacement in the event of environmental or climate change-related disasters as the population continues to rise.

Between 2000 and 2019, Pakistan was found to rank eighth amongst the top ten countries most vulnerable to the negative impacts of climate change[8]. It is important to note that this vulnerability is not simply a consequence of Pakistan's inevitable susceptibility to various environmental risks. Instead, it resulted in part due to the inaction of policymakers and successive governments to cater to lower- and middle-income groups and their collective failure in ensuring the provision of a mass public transport system, sufficient waste management, modern infrastructure, and safe and resilient housing to these population segments.

The issue of inadequate housing supply is as much an issue of availability as it is affordability. The average price of a home in Pakistan—generalised across house sizes—between 2013 and 2018 increased by 134%, with urban plot prices increasing by 151%[9]. In contrast, Pakistan's per-capita gross domestic product (GDP) exhibited an increase of only ~20% between 2012 and 2018. As a result, house and plot prices continue to increase at exorbitant rates, while the rate at which household income is increasing is much slower. The issue of affordability is further compounded by the lack of housing finance available, evidenced by the fact that Pakistan possesses one of the lowest mortgage-to-GDP ratios (0.25%) in all South Asia[10].

According to 2022 estimates, the cost of constructing an A-grade standard home is estimated to be 4,430.75/sq. ft.,[11] which includes mechanical, electrical, and plumbing; grey structure; and high-quality finishes. The cost of construction for a traditional five-marla (1,361 sq. ft.) home in Pakistan, therefore, amounts to PKR 6,031,375, excluding the additional finance that may be required to purchase land (Table 2).

Table 2: Average construction costs in Pakistan - key statistics on 'standard' homes

Grey structure cost (5 marlas)	PKR 3,331,375
Interior, exterior, finishing, and labour cost (5 marlas)	PKR 2,700,000
Total cost (5 marlas)	PKR 6,031,375
Rupee cost/sq. ft.	PKR 4,430.75/sq. ft.

[7] *Sheikh, A. 2021. "Rethinking Urbanisation in Pakistan." Jahangir's World Times. 26 August. https://www.jworldtimes.com/old-site/css-exclusive/22913/.*
[8] *United Nations Development Programme. 2022. Leveraging Private Investments for Pakistan's Sustainable Development: Pakistan SDG Investment Report 2021. Islamabad: United Nations Development Programme. https://www.pk.undp.org/content/pakistan/en/home/library/development_policy/leveraging-private-investments-for-pakistans-sustainable-develop.html.*
[9] *Asad, A. 2022. "Yearning for Home Sweet Home." Tribune Magazine. 1 May. https://tribune.com.pk/story/2355002/yearning-for-home-sweet-home.*
[10] *Ibid.*
[11] *PKR/sq. ft. cost calculated using public data. See, Pakistan Property Services. 2022. "5 Marla House Construction in Pakistan 2022." https://pakistanpropertyservices.com.pk/5-marla-house-construction-in-pakistan-2022/.*

To situate this cost in the context of the household income of lower-income families in Pakistan, the Pakistan Mortgage Refinance Company Ltd. (PMRC) defines 'middle-income' as those with a maximum monthly household income of PKR 400,000 and 'lower-income' as those with an income of up to PKR 165,000[12]. Together, the first and second quintiles of the population represent the bottom 40% (B40). However, in the most recent Household Integrated Economic Survey, conducted in 2018–2019,[13] the average monthly income was noted as PKR 29,049 and PKR 23,192 for the first and second quintiles of the population, respectively. Subtracting the average expenditure per household for the same year[14] from household income, the average savings come to PKR 1,905 for a first-quintile income household and PKR 1,457 for a second-quintile income household. As of 2022, with a noted rise in inflation rates, as well as fuel and commodity prices, household incomes are likely to have further shrunk as a result of this increased expenditure.

Based on these calculations, with average savings of less than PKR 2,000 per month and no access to housing finance, a second-quintile income household would need to save for 264 years, while a first-quintile income household would have to save for 345 years just to save the PKR 6 million required to construct a standard five-marla home, excluding the cost of land.

Thus, the prospect of building a new, albeit humble, family home for lower-income households is an aspiration that, in the absence of housing finance, remains entirely out of reach for families without generational wealth. It is precisely for this reason that interventions are needed that can address housing affordability, including measures to enhance access to housing finance for lower-income groups.

The notion of climate-smart housing is defined in this report based on the broadly accepted understandings held by the range of stakeholders interviewed. Climate-smart housing is residential housing equipped with innovations that promote climate resilience (resilience towards climate-related events) and/or a reduced carbon footprint (lowered levels of embodied carbon). Such houses differ from standard constructed homes, whether through maximising energy efficiency, reducing water consumption, or endorsing weather- and climate-appropriate design that can withstand relevant environmental hazards in vulnerable areas. While an established definition does not exist, it is broadly accepted that a climate-smart home should have some mix of the aforementioned features.

The principle of passive design or Passive House Standards discussed later in section 2 falls within the umbrella of design solutions for maximising energy efficiency, as does the incorporation of renewable energy solutions. When constructed in line with Passive House Standards, a home requires little energy to maintain a comfortable temperature year-round, allowing for energy savings of up to 90%. Reduced carbon emissions may be achieved through the manufacturing or construction techniques employed, such as the lower usage of cement, concrete, and steel, and limited use of any other resource- or energy-intensive material.

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[12] Pakistan Mortgage Refinance Company. 2022. "Middle-Income Group." https://pmrc.com.pk/products/middle-income-group/. and Pakistan Mortgage Refinance Company. 2022. "Low-Income Group." https://pmrc.com.pk/products/low-income-group/.

[13] Average monthly household income derived from public data. See, Pakistan Bureau of Statistics. 2020. "Table 11: Percentage Distribution of Monthly Household Income by Source and Quintiles, 2018–19." https://www.pbs.gov.pk/sites/default/files//pslm/publications/hies2018-19/TABLE_11.pdf.

[14] Calculated by multiplying the average number of persons per household by average per-capita expenditure (for low- and middle-income quintiles, respectively). See, Pakistan Bureau of Statistics. 2020. "Table 22: Monthly Per Capita Consumption Expenditure Per Household by Major Groups of Items and Quintiles, 2018–19." https://www.pbs.gov.pk/sites/default/files//pslm/publications/hies2018-19/TABLE_22.pdf.

At the same time, reduced water consumption or increased efficiency in water usage may be achieved by implementing solutions ranging from aerated taps and toilet flushes to rainwater harvesting systems. With a definition so broad, climate smartness in housing can be most accurately thought of as a spectrum, with net-zero homes on one end and highly inefficient homes without any such innovation on the other.

1.2 Climate change-related hazards applicable to Pakistan

In South Asia, climate change is anticipated to be one of the most significant drivers of insecurity[15] in years to come, with some countries already facing significant trials in attempting to mitigate and adapt to threats posed by the changing climate. Pakistan is no exception, as the country has experienced unprecedented heatwaves,[16] floods, and earthquakes that are increasing in intensity and frequency. This is demonstrated by the recent floods in August 2022, which had a devastating impact on the country.

1.2.1 The impact of the 2022 flooding

Pakistan has endured severe monsoon weather since June 2022, which saw area-weighted rainfall 67% above normal levels in that month alone. As of 27 August, rainfall in the country is equivalent to 2.9 times the national 30-year average. This has caused widespread flooding and landslides, with severe repercussions for human lives, property, and infrastructure. To date, 72 districts across Pakistan have been declared 'calamity hit.'[17]

The Government of Pakistan estimates that around 33 million people across the country are affected by the rains, floods, and consequent impacts such as landslides. More than 421,000 refugees living in calamity-declared districts are also affected or at risk. As of 27 August, some 6.4 million people were estimated to need assistance. Livelihoods are also being heavily impacted. Over 719,000 heads of livestock—a critical source of sustenance and livelihoods for many families—have died, of which some 69% were in Balochistan and 28% in Punjab[18].

The humanitarian situation is being compounded by severe impacts on infrastructure. Damage to nearly 3,500 km of roads and 149 bridges has impeded people's ability to flee to safer areas, and compromised aid delivery to people in need. Internet outages have also been reported, with the Pakistan Telecommunications Authority attributing widespread internet cuts in central and northern Pakistan on 19 August to technical faults in the fibre-optic network resulting from the heavy rains and floods. The humanitarian situation is likely to deteriorate further as heavy rains continue over areas already inundated by more than two months of storms and flooding. Flash floods and rain-induced landslides are compounded by the inability of existing infrastructure to cope with the extraordinary amount of water. Many rivers, including the Indus River, which traverses the length of Pakistan, are at high-flood warning levels and/or have breached their banks. Major dam reservoirs are rapidly filling or already overflowing, posing additional risks to people in the vicinity and downstream[19].

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[15] Brock, H. 2012. Climate Change: Drivers of Insecurity and the Global South. London: Oxford Research Group. https://www.files.ethz.ch/isn/146109/Climate%20Change%20and%20Insecurity%20in%20the%20Global%20South.pdf.
[16] Mogul, R., Mitra, E., Suri, M., and Saifi, S. 2022. "India and Pakistan Heatwave is 'Testing the Limits of Human Survivability,'Expert Says." CNN. 2 May. https://edition.cnn.com/2022/05/02/asia/india-pakistan-heatwave-climate-intl-hnk/index.html.
[17] ReliefWeb. 2022. "Pakistan 2022 Floods Response Plan: 01 Sep 2022–28 Feb 2023 (issued 30 Aug 2022)." https://reliefweb.int/report/pakistan/pakistan-2022-floods-response-plan-01-sep-2022-28-feb-2023-issued-30-aug-2022.
[18] Ibid.
[19] Ibid.

The flooding has also had a devastating impact on the economy. The Planning and Development minister estimated that the cost of the floods will be far greater than USD 10 billion. These economic impacts come at a time when the country is already reeling from dwindling currency reserves and the highest inflation in decades. The floods have swept away around 18,000 sq. km. of agricultural land, which is also set to have a significant economic impact. An estimated 45% of Pakistan's cotton crop for the year was washed away, a crop that is the key raw material for the textile industry and the country's top foreign exchange earner. To fill this gap alone, it is estimated that the government would need to import an estimated USD 3 billion in cotton. Meanwhile, a surge in food costs and increased import bills are expected to add further strain on the economy[20].

1.2.2 Ongoing impacts of climate change in Pakistan

Pakistan is characterised by several climatic zones and varying topography and ecosystems. The country's climate can be considered as broadly 'tropical continental,' with large parts of the country experiencing warm desert or warm semi-arid climates. However, significant regional variations in temperature exist, with a generally hotter and drier climate in coastal areas or lowlands near the Indus River and cooler climates towards the northern mountainous regions and Himalayas[21]. The same diversity can be witnessed in temperature and rainfall patterns, with most of the country receiving little rainfall, except for Pakistan's northern areas. The northern areas have been noted to receive more than 200 millimetres of rain in a month during the July–September monsoon season, which can be particularly hazardous for individuals living in informal or low-resilience dwellings in these areas[22].

Pakistan is subject to several climate and weather-related hazards, such as recurring heatwaves, droughts, flash floods, riverine flooding, and tropical cyclones. Vulnerability to disaster risk in Pakistan is partly driven by the country's heavy reliance on climate-sensitive resources such as water and land for individual livelihoods and food security[23]. Climate change is expected to increase both the intensity and frequency of these natural hazards, which are projected to include widespread increases in temperature. This will be particularly disastrous for mountainous regions, leading to glacial melt, which may affect downstream Indus River flows, and in turn, water security. Post-1960, the warming trend in Pakistan has been accelerating, resulting in hotter summers with temperature increases of 0.6–1.0°C and cooler winters (Kapoor et al., 2021, p. 7). By 2100, Pakistan's temperatures may well be higher than the global average, within the range of +3–6°C. To put this into context, even if global temperatures rise less than 2°C, the adverse impacts on human health will be catastrophic for more than half the world's population.

The agency manages the disaster management cycle, which includes preparedness, mitigation, risk reduction, relief, and rehabilitation. The NDMA has since released numerous warnings on different occasions with regard to flash floods, riverine flooding, and heat waves. However, it should be noted that the NDMA's mandate does not include disaster risk mitigation measures at the level of residential housing.

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[20] Hussain, A. 2022. "After Record Floods, Now Pakistan Has to Worry About Economy." Aljazeera. 7 September. https://www.aljazeera.com/economy/2022/9/7/after-record-floods-now-pakistan-has-to-worry-about-economy.
[21] World Bank Group and Asian Development Bank. 2021. Climate Risk Country Profile: Pakistan. Washington D.C.: World Bank Group and Manila: Asian Development Bank. https://www.adb.org/sites/default/files/publication/700916/climate-risk-country-profile-pakistan.pdf.
[22] Ibid.
[23] Kapoor, A., Alcayna, T., de Boer, T., Gleason, K., Bhandari, B., and Heinrich, D. 2021. Climate Change Impacts on Health and Livelihoods: Pakistan Assessment. Geneva: International Federation of Red Cross and Red Crescent Societies. https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Country-assessments-PAKISTAN-V4.pdf.

Pakistan is subject to frequent heatwaves during which some of the world's highest maximum temperatures are recorded, with severe impacts on human health. Over 65,000 Pakistanis were hospitalised for heatstroke during a heatwave in 2015. More recently, in Turbat, temperatures were recorded to have hit an unprecedented high of almost 50°C. The heatwave in question swept through Turbat, resulting in critical energy shortages with up to nine hours of daily 'load shedding' for its 200,000 residents. As the adverse impacts of climate change continue to cause temperature peaks, the combined effect of the UHI effect and urban expansion are likely to result in economic damages through direct blows to human health and labour productivity. Alongside this, the heat is expected to increase the national demand for energy, further straining the country's energy supply.

Pakistan's urban population possesses high levels of vulnerability to increased temperatures, with 17.5% of the urban population living below the poverty line. Some of the harshest impacts of climate change will be experienced by urban dwellers due to the high concentration of concrete buildings and asphalt in urban areas, exposing these individuals to life-threatening heat and humidity. Even in the case that such households have air conditioning and cooling systems, additional strain on the already compromised energy generation system in Pakistan could result in either extended load-shedding or exorbitant energy costs in the near future, increasing the likelihood of heat-related mortalities even when at home.

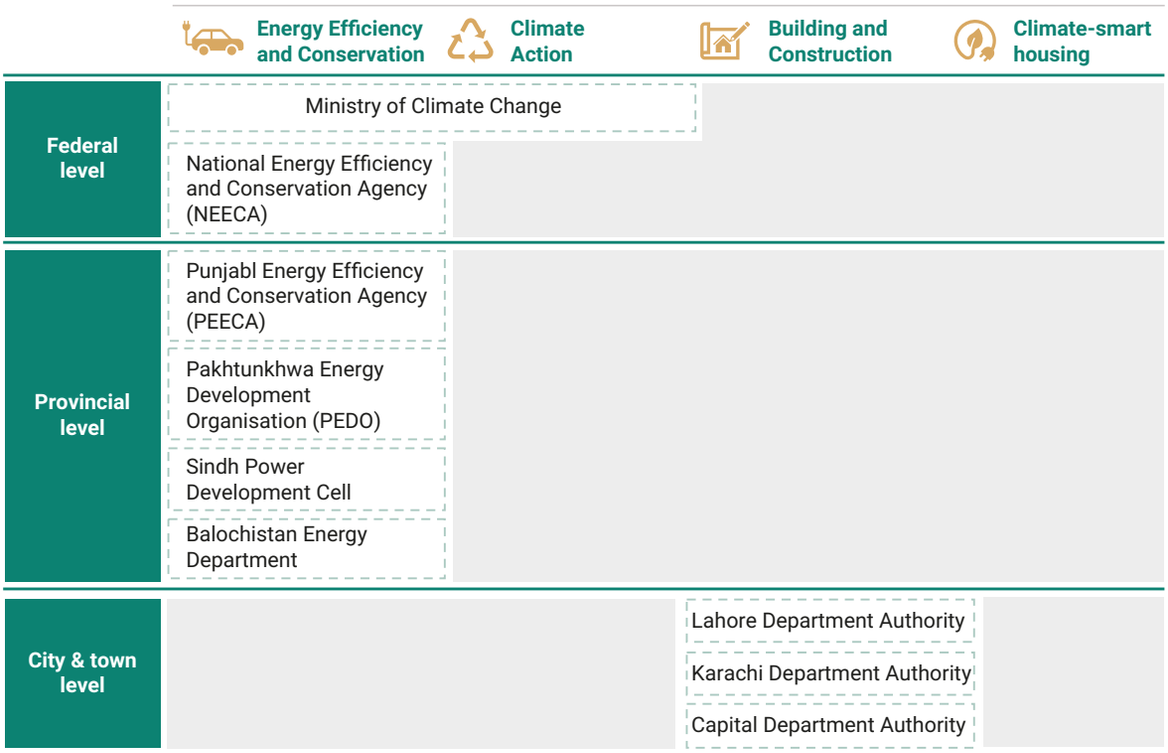
While the correlation between earthquakes and climate change is contested, mortality attributable to natural hazards in Pakistan thus far has been dominated by earthquakes. In addition to earthquakes, flooding has had a severe impact on livelihood security for lower- and middle-income households, with areas historically subject to 'low intensity, high frequency' flooding now experiencing 'high-intensity, high-frequency' flooding, as evidenced by the 2010 and 2011 floods that swept through large parts of Sindh and Balochistan. Through such disasters, the warming climate has the potential to create greater competition over already scarce resources in Pakistan, with needs such as water, food, shelter, and energy likely to become further out of reach.

[24] *Ellis-Petersen, H., and Baloch, S.M. 2022. "'We Are Living in Hell': Pakistan and India Suffer Extreme Spring Heatwaves." The Guardian. 2 May. https://www.theguardian.com/world/2022/may/02/pakistan-india-heatwaves-water-electricity-shortages.*
[25] *Ibid.*
[26] *Ibid.*
[27] *Ibid.*

2. THE PROVISION OF CLIMATE-SMART LOW-INCOME HOUSING IN PAKISTAN

2.1 The legislative and regulatory environment

Figure 1: Regulatory bodies in Pakistan



None of the legislation under which the government bodies mentioned operate, at the federal, provincial, and town level, acknowledges climate-smart housing, nor does it provide any regulatory guidelines in this regard.

The Federal Ministry of Climate Change was established in 2017, before which no government vehicle for climate change adaptation or mitigation existed at either the federal or provincial levels. In light of the looming threat that climate change poses to livelihood security in Pakistan, the Ministry updated the landmark National Climate Change Policy (NCCP) in 2021[28].

The NCCP and the Ministry of Climate Change share the same guiding vision, which aims to "steer Pakistan towards climate-resilient and low-carbon development" (Government of Pakistan, 2021, p. 2). The policy outlines national-level objectives under the umbrella of climate adaptation and mitigation. Under mitigation, broad policy aims are defined for energy generation, energy efficiency and conservation, transportation, urban planning and waste management, industries, agriculture, carbon sequestration, and forestry.

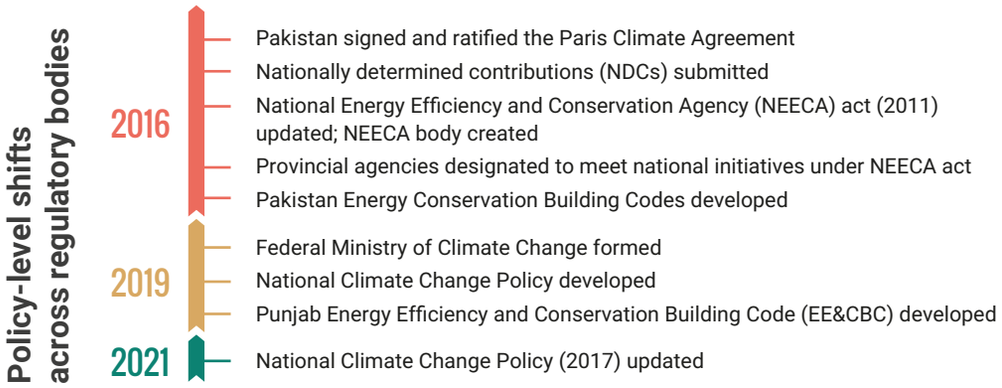
[28] *Government of Pakistan. 2021. National Climate Change Policy. Islamabad: Ministry of Climate Change*

Under adaptation, similar broad policy aims are defined for water conservation and management, food security, human health management, and disaster preparedness.

However, the NCCP does not identify any specific implementation mechanisms for the policy measures described. The NCCP references the 2017 Pakistan Climate Change Act, which provides for a Climate Change Authority and Fund, although neither discuss the provision of climate-smart housing. There is also no clarity on whether the aforementioned fund is functional. Moreover, an acknowledgement is made in the NCCP that capacity-building initiatives are needed to ensure these bodies can perform their intended functions correctly. The policy notes that a prime ministerial committee has been established, composed of the prime minister, provincial chief ministers, and federal ministers for planning and development, power, food security, finance, water resources, and climate change. It is this committee that is responsible for overseeing the progress of the NCCP's implementation across government units.

Under energy generation, the NCCP endorses the adoption of clean and renewable energy sources as opposed to continued reliance on fossil fuels[29]. Reference to the Alternate and Renewable Energy Policy, 2019 is made, where the NCCP urges the creation of a conducive environment for sector activity and growth. The promotion of 'futuristic' buildings equipped with solar panels, particularly public sector buildings, is also mentioned as a policy measure to help ensure long-term sustainability. The introduction of a carbon tax is discussed along with the promotion of energy innovations such as smart grids and net metering—sending surplus electricity generated from solar panels to the national grid—for residential solar users, among other recommendations[30].

However, the discussion of these measures within the NCCP is far removed from on-ground realities within the climate-smart landscape in Pakistan. To date, few public sector buildings are equipped with solar systems. A carbon tax is far from being introduced, with little visibility to the public over whether any progress has been made towards one. The same can be said for the introduction of smart grids. As for net metering, the uptake of solar systems is entirely voluntary, with net metering available only to residential solar users with three-phase connections to the national grid. The process through which net-metering facilities are obtained is an application that must be approved by the relevant distribution company, as per National Electric Power Regulatory Authority (NEPRA) guidelines published in 2015.



[29] *Ibid.*
[30] *Ibid.*

Under energy efficiency and conservation, the gradual introduction of green reforms is discussed to promote the reduction of carbon emissions. The provision of climate-smart housing is absent from the NCCP, with only the improvement of energy efficiency in buildings through the introduction of standardised building and construction codes discussed as a favourable policy measure.

As a part of the Paris Agreement of 2016, Pakistan developed Nationally Determined Contributions (NDCs), the mitigatory and adaptive actions it would undertake to curb the climate crisis and meet agreement goals. The NDCs are largely focused on renewable energy, electric vehicles, and a moratorium on coal power plants. While the climate mitigation potential of housing has been neglected, there are no mechanisms identified for the proposed mitigatory and adaptive actions either.

What the NCCP neglects to mention is that standardised building and construction codes already exist in the form of the 2016 Pakistan Energy Conservation Building Codes (ECBC). The federal body for energy efficiency and conservation, the National Energy Efficiency and Conservation Agency (NEECA), was created under the 2016 National Energy Efficiency and Conservation Act. The 2016 act replaced the 2011 version of the same act, allowing for the update of the ECBC, which NEECA and its provincial counterparts have the responsibility of implementing. The provincial counterparts are the Punjab Energy Efficiency and Conservation Agency (PEECA) in Punjab, Pakhtunkhwa Environment Development Organisation (PEDO) in Khyber Pakhtunkhwa (KP), the Power Development Cell in Sindh, and the Energy Department in Balochistan.

The ECBC—including the Punjab variant, the Energy Efficiency and Conservation Building Code (EE&CBC), Punjab, 2017—applies to any building with a load of ≥ 100 kW, contract demand of ≥ 125 kVA, unconditioned areas of ≥ 1,200 m2, or conditioned areas of ≥ 900 m2. The guidelines only provide minimum requirements for the energy-efficient design and construction of buildings. The ECBC's provisions cover building envelopes, mechanical systems, and equipment, including heating, cooling, and ventilation systems, service water heating, lighting, electric power, and motors. Excluded from the ECBC are any buildings that do not use electricity or fossil fuels for power, historically significant buildings, or portions/equipment within buildings that are for manufacturing.

Figure 2: Estimated rate of electricity consumption - household vs. commercial

		
Area covered	50 m^2/540 sq. ft.	1,200 m^2/12,900 sq. ft.
Estimated appliances used	6 energy-saver bulbs, 2 tube lights, 3 ceiling fans, 1 fridge (12 cubic ft.), 1 pump motor, and 1 air conditioner (1 ton)	100 energy-saver bulbs, 10 tube lights, 30 ceiling fans, 5 fridges (12 cubic ft.), 5 pump motors, and 7 air conditioners (1 ton)
Estimated electricity consumption	~87 kw	~630 kw

However, despite the fact that the ECBC has been enacted, requiring mandatory compliance, not one building in any of Pakistan's provinces is certified or approved against the ECBC. This is partially due to the lack of clarity between provincial bodies regarding roles and responsibilities in the regulatory structure. NEECA maintains that the responsibility for ensuring compliance with the ECBC lies with city planning and development authorities, which differ between provinces and localities, such as the Lahore Development Authority (LDA) in Lahore, Karachi Development Authority (KDA) in Karachi, and Capital Development Authority (CDA) in Islamabad. While this structure is plausible, as it is these authorities that ultimately regulate the approvals process for new buildings, city planning and development authorities simply do not have the technical capacity to evaluate energy efficiency against the ECBC, nor is it their mandate. This lack of clarity in the regulatory structure coupled with deficiencies in technical capacity has resulted in the neglect of these codes and glaring gaps in the regulation of buildings. Therefore, rather than the design and implementation of new standardised building codes, priority should be given to capacity-building initiatives and ensuring that much-needed clarity is provided to regulators if green reforms are to be introduced in the near future.

This lack of progress can be examined against an international example—the implementation of the energy performance of buildings (EPBD) in 2016 for Belgium far exceeds that of the ECBC's implementation in Pakistan in 2022. As the centre of the European Union (EU), Brussels was the first region in the world to set and adhere to stringent building codes such as the Passive House Standard, despite possessing some of the most energy-inefficient buildings in Europe at the turn of the 21st century[31]. With little natural resources or space to explore renewable energy, Brussels turned to energy efficiency and conservation as its route towards achieving net-zero targets, resulting in the widespread promotion and adoption of Passive House Standards.

The Passive House Standard is a building design standard requiring set levels of insulation, air tightness, high-performance windows and doors, etc., to be integrated into building design[32]. In essence, the Passive House Standard can be considered a pathway towards climate-resilient, net-zero buildings. In contrast, the Punjab variant of the ECBC is significantly lax in its prescriptions, avoiding discussion on insulation levels and recommending U values for walls and roofs (measure of the rate of heat loss) that are not on par with good international standards of efficently designed buildings.

As per an official document produced by the Concerted Action Energy Performance of Buildings (CA EPBD) detailing the implementation of the EPBD in Brussels as of 2016, energy performance requirements were made mandatory for new buildings in July 2008, as well as renovations by this time[33]. Energy performance requirements were set following EU energy-saving and carbon emission targets and strengthened in 2011 for primary energy consumption, required insulation levels, ventilation, heating, and technical installation[34].

The implementation of the EPBD is clearly defined as a regional responsibility in Belgium, with the Brussels region falling under the responsibility of the minister of the government of Brussels.

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[31] Antonelli, L. 2016. "How Brussels Went Passive." Passive House+.https://passivehouseplus.ie/magazine/insight/how-brussels-went-passive.
[32] Ibid.
33 Govaert, M., Knipping, G., Mortehan, Y., Rolin, I., and Rouard, J-H. 2018. EPBD Implementation in Belgium - Brussels Capital Region: Status in December 2016. Brussels: Concerted Action - Energy Performance of Buildings Directive. https://epbd-ca.eu/wp-content/uploads/2018/08/CA-EPBD-IV-Belgium-Brussels-Capital-Region-2018.pdf.
[34] Ibid.

The document also notes that the same minister possesses the authority to oversee all matters relating to housing, living standards, energy, and the environment[35]. The EPDB's energy prescriptions are laid out clearly and succinctly for both existing and new buildings. Reference is made to available financial instruments, along with subsidies, for renovation work in residential buildings in aid of energy efficiency and conservation in line with Passive House Standards.

Pakistan can be said to have made some progress in this regard with the establishment of NEECA and its provincial counterparts, the development of the ECBC, and the establishment of a prime ministerial committee. However, what is lacking is clearly defined reporting structures, more stringent legislation, and the technical capacity required for their successful implementation. Institutional strengthening is needed if the climate-smart building or housing sector is to achieve a feat that is in any way similar to that of developed nations.

However, it should be noted that as far as the regulation is concerned, there are no federal bodies with the authority or mandate to maintain oversight over issues relating to residential housing. This has significant implications for the likelihood of housing reforms being introduced in favour of climate-smart housing. Indeed, residential housing is a provincial subject for which regulation is further devolved to city and planning development authorities like the LDA, CDA, and KDA. To that end, there is currently no legislation at the provincial, city, or town level that addresses the requirements for climate-smart housing.

2.2 Existing public sector-led efforts

As discussed in the previous section, policy-level initiatives specifically for climate-smart housing are far from becoming a public-sector priority, with the government neglecting to ensure that the necessary regulatory structure is even available for promoting the development of climate-resilient buildings in Pakistan.

In consideration of public sector efforts toward climate resilience in buildings, addendums to the Pakistan Building Codes have been made in the cause of energy conservation and protection against seismic events. However, the 2008 Pakistan Building Codes apply only to the design of multi-storey buildings, and until recently, no such codes existed specifically for residential housing units. Additionally, while protection against seismic events has been incorporated into the assessment criteria for new buildings by city planning and development authorities like the LDA, progress on energy efficiency and conservation remains unclear due to a lack of technical capacity and clarity between government units.

Efforts to bridge this gap resulted in the 2021 Standardisation of Building Codes, Standards, and Specifications for low-income (Affordable) Units, developed as part of a joint effort by the Pakistan Engineering Council (PEC) and Naya Pakistan Housing Development Authority (NAPHDA)[36]. These building codes reiterate established standards and best practices for the design of low-income homes and apply to new affordable housing units to be built in Pakistan.

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[35] *Ibid.*

[36] *Pakistan Engineering Council. 2021. Standardisation of Building Codes, Standards, and Specifications for Low-Cost (Affordable) Units-2021. Islamabad: Pakistan Engineering Council. https://naphda.gov.pk/naphda.gov.pk/docs/Standardization%20of%20Building%20Codes,%20Standards%20and%20Specifications%20for%20Low-Cost%20(Affordable)%20Units%20-%2020May%2021.pdf.*

Using the State Bank of Pakistan's (SBP) definition of affordable housing, a low-income housing unit is given in this document as possessing a covered area of up to 3.1 marlas (850 sq. ft.), a maximum value of PKR 3.5 million, or requiring a loan size of up to PKR 3.15 million.

The purpose of the building codes is "to provide for public health and safety by establishing minimum requirements for strength, serviceability, durability, and integrity of low-income units to be built in Pakistan" (PEC, 2021, p. 1). The building codes are an extensive document, reading as an operational manual for developers, architects, engineers, and other relevant stakeholders engaged in the design and construction of affordable housing. The codes clearly state that coverage is given only for what is 'conventional and common,' with 'atypical' or 'rarely encountered industry practices' purposefully neglected, leaving no room for discussion on climate-smart techniques or innovations.

To illustrate this, the manufacture of bricks used in construction is required by the building codes to be produced from either clay or loam using the trench kiln method, which can be exceptionally hazardous for the environment without climate-friendly modifications. The trench kiln method of manufacturing clay and/or loam bricks is hazardous precisely because it is a process through which particulate matter is expelled into the surrounding environment. Particulate matter lessens air quality to the extent that, depending on the size of the particle, it can lead to an increased likelihood of respiratory symptoms, decreased lung function, arrhythmia, and even premature death for those with existing heart or lung problems.

Additionally, once laid, water curing for a minimum period of seven days is recommended for all brickwork requiring mortar. There are no prescriptions for resource conservation or carbon sequestration of any kind. Any discussion on innovations that could be considered 'climate-smart' is absent from the document published just last year[37]. While climate-smart or low-carbon alternatives are not necessarily prohibited by the building codes, the absence of any discussion or recommendations for climate-smart construction or techniques is indicative of the fact that government-led contributions to the climate-smart housing landscape are far off.

Through the creation of NAPHDA, affordable housing was acknowledged as a political and public-sector priority for the first time in Pakistan, with previous governments being unable to fulfil their promises to cater to the housing needs of the B40[38]. NAPHDA was established as a corporation on 15 January 2020[39], with the purpose of the "planning, development, construction, and management of real estate development schemes and projects including housing" (NAPHDA.gov.pk, 2022).

However, as of 2022, NAPHDA's anticipated strides have fallen short of plugging the current housing shortfall of 12 million homes. Of the five million housing units initially promised to be built through NAPHDA, less than one percent has been delivered, and none have been through NAPHDA-led projects. A summary of progress on NAPHDA's website[40] shows a total of 167,551 low-income housing units being built under the scheme. Of these, just 13.1% are listed as complete.

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[37] Ibid.
[38] Siddiqui, S. 2021. "Low-Cost Housing Projects in Full Swing." The Express Tribune. 22 March. https://tribune.com.pk/story/2290682/low-income-housing-projects-in-full-swing.
[39] Naya Pakistan Housing and Development Authority. 2022. "Who We Are." https://naphda.gov.pk/about-us.aspx.
[40] Naya Pakistan Housing and Development Authority. 2022. "Summary - Low-Cost Housing Projects." https://naphda.gov.pk/naphdaProjects.aspx.

Of completed units, 3,564 were provided by the Workers Welfare Foundation (WWF) in Islamabad and KP, and 18,405 were constructed through the Akhuwat Foundation[41]. In contrast to what is listed on the website, the Akhuwat Foundation takes full ownership of the provision and construction of these 18,405 housing units. The case is the same for the WWF housing units[42].

This dispute aside, it should be noted that NAPHDA's efforts to address the supply of affordable housing do not, at this time, incorporate climate-smart approaches, nor is there any evidence that NAPHDA is aware of the climate mitigation potential of housing or the existence of climate-smart innovations. This finding was corroborated during interviews with the chairperson of the Pakistan Housing Task Force (PHTF) (NAPHDA's policy wing), indicating the need for the improved capacity of NAPHDA.

2.3 Existing private sector and non-government efforts

Private sector and non-government efforts made towards the provision of climate-smart housing in Pakistan include both development of climate-smart homes and technical or financial products that have been developed or distributed in the cause of improving climate resilience in residential homes. As opposed to the public sector, private sector and non-government institutions have led or engaged in initiatives or activities that have significantly contributed to the development of the climate-smart housing landscape in Pakistan. These contributions to the landscape are given below for a selection of the stakeholders engaged in this project.

The discussion in this section is limited to contributions made by each stakeholder to the climate-smart landscape in Pakistan. Stakeholder incentives for participation, industry, and end-user insight, as well as any discussion on financial products or interventions, are left for subsequent sections of this report.

Table 3: Excellence in Design for Greater Efficiencies (EDGE) certification levels & requirements

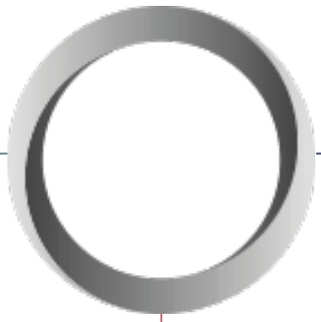
Certification level	Savings requirements	Award of certification
Level 1: EDGE Certified	20% or more savings in energy, water, and embodied energy in materials	At preliminary and final certification stages
Level 2: EDGE Advanced	40% or more on-site energy savings, water, and embodied energy in materials	At preliminary and final certification stages
Level 3: Net zero/carbon-neutral	EDGE Advanced with 100% renewables on-site or off-site or purchased carbon offsets to top off at 100%. All energy must be accounted for, including diesel and liquid petroleum gas (LPG)	At least one year after final EDGE certification with 75% occupancy, when operational data must be submitted

[41] *Ibid.*
[42] *Abbasi, K. 2022. "Only 17,000 Housing Units Delivered Under Naya Pakistan Initiative." The News. 19 April. https://www.thenews.com.pk/print/951446-only-17-000-housing-units-delivered-under-naya-pakistan-initiative*

A key insight to note is the incorporation of EDGE by private sector developers in Pakistan. EDGE is an innovation developed by the International Finance Corporation (IFC) to help design and certify resource-efficient housing or commercial projects. Using the EDGE browser-based app, developers can plan how they will decrease energy and water use and the embodied energy of materials in the buildings they construct. The technology is available as free software and doubles as an internationally recognised green building certification. EDGE certificates are given to projects after an audit is conducted by a verified EDGE auditor who calculates the extent to which measures have been implemented to minimise embodied carbon (i.e., through the materials used in construction) and maximise energy and water savings.

Table 4: Why EDGE?

EDGE is free software that developers can use as a planning tool prior to construction and also a certification for existing buildings. EDGE certification (as opposed to others such as Leadership in Energy and Environmental Design [LEED] or the Building Research Establishment Environmental Assessment Method [BREEAM]) is often the preferred choice of green building certification for developers in emerging markets due to its transferability, affordability, and adaptability.



Transferability

EDGE has a simple and user-friendly interface that is powered by region-specific data. The software is presently available in over 160 countries.

Transferability

As a certification, EDGE can be more affordable for developers in emerging markets, whereas other certification systems may be too costly, e.g., LEED can cost upwards of thousands of US dollars.

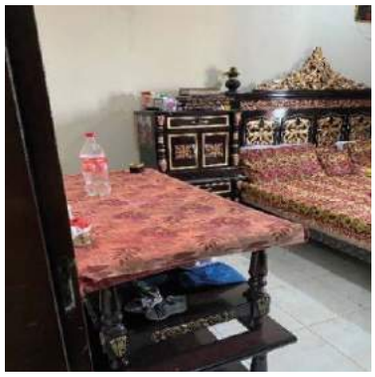
Adaptability

EDGE is preferrable in emerging markets as its simplicity can close the gap between non-existent (or weakly enforced) green building regulations and complex international regulations.

2.3.1 Ansaar Management Company (Pvt.) Ltd.

AMC is a social enterprise founded in 2008. Its mission is to bring real change to Pakistan's housing sector by making affordable, quality housing accessible to the average Pakistani. Headquartered in Lahore, the company has housing projects across Punjab, Sindh, and KP. To date, AMC has built 1,250 housing units for lower- and middle-income families in Peshawar, Faisalabad, Kot Addu, Lahore, Multan, Kasur, Muzaffargarh, and Mirpur Khas. It works in larger cities due to the critical housing shortage in these localities, particularly of affordable housing.

Figure 3: AMC's Safiya Home units, Lahore



While AMC's major focus has been affordable homes, it has recently started to develop affordable, climate-smart housing. For example, AMC's Safiya Homes project, located on Sue-e-Asal road in Lahore, has achieved Level-1 EDGE certification and is marketed as Pakistan's first EDGE-certified housing project. Each housing unit possesses 34% energy savings, 42% water savings, and 35% less embodied energy in materials. These savings have been generated through adherence to passive design principles, as well as the utilisation of energy-saving fixtures throughout each housing unit.

The Safiya Homes project consists of both single- and double-storey homes. The size of the single-storey homes is ~810 sq. ft., with a covered area of 576 sq. ft. The current selling price is ~PKR 3.9 million. The homes are constructed in as close to a traditional manner as possible, using bricks, mortar, and concrete, to remain palatable to the end-user. They contain one to two bedrooms, a living room, washroom, dining area, kitchen, and storage area. There are only nominal differences in the construction costs of their climate-smart and traditionally built homes. However, tenants in climate-smart homes benefit from improvements in ventilation, lower water consumption, and lower energy bills.

For most of its projects, AMC has acquired its homes directly from private landowners. This was done through a direct sale in most cases. However, in one instance, AMC partnered with a landlord who retained a 40% share in the ownership of the land. AMC built affordable homes on this land, and the landowner maintained a share of the equity in the project. Land for projects is selected based on a 'land scoring matrix,' which examines various land features, such as type of road access and distance from commercial areas, transport hubs, and key services like hospitals and schools.

The sale proceeds if the land is in a good location for the target market. This is only done once due diligence on the land has been completed to ensure that there are no disputes over the land and that all no-objection certificates (NOCs) can be acquired from relevant government departments. For instance, in Lahore, various LDA departments issue individual NOCs, which need to be finalised before construction can begin. This includes the revenue department, water and sanitation agency, parks and horticulture agency, and environmental department, all of whom need to issue NOCs to show that there are no impediments to building on the land.

AMC makes its homes affordable in several ways. First, the land parcels it develops are divided into smaller plots of 2.5 marlas to keep the cost of land low for the customer. Second, while it builds sound structures, it tries to limit aesthetic costs to keep houses affordable. Third, 40–50% of the land it acquires is developed as serviced plots, which earn a high premium from investors and ensure the company can make a profit. Its marketing strategy also differs from traditional developers in that it relies heavily on word-of-mouth to find potential customers, in addition to marketing over social media rather than billboards and newspaper advertisements.

Building active, sustainable communities is also a key aspect of AMC's business model. It upholds a strict policy of selling only to households that intend to occupy the property for a minimum of five years upon purchase. This mitigates the risk of its housing society becoming barren, which would be unattractive to potential customers. Additionally, this occupancy requirement helps ensure that these homes are purchased by low-income households and not investors. Over five years, AMC remained engaged with the project post-sale. During this time, it sought to establish a self-governing structure within the society itself through community development and capacity-building initiatives. These actions help create a sense of community belonging, turning 'houses' into 'homes.' AMC also promotes community building through the provision of free land for partners who are willing to fund communal facilities.

To enable AMC to provide homes to a wider range of clients who are on low incomes, it partnered with Trellis Housing Finance Ltd. (Trellis), which allowed it to enhance the sales of its affordable homes and expand the volume of customers to which to cater. Previously, it was more difficult for clients without documented income to gain access to mortgage finance, but Trellis provided a mechanism for those on informal incomes to obtain housing loans. AMC also holds a partnership with the Housing Building Finance Company (HBFC), which provides affordable housing solutions to low- and middle-income groups.

AMC has demonstrated that developing affordable, climate-smart housing can be a profitable business venture in Pakistan. More demand exists for affordable housing than for large, high-end properties owing to the shortfall of homes that disproportionately affects middle and lower-income families for whom high-end, large properties are out of reach. The challenge for developers lies in innovating to keep costs low and accepting smaller margins to remain profitable. Where these objectives align with climate-smart objectives is where the development of the climate-smart landscape becomes viable for developers.

2.3.2 Entertainment Pakistan Ltd.

EPL is a developer engaged in commercial, residential, and affordable housing in Pakistan. Its affordable housing project, Roshan Homes, is a vertical (apartment building) development constructed in partnership with Reall Ltd.

While the Roshan Homes project does not incorporate climate-smart innovations, it does boast lesser use of heavily embodied materials like clay bricks, concrete, and steel, as compared to the proportions in which these materials are used in higher-end developments.

EPL has been exploring climate-smart innovations for use in future projects and has insight into the challenges and issues of trying to penetrate this sub-section of the affordable housing market. It has experience in corporate, commercial, and residential real estate, vertical developments, hotels, multi-use projects, and, more recently, horizontal developments. Like AMC, EPL views affordable housing as a profitable venture. Its interest in exploring climate-smart innovations comes from the idea that its competitive edge can be strengthened if such innovations can be used to decrease the overall cost passed to the end-user.

EPL's experience in affordable housing led to the realisation that the cornerstone of sustainability is economic viability—for both end-user and developer. As opposed to traditional real estate developers in Pakistan, EPL focuses less on selling plots as a commodity and more on building price-sensitive, conveniently located, quality multi-storey buildings targeted at lower-income families. EPL's site selection is centred around convenience, ensuring access to essential utilities (electricity, water, gas, sewerage), services (schools, healthcare, jobs, green spaces, etc.), and transport links. Ensuring residents can be proud of where they live by seeking to build an 'inclusive community' is what EPL views as the key to sustainable development. Like AMC, ensuring its housing projects are sustainable by keeping site selection at the forefront of the design stage is at the heart of EPL's affordable housing projects.

While EPL's beneficiaries may not be climate-sensitive, they are price-sensitive. This concern is factored into every stage of development, from design to construction. Its compliance with passive design standards, utilising insulation, and maintaining reduced window-to-wall ratios diverges from traditional construction as it remains cognisant of costs that may be passed to the end-user if these principles are not adhered to. In the summer months, a well-insulated home with smaller and/or north-facing windows can significantly lessen the cost of electricity borne by the inhabitants of a home. In future projects, EPL is exploring the feasibility of installing reverse osmosis units and solar systems. These features are not only viewed as a pathway to climate smartness, but to a more self-sustaining living environment, improving inhabitants' quality of life.

As a caveat, EPL's homes are constructed with steel, cement, and clay bricks and do not differ vastly in appearance from 'standard' constructed homes in Pakistan. However, surges in the cost of these materials due to global developments are beginning to necessitate innovations for alternatives. The sales prices of EPL's Roshan Home properties are in the range of PKR 2.9–6.5 million for one- and two-bedroom apartments in Lahore. That said, these prices were based on construction costs calculated in November 2019. At the time, the cost of steel was PKR 175/kg and cement was PKR 630/bag. By 2 April 2022, the price of steel had risen to PKR 230/kg and cement to PKR 900/bag. As a result, EPL's construction cost in 2022 may be anywhere in the range of PKR 3,000–3,200/sq. ft. Due to this rise in construction costs, EPL will likely be revising its sale prices in the near future, as well as working towards using more sustainable alternatives to keep costs low.

One cost-effective innovation that EPL is in the process of exploring is fly-ash bricks. The price of the locally sourced clay bricks it currently uses is ~PKR 13/brick. Not only are clay bricks highly resource-intensive with adverse impacts on the environment, they are also labour-intensive.

EPL data shows that the construction of a conventional 100 m^2 brick wall would take 288 working hours by a team of one mason and two assistants. Conversely, fly-ash bricks, for which EPL has recently purchased a production facility, are less labour- and resource-intensive as well as highly climate-resilient compared to clay bricks. Fly-ash bricks are available in Lahore for ~PKR 7–8/brick, an almost 50% reduction in unit cost compared to clay. EPL has used readymade fly-ash bricks previously in its housing projects but hopes to drive these costs further down by producing its own.

At present, the fly-ash bricks EPL is developing are in the preliminary stages of development. Having procured fly-ash from various factories in Punjab, EPL has produced samples of bricks that are now being tested for strength and durability. Fly-ash bricks are highly favourable construction materials precisely because they possess a range of features that allow cost reductions. They have lesser thermal conductivity, possess more compressive strength and are less porous. As a result, using fly-ash bricks in construction could result in a building or home that is more durable and able to withstand environmental pressures, reducing spending on insulation. EPL recognises the necessity of adapting to the warming climate and aims to incorporate more indigenous and cost-effective innovations into its housing projects in the foreseeable future.

Figure 4: Features of clay vs. fly-ash bricks[43]

	Clay Bricks	Fly-ash Bricks
Thermal conductivity	1.25-1.35 W/m2 oC	0.9-1.05 W/m2 oC
Compressive strength	1,400-1,500 psi	1,800-2,000 psi
Porosity and water absorption	More porosity, higher water absorption	Less porosity, lower water absorption

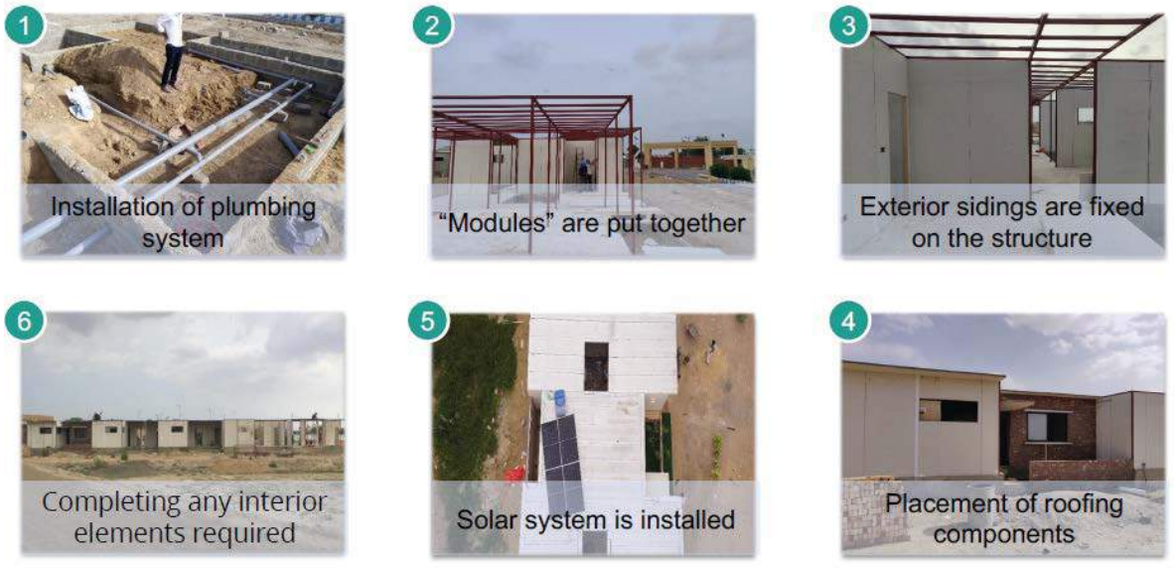
2.3.3 ModulusTech

ModulusTech is both a developer and supplier working to completely disrupt and revolutionise Pakistan's housing sector. Before operationalisation, it engaged in extensive research and development on climate-smart homes and materials to ensure that its product offerings were suitable for Pakistan's climate-related vulnerability and sensitive to the needs of target consumers. ModulusTech differs from developers like AMC and EPL in that it uses unique construction technologies that have not previously been utilised in low-income housing in Pakistan. Its homes are EDGE Advance-certified[44].

[43] Adapted from EPL pitch deck presentation.
[44] ModulusTech, n.d. "Saving the World One House at a Time." https://modulus-tech.com/new/about-us/. Accessed 26 September 2022.

ModulusTech's product offerings include affordable, prefabricated/flat-pack carbon-neutral housing, as well as tiny houses/backyard homes and climate-friendly tourist chalets targeted at higher-income households. Its flat-packed homes can be erected in one to three days, are relocatable, fire and earthquake safe, conform with international building codes, and are fully autonomous and self-sustaining due to the incorporation of solar systems. They are easy to extend due to their adherence to modular design principles, and most significantly of all, are either carbon neutral or incorporate significant savings (up to 95%) across energy and water consumption and embodied carbon.

Figure 5: Assembly of a ModulusTech affordable home



As a developer, ModulusTech previously engaged in a project to develop homes for lower- and middle-income families in Karachi, titled the Karachi Net-Zero Project. Ten climate-smart homes were developed through financing provided by Reall Ltd. in April 2021. With this grant, ModulusTech was able to source a plot in a gated housing society in Gadap Town, Karachi. The manufacturing of all necessary inputs was completed off-site in 60 days, after which they were transported to the project site for assembly. Assembly took less than a week, and the homes were then passed onto the team responsible for completing finishes. Through a partnership with Trellis, these homes were provided to eligible lower-income households on long-term mortgages.

All ModulusTech homes aim to be energy efficient by incorporating both passive and active design techniques. While passive design techniques have been employed by the other developers discussed in this report, ModulusTech homes conform more strictly to these principles. Unique construction materials are used rather than the traditional clay brick and mortar home, and the roofs and exterior walls of each ModulusTech home are painted white to reflect light and heat. All windows are north-facing, all structures are air-tight, and large overhangs are placed over each window to deflect glare from the sun.

The homes developed by ModulusTech are typically single-storey homes with a floor area of 650 sq. ft. While they can be expanded horizontally with ease, they cannot be high-rises within their given price range. The homes are priced at ~PKR 1.7 million and include electrical and plumbing systems. The total person-hours required to assemble these homes is 72–100 hours, requiring no heavy tools or machinery. The homes possess a lifespan of approximately 50 years. In terms of active design techniques, ModulusTech homes are constructed without labour- or resource-intensive materials, are highly insulated, and are offered to end-users with solar systems that are incorporated into the sale price.

ModulusTech has also worked as a builder in a business-to-business capacity to supply prefabricated climate-smart housing for corporate clients across Pakistan's urban and rural areas. The techniques used in all ModulusTech homes are cost-effectively employed without passing significant costs on to the customer, and result in an improved quality of life for inhabitants. In rural areas, ModulusTech's homes have been particularly attractive to corporate clients as construction can cost up to three times more than it would in urban areas due to a lack of enabling infrastructure—i.e., transport links and tough terrain. The value of ModulusTech homes becomes doubly competitive in this context, as not only are costs significantly lower, but the manufacture of ModulusTech's inputs can be conducted off-site. Additionally, remote locations, such as mountainous or desert regions, are subject to harsh climate-related hazards and often lack access to essential services like electricity. This is where ModulusTech homes, due to their climate resilience and self-sustaining features, become significantly attractive.

Figure 6: Geographic presence of climate-smart developers in Pakistan

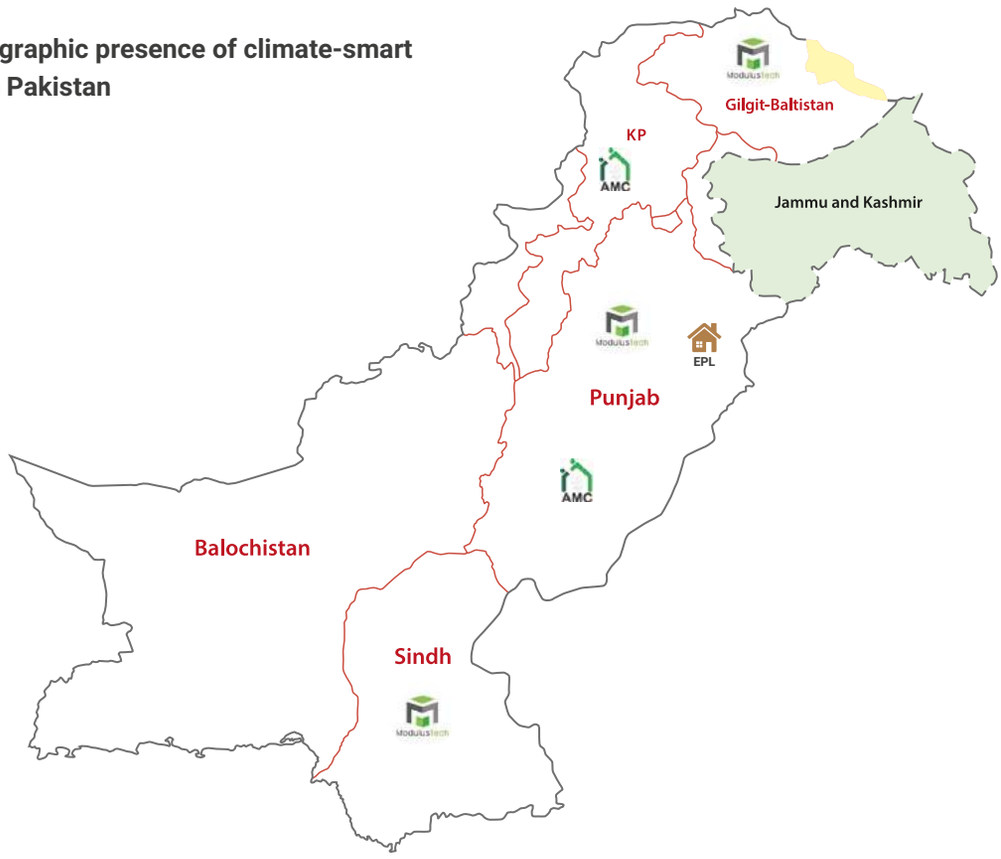


Table 5: Estimated cost of construction - climate-smart low-income housing developers (2022)

2.3.4 Aga Khan Agency for Habitat

The Aga Khan Agency for Habitat (AKAH) is an apex agency within the Agha Khan Development Network (AKDN). AKAH was formed to address habitat-related issues at the community level in AKDN countries. It focuses on strengthening the climate resilience of the marginalised and underprivileged communities with which it works. AKAH is unique in that it uses a participatory approach to working with these communities, seeking not only to provide them with solutions to enhance their resilience to natural and environment-related hazards but also to work alongside them in a way that ensures they have the necessary awareness to seek such solutions. Aside from AKAH's work to improve the climate resilience of communities, AKDN has also pledged to reach net-zero by 2030 in every country it works, including Pakistan.

AKAH has made significant strides towards improving the climate resilience of vulnerable communities in Pakistan through innovations in rural housing. Two major AKAH initiatives in this regard were the Water and Sanitation Improvement Programme (WASIP) and the Building and Construction Improvement Programme (BACIP). WASIP was initially implemented in communities residing in the remote mountain regions of northern Pakistan where communities suffered from a lack of access to clean water and sanitation. Under WASIP, the unique environmental challenges present in these areas necessitated innovations such as using natural springs or gravity-based water supply solutions to ensure continuous clean water supplies. BACIP was later initiated in 1997 after a period of working alongside these communities unearthed additional environmental vulnerabilities such as thermal comfort (or the lack thereof), indoor air pollution, and frequent earthquakes.

Through BACIP's exploration of how to strengthen the climate resilience of these communities, AKAH remained cognisant of the fact that if these communities had the financial capability, they would not be residing in highly vulnerable areas to begin with. This notion spurred AKAH's approach towards developing climate-smart 'add-ons' to repurpose existing homes to be more climate-resilient rather than focusing on innovations that could only be implemented in the design or construction stage. These approaches have since been implemented in all of the communities in Pakistan with which AKAH works, depending on their climate-sensitive needs.

To improve indoor air quality and thermal comfort, AKAH endeavoured to shift these communities from wood-intensive heating and cooking to less carbon-intensive approaches.

The communities with which AKAH works are often marginalised and underprivileged—they would use whatever materials they could if wood was unavailable, including old tires and other hazardous materials. In response, AKAH developed low-income products like energy-efficient cooking stoves, candle wick lamps, and solar-powered water heaters. It also developed and supplied low-income products that could be used in the construction stages of building homes. These included roof-hatch windows, double-glazed windows, wall-insulation, roof treatment techniques (for thermal efficiency), candle wick lamps, floor and wall insulation, and household biogas plants as a source of renewable energy for cooking and water heating.

With global warming already having increased the frequency and intensity of climate-related disasters in vulnerable areas, it becomes even more significant for these communities to be provided with adequate dwellings that can resist the impact of seismic events. However, through BACIP, AKAH found that little could be done to improve the structural integrity of existing homes. The products they developed to improve the structural integrity of homes at the construction stage included lightweight and low-income galvanised iron reinforcements and beams made of wood composites for roofs which simultaneously reduced reliance on timber in roof construction.

To ensure new homes were as resistant to seismic events as possible, they developed green building guidelines, which were later presented to the PEC, although these were reportedly not taken up at the time or since by any public sector body in Pakistan.

2.3.5 Karawaanserai Studios

Figure 7: Images of the Bamboo Pilot house, Lahore

Karawaanserai Studios specialises in climate-smart housing and buildings and further specialises in affordable housing. It is based in Lahore, Punjab, and has worked on projects across Pakistan.

Of particular relevance is its work on lightweight, low-income, sustainable housing developed for lower-income and impoverished communities in both rural and urban Pakistan. At the core of this work is the exploration of climate-sensitive housing design and indigenous alternative materials for housing construction. Using locally sourced bamboo, it designed and constructed a modular home in Lahore as a pilot with Shaksat Group and Co., intending to subsequently scale-up the design for marginalised communities in the disaster-prone areas of Sindh and, later, south Punjab.

In collaboration with the Lahore College of Theology, Crown Research (Pvt.) Ltd. engaged Karawaanserai Studios to develop this housing design as a prototype for farming communities living in informal dwellings on the outskirts of Hyderabad, Sindh. These communities were severely affected by floods during the monsoon seasons in Pakistan. Their existing homes, predominantly made from mud, typically sustained severe water damage during these times, putting the families that occupied them at risk of an array of waterborne diseases. The Lahore College of Theology then commissioned the construction of resilient climate-sensitive housing to improve the quality of life of the affected poverty-stricken communities. The resulting design of the 'bamboo house' was made cost-effectively using naturally abundant bamboo sourced from forests in Kasur, Punjab, as a building material for each aspect of the home—from its interior and exterior walls to its roofing system.

Contrary to popular belief, bamboo is a type of perennial grass. The construction-grade bamboo used was one of three types produced in Pakistan, this being the most viable replacement for standard construction materials due to its superior tensile strength—comparable to that of steel. House foundations are laid with concrete, but the use of concrete is sparing, limited only to sections where the bamboo pillars that support the house's structure are placed. The raised single-storey modular pilot home integrates bamboo in almost every aspect.

The three-room bamboo house has a covered area of ~500 sq. ft. The floors are made of several eight × eight-foot modular bamboo weaves, adding to the bamboo's existing structural integrity and negating the need for other materials. The roofing system is engineered to include load channels composed of bamboo, where no additional support is required due to the various types of trusses incorporated. With the interior and exterior walls made from bamboo poles, space is left in-between to fit standard industrially manufactured insulation sheets. For finishing, the exterior is also suitable for lime finishing, which adds to its ability to resist water damage.

Due to the simplicity of the bamboo weaves for flooring or walls, the inputs needed to make a module can be prefabricated off-site and quickly assembled on-site without heavy machinery. The house also boasts a mains electricity connection and is suitable for water connections, although these connections require skilled labour. Owing to its passive design and the construction materials used, the bamboo house has minimal levels of embodied carbon. If insulation and lime are added to the exterior, the house is able to withstand harsh temperatures and protect its inhabitants from the frequent floods they currently face.

However, the design of the bamboo home should be noted to be a rare occurrence in Pakistan. The use of bamboo as a primary construction material is uncommon and in stark contrast to the noted desire among most Pakistanis for a concrete home. Additionally, the design of the bamboo home was born not only from a need to create housing that could withstand torrential rains but from a community whose current housing possessed almost no ability to withstand water damage, which is not necessarily the case with all areas in Pakistan. In terms of the potential for scalability, the design may be limited due to end-user demand (see section 4). In addition, there is limited capacity for sourcing bamboo in a cost-effective manner, as the forests in Kasur, Sargodha, and Pattoki (primary bamboo-producing areas) may not be able to sustain exponential increases in demand.

3. STAKEHOLDER MAPPING

3.1 Key stakeholders in Pakistan's climate-smart housing landscape

This report is the culmination of primary and secondary qualitative research and is supported by quantitative data where necessary. Industry leaders and key stakeholders were engaged through semi-structured interviews that provided insights and evidence on Pakistan's housing landscape. The stakeholder engagement evolved from these expert interviews, enabling wider data collection from other stakeholders in relevant industries, including architecture, construction, banking, and housing finance. First-hand information was further supplemented by desk research occurring throughout the project. The research findings obtained were synthesised to provide a multidimensional understanding of the key issues underlying the extent of the (under)development in the landscape.

The key stakeholders identified and engaged for this project are shown in Table 6. A summary of their key contributions to the climate-smart landscape is also provided.

Table 6: Project stakeholders

Industry	Organisation	Key contributions to the climate-smart landscape
Climate-smart and/or affordable housing developers	ModulusTech	• Developer and supplier of climate-smart materials and homes • Pioneer in low-income, prefabricated, climate-smart housing
	AMC	• Safiya Homes, Level 1 EDGE-certified housing project based in Lahore
	EPL	• Developer working to incorporate climate-smart innovations in existing housing projects • Production of fly-ash bricks for future use in affordable housing projects
Public sector and government units	NEECA	• A federal-level government unit working in the cause of energy efficiency and conservation
	PHTF	• Worked to advise on policy aims for PHTF—the policy-focused counterpart to NAPHDA • Established a centre for affordable housing research (acash.org.pk), amalgamating local and global research
Architecture	Karawaanserai Studios	• Architecture firm specialising in the design of affordable and climate-smart homes • Architect and designer of the 'Bamboo House' pilot project in Lahore
Non-government organisations	Pakistan Green Building Council (PkGBC)	• Advocates for green buildings in Pakistan • Auditor of the Sustainability in Energy and Environmental Development (SEED) certification (local equivalent of EDGE)
	AKAH	• Delivers a range of climate-smart innovations to strengthen climate resilience in residential housing • Developed green building guidelines for AKDN countries
	Pakistan Environment Trust	• Leverages global finance to fast-track climate action in Pakistan • Delivers two landmark programmes: creating pathways for industry leaders to go carbon-neutral, and identifying opportunities for local entrepreneurs to tap into the voluntary carbon market

3.2 Identified incentives for key stakeholders

The key insights and incentives for sector activity and participation identified by the stakeholders interviewed are given below. These incentives—or disincentives in need of redressal—are provided and separated by industry.

3.2.1 Climate-smart and/or affordable housing developers

- Most developers have little interest in constructing affordable housing as there are no incentives provided by the government to do so. In the absence of government regulation over the treatment of land as a commodity in Pakistan (see section 4), developers are, in fact, perversely incentivised to continue selling empty plots of land rather than housing.

- The lack of an enabling environment owing to lenient bylaws, as well as lengthy and time-consuming processes for obtaining NOCs—government-issued authorisation documents—for housing projects further disincentivise developers. Financial incentives are needed (i.e., through green subsidies or financing at favourable interest rates) to 'cover' the high costs of climate-smart innovations and encourage the construction of climate-smart homes at scale.

- Collaborations between academia and the industry may be needed to create market-based solutions. If climate-smart technologies like fly-ash bricks, low-impact cement, aerated taps, high-performance glass, etc., can be developed indigenously, the uptake of these products will be more financially feasible for developers to implement in their housing projects.

3.2.2 Public-sector and government units

- The in-house capability of government units such as city planners and development authorities is lacking in the technical expertise needed to evaluate the climate smartness of housing projects. Their ability to evaluate building design is limited to basic zoning requirements (i.e., building height, basic seismic requirements, etc.), meaning that even if significant regulatory shifts were to take place in favour of climate-smart buildings, this lack in technical capacity would significantly slow any progress.

- The first step in decreasing embodied carbon and emissions in the housing and construction sector is measurement. However, no formal mechanism is available for tracking carbon emissions in Pakistan, nor is there any compulsion from the public sector to do so within construction. In fact, restrictions on cement, brick, steel, or other high-impact material production do not exist. As a result, developers are neither concerned with reducing their use of these materials, nor do they have any incentive to measure them unless they are export-oriented and compelled by the market to which they wish to export.

- In 2014, the minimum area required for private development schemes in Punjab was changed from 100 kanals (12.5 acres) to 24 kanals (3 acres)[45].

[45] *Private housing developers were required to submit applications for approval for land not less than 100 kanals, whereas in the 2020 land use regulations, developers were required to submit applications for no less than 24 kanals. See, Government of Punjab. 2010. "The Punjab Private Housing Schemes and Land Subdivision Rules, 2010." https://lgcd.punjab.gov.pk/system/files/THE_PUNJAB_PRIVATE_HOUSING_SCHEMES_AND_LAND_SUB_DIVISION_RULES_2010.pdf and Lahore Development Authority. 2020. "Land Use Regulations 2020." https://lda.gop.pk/website/images/LDA_Land_Use_Regulations_2020_dated_07_10_2020.pdf.*

3.2.3 Financial institutions and banking

- The SBP developed and published the Green Banking Guidelines in 2017. However, there is no mandatory requirement placed on banks to adhere to these guidelines—uptake is voluntary.

- Many commercial banks in Pakistan are highly conservative and avoid extending housing finance to the B40 despite the need present in this segment of the population. This is despite the SBP revising the portfolio requirement applicable to financial institutions, whereby as of 2021, seven percent of the overall portfolio of each bank must comprise housing finance. The organisational culture that persists in commercial banks favours risk-averse lending, and as a result, banks typically circumvent this requirement by extending housing finance to their own employees or do not lend to the B40 at all.

3.2.4 End users—beneficiaries of affordable housing

- A general lack of awareness persists in lower- and middle-income households about the looming effects of climate change. Meanwhile, end users tend to prefer traditional brick-and-mortar structures and are unaware of more environmentally friendly construction materials. As a result, they tend to demand more traditionally built houses. Thus, the uptake of affordable climate-smart housing is low as demand for sustainable living simply does not exist. Despite the government's introduction of affordable housing schemes like Mera Ghar Mera Pakistan (MGMP), sector activity is not market-led, further disincentivising the construction of such housing.

- As the majority of the B40 (with the potential exception of those living in disaster-prone areas) is price-sensitive rather than climate-sensitive, even where climate-smart innovations are available at only slightly higher costs, the cheaper option is still favoured. For instance, energy-efficient fans (60–65 watts) are available in Pakistan for approximately PKR 200–300 more than conventional fans (135–140 watts). These fans can result in up to 50% savings in monthly electricity bills. However, the additional up-front cost, although marginal, still deters lower-income families from purchasing them.

4. RESEARCH INSIGHTS

4.1 Evidence gathered on demand: End-user insights

At the core of the reduced demand for climate-smart housing in Pakistan is a lack of awareness among end-users of climate change and its impacts. This extends to the reduced awareness of climate-smart housing as a mitigation effort. This notion exists across income levels, with higher-, lower-, and middle-income families being widely ignorant of the need for resource conservation in housing construction. With lower- and middle-income families, the cultural importance of pride leads them to desire a house that resembles homes built by the affluent. This implies a need to target technology and design solutions for higher-income households that can raise aspiration for climate-smart housing, allowing demand to trickle down to lower- and middle-income families. An insight into this mindset, from affordable housing developers EPL and AMC, is that the first thing a potential customer does upon visiting a property is knock on its walls—solidity is seen as an indication of durability. As a result, the further away a home is from the traditional concrete, brick, and mortar design, the harder it is to market such homes to the B40.

The same notion underlies the desire for flat concrete roofing in Pakistan, which is not necessarily the most appropriate choice given the heavy monsoon seasons that occur across large parts of the country. The development of a reinforced concrete roof is resource-, labour-, and time-intensive. Reinforced concrete is an exceptionally expensive technique, with cement priced at PKR 900/bag and steel at PKR 230/kg as of April 2022. The process of making such a roof is also costly in terms of the time it takes for the concrete to cure, which is approximately one-and-a-half months. The desire for this type of roof, for the end-user and builder, stems only from their familiarity with it, as it is neither appropriate for Pakistan's weather and climate, nor cheap or quick to construct.

The challenge faced by developers like ModulusTech is in ensuring that their product is desirable to middle- and lower-income customers, despite its design and construction as a sustainable home. In ModulusTech's experience, generating demand among these groups based on using new technologies alone has not been successful as the average Pakistani—irrespective of socioeconomic background—is not quick to adopt new technologies. In catering to these customers, ModulusTech's products must instead appeal to these audiences by drawing stark parallels with the shortcomings of traditional brick and concrete homes, as the inherent value of sustainable technologies is not easily communicated to the B40.

Given its weather and climate, Pakistan has been noted for its tremendous potential for harnessing solar power as a pathway to climate mitigation and reduced reliance on fossil fuels[46]. However, on the challenges associated with the uptake of renewable energy solutions, most lower-income families would simply not be able to afford the upfront cost of adoption. Solar systems—comprising panels, an inverter, and a solar battery—with a three-phase connection can cost at least PKR 0.5 million[47].

[46] *World Bank Group. 2020. "Expanding Renewable Energy in Pakistan's Electricity Mix." https://www.worldbank.org/en/news/feature/2020/11/09/a-renewable-energy-future-for-pakistans-power-system#:~:text=Pakistan%20has%20tremendous%20potential%20to,is%20also%20an%20abundant%20resource.*

[47] *Premier Energy. 2022. "On-Grid/Grid Tie Solar System in Pakistan." https://premierenergy.com.pk/on-grid-solar-system-in-pakistan/.*

Cost aside, most middle- or lower-income families have single-phase connections to the national grid. This makes them ineligible for net metering and bars their access to the financial incentives even if they were to install solar panels.

While the cost of a solar system in Pakistan has a payback period of four to five years, the upfront costs of purchasing and installing household solar systems are unlikely to be affordable for lower- or middle-income families without financing. Interest-free solar financing for individuals or businesses does exist under the SBP's refinance scheme. However, according to requirements outlined by Meezan Bank—a finance provider under this scheme—only salaried permanent employees, business customers, and in certain cases, pensioners, are eligible[48]. In addition, individuals must have a minimum monthly gross salary of PKR 100,000, a minimum job tenure of two years (in the same company), and an active national tax number[49]. Recalling that the average household income for the first and second quintiles is PKR 29,049 and PKR 23,192, respectively, solar financing from traditional banking institutions under the SBP refinance scheme is likely to be inaccessible to the B40. Similar requirements are applied across the board for other financial institutions participating in the scheme, such as the Bank of Punjab, the National Bank of Pakistan, Habib Bank Ltd., Habib Metro, Bank Alfalah, JS Bank, and others. As the B40 is often informally employed and unlikely to possess a pension, most lower-income households would be overlooked by traditional banks for solar financing.

The promise of solar achieving up to 70% savings on monthly electricity bills (compared with a concrete home of the same size) is enough to convince those who are aware of the importance of renewable energy of the value of purchasing a solar system. However, this knowledge alone is often insufficient to persuade lower-income families since it means paying an up-front cost of PKR 0.5 million. Consequently, to ensure the provision of homes that are net-zero in their emissions or close to it, ModulusTech incorporates the cost of solar systems into the mortgage package offered to end-users without the subsidisation that is available to higher-income groups. For greater affordability of net-zero housing, financing and convenience must be factored in to increase the uptake of renewable energy among lower- and middle-income households.

In its work to provide labour housing, ModulusTech was able to gain further insight into the marketability of passive design techniques to lower-income individuals. For workers living and working in the remote desert regions of Sindh and Balochistan, concrete homes were still widely considered the better, 'stronger' option—that is, until these individuals experienced living in a ModulusTech home, which they found to possess higher levels of thermal comfort as compared to a container or concrete home, due to ModulusTech's adherence to passive design principles, the use of composite materials as opposed to concrete, and high levels of insulation. Similarly, in AMC's Safiya Homes project, inhabitants of the single-storey homes noted that they were far cooler (without air conditioning) than the houses they had previously inhabited—they said they would recommend the houses to their peers. This highlights the value of demonstration as a valuable strategy to persuade end-users of the benefits of climate-sensitive housing, thereby increasing awareness and uptake.

An additional challenge that hinders the widespread uptake of climate-smart housing in Pakistan is that the marketability of such housing is low for families in less disaster-prone areas.

[48] *Meezan Bank. 2022. "Meezan Solar." https://web.archive.org/web/20220125073423/https://www.meezanbank.com/solar-panel-financing/ [archived version].*
[49] *Ibid.*

Building on the significance of demonstration as a key tool to exhibit the benefits of climate-smart housing, individuals who have not lived through natural disasters (flash floods, earthquakes) are much more reluctant to adopt climate-resilient practices or technologies. For a lower-income household residing in the urban areas of Lahore or Karachi, where thermal comfort and overcrowding are the dominant housing issues, a larger home is thought of as a pathway to increased thermal comfort rather than the materials used to construct the home.

However, the ease with which alternative materials and construction techniques can be accessed in Pakistan is limited, as is the demand for them—as seen in the previous section. For instance, low-impact cement and insulation exist but are not produced in Pakistan to the same quality as that available elsewhere. These inputs are costly to import and even more costly to use at scale in Pakistan, which renders them inappropriate for use in low-income housing.

4.2 Evidence gathered on supply: Industry insights

Structural stability must be ensured for a home to be climate-resilient, which is integral to every aspect of the home. For a house to have adequate levels of thermal comfort, insulation is required, which will necessarily put a load on the structure. Earthquake resilience is necessary if the homes are located in an area that is vulnerable to seismic events, requiring strong and/or reinforced structures. Solar panels may then be added to the rooftops of these homes for energy efficiency, especially if the home is aiming to be net-zero or close to it. This necessitates that the ceiling is adequately load-bearing. While most 'traditionally constructed' homes will achieve these feats using reinforced concrete or steel beams, a climate-smart home must also seek to save on embodied carbon by limiting or avoiding the use of such materials.

However, the ease with which alternative materials and construction techniques can be accessed in Pakistan is limited, as is the demand for them—as seen in the previous section. For instance, low-impact cement and insulation exist but are not produced in Pakistan to the same quality as that available elsewhere. These inputs are costly to import and even more costly to use at scale in Pakistan, which renders them inappropriate for use in low-income housing.

The methods used in traditional construction also pay little heed to the scarcity of resources. In Pakistan, the construction of a three-marla house (~980 sq. ft.) could use hundreds or even thousands of gallons of water due to the water-intensive processes of mixing concrete and priming bricks for mortar. However, while these processes do require large amounts of water and labour, both misinformation and cultural practices in the construction sector contribute significantly to water wastage—and lead to the aforementioned variation in water use. Clay bricks, as a standard, can require six hours of soaking in water to ensure sufficient bonding capability with the mortar that is laid on top[50]. However, in Pakistan, the soaking of bricks is traditionally done by using a hose for a constant supply of water, and the process can be erroneously done for several days before the bricks are laid. This contributes significantly to water wastage.

[50] *Swarup, P.R. 2006. "Soak Bricks for Good Mortar Strength." The Economic Times. 16 July. https://economictimes.indiatimes.com/property/soak-bricks-for-good-mortar-strength/articleshow/1758550.cms?from=mdr.*

For developers in Pakistan, the lower risk and higher reward pathway to profit is to avoid housing construction entirely. Instead, land is treated as a commodity, and selling undeveloped plots is an incredibly lucrative venture. According to property website zameen.com, the period January 2011–April 2022 saw the per-square-foot price of land in Lahore increase by 432.56%[51]. The per-square-foot price of residential property in Lahore saw an increase of 286.45% over the same period.

This disparity and the absence of restrictive zoning laws limiting the supply of undeveloped land, as seen in developed cities like San Francisco and New York[52], may result from two reasons. The first reason is that houses have a limited lifespan and, once built, continue to depreciate. Undeveloped land, however, does not have a lifespan and will likely only appreciate. The second reason is more specific to the effects of urbanisation witnessed in Pakistan over recent decades. Previously, undeveloped agricultural land on the outskirts of cities like Lahore and Karachi increased in value as the cities expanded. Large housing society developers, upon purchasing undeveloped land, took on the responsibility of turning it into functional neighbourhoods.

These developers ensured access to clean water, sanitation, sewerage, electricity, and gas and subsequently sold empty plots to target customers. Before this development, this land would have been barren and lacking in the essential services needed in a neighbourhood. As urbanisation increased, so did the value of the peri-urban land, in turn increasing the value of these housing societies. In this way, over time, the returns that could be realised from selling empty plots outweighed the effort and risk of developing actual units.

Developers in Pakistan are, for this reason, highly disincentivised towards building homes and liveable structures. Catering to the B40 may only result in a return on investment (ROI) of 10–20%, paling in comparison to the ROIs that may be achieved by selling to the affluent. The prospect of exponential increases in land value as urbanisation continues is a mindset that also trickles down to the B40. Resultingly, lower-income households also often choose to continue living in informal dwellings in the hope that, within their lifetime, a plot of land they purchased on the outskirts of a city will appreciate over time.

Potential policy-level mitigation suggested by AMC for the treatment of land as a commodity is that the Government of Pakistan could pass national-level legislation limiting the time that land can remain undeveloped. For instance, if it were mandatory for all plots in a housing society to be constructed within one to two years, developers would be compelled to construct on the land. This solution, however, is unlikely to be feasible at the national level because, currently, housing legislation is a provincial subject. On a smaller scale, this solution was lobbied for by AMC, resulting in a provision mandating that 20% of developer-owned land must be used to construct housing units. This provision was incorporated into the Punjab Housing and Town Planning Agency bylaws, which are now at the implementation stage. Moreover, the Finance Bill of 2022[53] creates some ease for developers and investors engaging in affordable housing finance for the reasons listed below, further encouraging them to continue investing:

- Taxes payable on profits and gains derived from low-cost housing have been reduced by 50%.

[51] Zameen.com. 2022. "Lahore Plots Price Index (Aug 2022)." https://www.zameen.com/index/buy/plots/lahore/.
[52] Schiller, B. 2017. "What Happens When Land is More Expensive Than the Buildings on Top?" Fast Company. https://www.fastcompany.com/40487403/what-happens-when-land-is-more-expensive-than-the-buildings-on-top.
[53] Government of Pakistan. 2022. Finance Bill, 2022. Islamabad: Federal Board of Revenue. https://www.fbr.gov.pk/Budget2022-23/FinanceBill/Finance-Bill.pdf.

- Any profits on PMRC-issued bonds are to be used to refinance the residential housing mortgage market.
- Tax exemptions have been introduced for any income derived from the Federal Government Employees Housing Authority and NAPHDA for the year 2020 and onwards.

4.3 Evidence gathered on the need for targeted financial products

While NAPHDA has made little progress on the housing construction front, its partnership with the SBP to provide housing finance has been relatively fruitful. The SBP's Government Markup Subsidy Scheme, MPMG, was first introduced in late 2020 to support financing for the housing and construction sector. This was in addition to an SBP requirement on banks, set earlier in 2020, that required lenders to increase their housing finance portfolios to at least five percent (revised to seven percent in 2021), which has encouraged financial institutions to come on board as financiers for the scheme.

Four types of financing have been made available under MPMG to first-time homeowners hailing from lower-income households. These include financing for the purchase of a built house or apartment, a new plot and housing construction, extension of an already owned housing unit, or housing construction on an already owned plot[54]. Financing of up to PKR 10 million (PKR 1 crore) is offered to eligible individuals at fixed rates (Table 7)[55].

Table 7: MPMG scheme tiers

	Tier 1	Tier 2	Tier 3
	NAPHDA projects	Non-NAPHDA	Non-NAPHDA
Categories and size of units	a. House up to 125 sq. yards (5 marlas) with a maximum covered area of up to 850 sq. ft. b. Flat/apartment with a maximum covered area of 850 sq. ft.	a. House up to 125 sq. yards (5 marlas) b. Flat/apartment with a maximum covered area of 1,250 sq. ft.	a. House up to 250 sq. yards (10 marlas) b. Flat/apartment with a maximum covered area of 2,000 sq. ft.
Maximum price of units	PKR 3.5 million This is the market value of a single housing unit/flat or apartment at the time of approval of financing	No cap	No cap

[54] State Bank of Pakistan. 2020. "Mera Pakistan Mera Ghar (MPMG) Government Subsidy Markup Scheme." https://www.sbp.org.pk/MPMG/index.html.
[55] Ibid.

The basic eligibility requirements[56] for the MPMG scheme stipulate that all borrowers must:

1. Possess a national identity card.
2. Be a first-time homeowner.
3. Have not taken any other subsidised loan facilities under the same scheme.

As fixed interest rates were previously unavailable in Pakistan, the MPMG scheme marks the first time an innovative financial product was made available to lower- and middle-income households. Several public and privately owned banks and non-banking financial institutions (NBFIs) were approved to provide financing under the scheme[57]. Four tiers (0, 1, 2, and 3) dictate which banking and non-banking institutions may provide financing, as well as which housing projects qualify[58]. Different requirements were placed on housing size depending on the tier. Minimum income and documentation requirements to assess eligibility differ between banks, with NBFIs like Trellis being slightly more flexible in their eligibility assessments.

In all tiers, non-structural renovations (painting walls, tiling), buying or building houses to rent out, and purchasing plots without construction are not available. For the beneficiaries of the scheme taking either tier 2 or 3, the first five years of financing is fixed at five percent for loan amounts up to PKR 6 million or seven percent for loan amounts above PKR 6 million (Table 8)[59].

Table 8: MPMG financing tiers

Tier	Financing available up to	Possible housing providers
0	PKR 2 million	Microfinance institutions like Akhuwat Foundation
1	PKR 3.5 million	NAPHDA housing
2	PKR 6 million	-
3	PKR 10 million	-

The following five years of financing are also fixed for beneficiaries at plus two percent. So, individuals whose rates were initially fixed at five percent will be required to pay seven percent, whereas those initially benefitting from a fixed seven percent rate will be required to pay nine percent[60]. Eligible beneficiaries can avail of loan tenors of either 5, 10, 15, or 20 years, with the caveat that fixed rates are available only up to 10 years. Beyond ten years, beneficiaries will be subject to prevailing market rates, as well as insurance or takaful charges, if applicable.

An SBP-led mela (fair) was held in Faisalabad, Punjab, on 19–20 March 2022 to promote the uptake of the MPMG scheme[61]. The two-day mela received an overwhelming response from the public—over 30,000 people visited to obtain information and apply for loans through a special one-window operation set up for the event[62]. The mela reportedly resulted in the conditional approval of ~PKR 7.4 billion in loans via the one-window set-up.

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[56] *National Bank of Pakistan. 2018. "Mera Pakistan Mera Ghar." https://nbp.com.pk/Mera-Pakistan-Mera-Ghar/product-features.aspx.*
[57] *Ibid.*
[58] *Ibid.*
[59] *Ibid.*
[60] *Ibid.*
[61] *Kazmi, S. 2022. "First-Ever Mera Pakistan Mera Ghar Mela." Pakistan and Gulf Economist. 28 March. https://www.pakistangulfeconomist.com/2022/03/28/first-ever-mera-pakistan-mera-ghar-mela/.*
[62] *Ibid.*

Overall, the MPMG scheme has been widely acknowledged as a success thus far, with a steep rise in the uptake of affordable housing finance linked directly to the scheme[63]. As of 30 March 2022, loan applications worth PKR 357 billion were reportedly processed, with PKR 56 billion having been disbursed to beneficiaries.

However, the SBP halted further MPMG disbursements in June 2022 as per government directives. With the recent change in the political landscape and economic turmoil, there is uncertainty about the scheme's future. The government has appointed a housing committee comprising members from the SBP, PMRC, and commercial banks to identify a pathway moving forward. The earliest re-launch can be expected in the first quarter of the 2023 financial year.

The housing finance company Trellis operates at the intersection of FinTech and housing finance. Its mode of operation differs from Pakistan's formal banking sector in that it tailors housing finance delivery to meet the needs of the B40. Trellis, too, offered housing finance under the MPMG scheme but employs additional measures to extend housing finance to undocumented and unbanked borrowers, thereby increasing financial inclusion.

Trellis operates by making a conscious effort to identify and connect with developers who are either interested in penetrating the climate-smart housing space or have already done so, evidenced by its partnerships with AMC and EPL. Its underlying motivation to connect with developers and organisations working in this space is to recommend homes or products to beneficiaries, who, in turn, benefit from resilient and high-quality living structures. The benefits of this approach are also financial. Customer trust in Trellis increases, which, in turn, increases its brand value, its chances of successful expansion to other cities, and ultimately, its ability to source more clients with reduced customer acquisition cost.

A significant number of low- or middle-income households cannot meet the requirements of commercial banks due to informal employment or financial exclusion. In some cases, these customers are referred to Trellis. Trellis maintains co-lending agreements with commercial banks for low- and middle-income customers. These individuals, who may be self-employed, employed by cash-based businesses, and/or do not possess bank accounts, are Trellis' target customers. Trellis's process of creditworthiness evaluations entails using proxy measures like wage books, shop rental agreements, and telephone bills to estimate customers' incomes and compare this against industry standards.

For instance, a store owner who may otherwise fail to provide the required documents to meet the eligibility criteria of formal banks may prove to be creditworthy upon an examination of their cash position and comparing their store against industry performance levels. Trellis does exactly this in addition to applying basic risk-management principles. Upon a positive evaluation of creditworthiness by Trellis, its beneficiaries are marked as 'formal business owners' and given to the commercial bank with whom Trellis maintains co-lending agreements along with an official recommendation letter. These individuals are then fast-tracked to receive housing finance from the commercial banks.

[63] *Ibid.*

Trellis' innovation of entering into co-lending agreements with commercial banks to better service the B40 through its 'mortgage-as-a-service' product is based on findings in neighbouring India[64]. In India, partnerships with commercial banks were shown to have accelerated the supply of affordable housing to small-home buyers[65]. This was achievable due to the facilitation provided by specialised housing finance companies to the undocumented (a large proportion of whom constitute the B40) to access affordable credit from commercial banks. In turn, this increased overall uptake levels of housing finance, helped the B40 obtain affordable homes, and contributed to the Indian government's vision of 'Housing for All by 2024[66].' During the COVID-19 pandemic, a few of the largest NBFIs in India saw a decline in repayments which led the Reserve Bank of India to apply regulatory laws to the NBFIs. The NBFIs were directed to keep 0.25–2% of the loan amount for standard assets[67] to mitigate systemic risks and improve regulatory oversight in the long run. A key learning was to ensure stricter regulations to mitigate systemic risks that can lead to bankruptcy and a complete shutdown of such housing finance schemes.

[64] *Financial Express. 2022. "SBI Ties-up with 5 Housing Finance Companies to Further Affordable Loans to Unserved." Financial Express. 24 March. https://www.financialexpress.com/industry/banking-finance/sbi-ties-up-with-5-housing-finance-companies-to-further-affordable-loans-to-unserved/2471051/.*

[65] *Ibid.*

[66] *Ibid.*

[67] *Reserve Bank of India. 2021. "Scale-Based Regulation (SBR): A Revised Regulatory Framework for NBFCs." https://www.rbi.org.in/Scripts/NotificationUser.aspx?Id=12179.*

5. ANALYSIS OF AVAILABLE FINANCIAL INTERVENTIONS

5.1 Overall investment climate for the climate-smart low-income value chain

Seventy percent of the global population is expected to be living in urban areas by 2050, with close to 90% of this increase in urbanisation taking place across Asia and Africa[68]. With 40% of the urban population in Pakistan currently residing in informal settlements or slums[69], there is a vast opportunity for green investment to shape the affordable housing market.

Given that there is an estimated housing deficit in Pakistan of approximately ten million homes, its estimated market size for affordable housing was reported to be ~USD 165 billion in 2020[70]. By 2050, this market size is projected to grow to ~USD 537 billion. Given this, the creation of market linkages between developers and green financiers could intervene to develop the climate-smart housing value chain and encourage further sector activity—the underlying goal would be to meet Pakistan's housing shortfall of ten million homes with as many net-zero homes as possible.

It should be noted that the estimated market size and its projected growth does not mean that the investment climate in Pakistan is without its constraints. The PMRC was set up in 2018 as a mortgage liquidity facility to increase accessibility to affordable housing finance through the provision of secure finance at attractive rates to primary mortgage lenders, enabling them to scale their long-term lending[71].

Increased PMRC activity, as evidenced by the PKR 23.7 billion in advances that were reported in 2021 (a growth of 59% from the previous year), points to an urgent need for liquidity in the housing market[72]. By injecting this much-needed capital into Pakistan's banking and housing finance sector, PMRC operations extend the reach of the commercial banks and specialised housing finance companies with which they have partnered. In addition, the PMRC issued several debt instruments in 2021, including a first-of-its-kind (in Pakistan) Shariah-compliant domestic bond, or sukuk. In its 2021 annual report, the PMRC stated its growth to be reflective of the market's increasing trust in the company's potential, standing, and ability to realise its mission. However, it should be noted that while the PMRC has become increasingly active over the last year, the advances it reported fall well below the advances reported for financiers in other sectors such as real estate, insurance, banking, and credit. This highlights the complexity inherent in the market and the need for greater focus on housing finance.

Indeed, obtaining segregated data—by institution type—on total mortgage advancements made across the housing finance sector has been increasingly difficult and is indicative of the large data gaps that exist across sectors in Pakistan.

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[68] Reall. n.d. "Building the Affordable Homes Movement in Africa and Asia, 2014–2020: Summary Report of Phase 2B of the Cliff Programme." https://reall.net/wp-content/uploads/2021/07/Summary-of-CLIFF-2B.pdf.
[69] Reall. 2022. "Pakistan - Market Shaping Indicators." https://reall.net/msi/pakistan/.
[70] Reall. 2022. "Impact: Affordable Homes are a Fundamental Human Right." https://reall.net/invest/impact/.
[71] Pakistan Mortgage Refinance Company. 2022. Annual Report, 2021. Karachi: Pakistan Mortgage Refinance Company. https://pmrc.com.pk/wp-content/uploads/2022/04/PMRC_AR2021_Digital.pdf.
[72] Ibid.

While data denoting total mortgage disbursements across institutions is likely collated by the SBP, it is not made publicly available in a timely manner. The most updated record of mortgage advances from the SBP was published on its website in 2019. Despite the initiation of the MPMG scheme and recent revisions in policy to allow for the uptake of the scheme by NBFIs like Trellis and HBFC, a cross-institutional view of the scheme's performance has not been made available to the public. Yet, the latest data from 2019 shows that the ratio of non-performing loans is quite high (ten percent), including both banks and development finance institutions.

If climate-smart low-income housing, as a subset of the affordable housing sector, is to witness increased investment, Pakistan's affordable housing sector must be supported through extensive reform. Insight into the building and construction sector from the stakeholders engaged has shown that developers need to be incentivised to build affordable, climate-resilient homes. One such avenue is through legislative reform addressing the treatment of land as a commodity. Another is subsidising developers through green financing to provide low-cost or climate-sensitive housing. Without such reforms or incentives, sector activity is likely to remain driven by noble intentions, which, on their own, are insufficient to transform the sector at scale.

It should be noted, however, that the underdeveloped nature of the value chain at present doubles as an opportunity for green housing finance to swoop in and unlock the market's potential. This can be seen in the development of the MPMG scheme and Trellis's 'mortgage-as-a-service' product which offers alternative credit assessments capable of enhancing the B40's financial inclusion.

The incorporation of certification tools like the EDGE certification system could be a fairly simple way to determine the extent of energy savings in a potential or existing home. If this were adopted at scale as a pre-condition and made part of the eligibility assessments for the developers of construction finance, the provision of climate-smart low-income housing could increase significantly in Pakistan, along with B40 awareness, acceptability, and uptake. However, the EDGE adoption at scale by housing finance companies may only be possible after there is a significant supply of EDGE-certified homes to underwrite against.

Alternate, but marginally expensive tools like LEED and BREEAM can be useful certifications for climate-smart housing. Another tool, a PKGBC guideline, 'Sustainability in Energy and Environmental Development (SEED), is focused on ensuring that development is energy efficient and environmentally responsible[73]. However, demand-side interventions must be complemented by supply-side initiatives (such as ensuring the appropriate incentives are available for developers) if development is to be realised across the climate-smart low-income housing value chain.

Of significance to a green investor is the lower construction cost of a net-zero home (~PKR 2,400/sq. ft.) compared to a traditionally constructed concrete home (~PKR 4,430.75/sq. ft). Following this reduced construction cost, even if a stringent estimate of 20 tons of lifecycle carbon/home is used[74], and Pakistan's 12 million home shortfall is ameliorated with the construction of only net-zero homes, 200 million tons of carbon dioxide equivalent (CO2e) could be avoided.

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[73] Pakistan Green Building Council. 2020. "Introduction to SEED." https://pakistangbc.org/seed-intro.php.
[74] Global Innovation Lab for Climate Finance, The. n.d. "The Lab's Impact." https://www.climatefinancelab.org/project/green-affordable-housing-finance/. Accessed 26 September 2022.

More applicable to current levels of uptake and the acceptability of climate-smart housing in Pakistan, however, would be to aim for these homes to at least be constructed to possess at least 20% savings across water use, energy consumption, and embodied carbon. Using the EDGE certification to verify these savings would mean that at a scale of 12 million homes, 160 million tons of CO_2e could be avoided.

5.2 Available financial interventions and their potential impact

5.2.1 Carbon trading

Globally, an increasing number of organisations are either committing to carbon neutrality or possess the desire to reduce carbon emissions across their supply chains. In place of reducing actual emissions, another pathway entails investing in carbon credits to 'offset' emissions through investment in green initiatives. Theoretically, the amount of CO_2e sequestered by a green initiative in which a company has invested can count towards a reduction of the same amount in the company's total emissions.

While organisations based in the developed world (i.e., in the EU) are regulated by stringent regulations on carbon trading, the voluntary carbon market allows for the purchase of carbon credits anywhere in the world. The voluntary carbon market is a burgeoning global phenomenon, with the market for carbon credits anticipated to be worth upwards of USD 50 billion by 2030[75]. With this growing demand for carbon credits in mind, the voluntary carbon market is significant for Pakistan because it can channel investment toward climate-action projects that would otherwise not be economically viable.

Pakistan's underdeveloped climate-smart housing value chain presents developers or banks ample opportunity to penetrate this sector and, in turn, seek funding in the form of carbon credits. Pakistani developers engaged in developing affordable housing will typically already conform to one of the major principles of climate-smart housing, which is to save on embodied carbon in the home's overall footprint—as compared to a 'standard' home. This is inadvertently achieved by many affordable Pakistani housing developers, because to reduce costs, they seek to utilise proportionally less heavily carbon-embodied materials.

For a home built using low-carbon techniques and materials, the owner may qualify for carbon credits if building the home is not economically viable without additional capital. For instance, low-carbon cement, high-quality insulation, or other such climate-friendly techniques can result in an additional cost that renders a housing project unprofitable at scale. For the owner of the household (whether a developer or a bank who owns the home until its mortgage is paid off), the pursuit of carbon credits for which they may qualify could result in a financial benefit that can be passed on to the end user. For a bank, this financial benefit could be passed on in the form of a lessened principal loan amount; and for the developer, this could result in a lower home sale price. In either case, the carbon credit could act to subsidise the cost of the home while simultaneously achieving a reduction in emissions for the organisation purchasing the credit.

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[74] Global Innovation Lab for Climate Finance, The. n.d. "The Lab's Impact." https://www.climatefinancelab.org/project/green-affordable-housing-finance/. Accessed 26 September 2022.

[75] Blaufelder, C., Levy, C., Mannion, P., and Pinner, D. 2021. "A Blueprint for Scaling Voluntary Carbon Markets to Meet the Climate Challenge." McKinsey and Company. https://www.mckinsey.com/business-functions/sustainability/our-insights/a-blueprint-for-scaling-voluntary-carbon-markets-to-meet-the-climate-challenge.

That said, while it may be true that affordable homes in Pakistan may save on embodied carbon, the requirements for carbon credits may be much more stringent than the techniques employed by Pakistani developers. Consequently, it may not be an easy feat for a housing project to qualify for carbon credits. Currently, the voluntary carbon market is regulated by the carbon credit programmes of two main bodies: the Gold Standard and Verra, which certify the integrity of carbon credits for green projects under the principle of additionality. The extent to which a carbon credit has 'integrity' depends on whether the project for which it is issued could take place without the additional funds generated by the sale of the credit. If the project is viable without the credit, it is not a quality credit and will not be certified.

The concept of additionality aside, an added caveat is that no internationally recognised standardised methodology exists for constructing a climate-smart or low-carbon impact home—as noted in earlier sections. EDGE can be used as a planning tool and can calculate the extent to which savings in energy, water, and embodied carbon exist, but it is not prescriptive. The impact of this significantly hinders the scalability of pursuing carbon credits for climate-smart low-income housing projects. As a result, promoting large-scale sector activity will first require arriving at a consensus on what constitutes a climate-smart home. Only once there is a standardised methodology accepted by carbon credit programmes will there be any sort of guarantee towards developers that they could receive investment in the form of carbon credits. Ultimately, carbon credits for low-income housing projects may still be possible to acquire, but at a smaller scale. Without a standardised methodology, developers will be left to determine how best to make their projects climate-smart, and it might be that their actions fall short of what is required to attract investment.

5.2.2 Social impact and climate-action financing

On the other hand, using environmental, social, and governance (ESG) criteria, an investor may be able to assess a potential climate-smart housing developer for their compliance and use this to determine whether to invest. For instance, BlackRock has incorporated ESG indices in its investment strategy and considers a broad range of behaviours to determine an organisation's compliance across these three categories[76]. If a company scores well on ESG indices, it may potentially be attractive to global investment firms like BlackRock and others. This opens the door for developers to attract funding from an array of global investors who are concerned with the environmental impact of their investments.

For local investors, this becomes increasingly significant, as increased sector activity could be realised by facilitating developers or innovators within the climate-smart housing landscape to score highly on ESG criteria. High scores may, in turn, allow these organisations to attract investment from global investors like BlackRock. This investment could potentially be in the form of risk participation agreements between local financial institutions and international investment firms.

Additionally, the Green Climate Fund (GCF) works to promote climate action in developing countries, including Pakistan, by identifying national partners to facilitate the evaluation of projects and disbursement of funds. The national partners are called direct access accredited entities[77], and in Pakistan include JS Bank and the National Rural Support Programme (NRSP).

[76] *Blackrock. 2022. "Investors' Top 5 ESG Challenges." https://www.blackrock.com/lu/intermediaries/etfs-and-indexing/sustainable-investing/investors-top-5-esg-challenges#esg-data.*
[77] *Green Climate Fund. n.d. "Pakistan." https://www.greenclimate.fund/countries/pakistan. Accessed 26 September 2022.*

JS Bank possesses the financing capability of USD 250 million, whereas NRSP can disburse up to USD 10 million to qualifying projects. However, the evaluation process for projects is arduous and time-consuming, resulting in relatively few funds having been disbursed in recent years. The process is such that a concept note must be submitted to the GCF board and approved after its preliminary approval by JS Bank or NRSP.

The overall timeline from the proposal stage to funds disbursement can be up to a year, and only exceptionally airtight business cases receive approval. In Pakistan's case, the capacity to create high-quality proposals that can be eligible for such funding is lacking, and consequently, only three projects are listed on the GCF-Pakistan website[78]. Of significance to local investors is both the skills vacuum for proposal development and the vacuum that exists on the management side to vet these proposals, which hinders the likelihood of funds disbursement to worthy projects. This could potentially be mitigated through investment in skills development for green projects, as well as by working with existing accredited entities to facilitate proposal evaluations and ultimately funds disbursement.

5.2.3 Green bonds

Alternatively, green bonds may be issued to raise the capital needed to increase the availability of housing finance for primary mortgage lenders as a viable tool with which to attract private and/or foreign investment. In 2021, the bonds issued by the PMRC (none have been 'green' bonds) were mostly placed privately, perhaps to establish investor appetite and expectations.

There are potential caveats associated with green bonds. Unlike social impact bonds, green bond issuance can be successful at attracting investment, but investors may have stringent conditions and expectations for the impact they wish to achieve with their finance, seeking to fund what is observable, measurable, and likely to provide a good ROI. Focus may be placed on measurable project outputs rather than intangible outcomes.

To that effect, the issuance of green bonds may limit project scope in accordance with investor needs—rather than the needs of the landscape or market. For instance, one such investor expectation may be strict adherence to greenhouse gas protocols and periodic reporting of CO_2e emissions to ensure finances raised by the green bond are being used to achieve the intended outcome. This would require rigorous independent programme evaluations, which would necessarily incur costs, and may also entail strong reporting infrastructure and data collection mechanisms—which this report has found to be severely lacking in Pakistan's climate-smart housing landscape.

The process of certification for green bonds is also more costly than conventional bonds, which overall renders green bonds more expensive than others[79]. In partial support of this notion are the findings from an assessment of the market for green bonds, which revealed green bonds to be representative of just two percent of total bond issuance since 2020[80]. Following this, studies conducted in 2015 and 2016 revealed the premiums from green bonds to possess an inverse relationship with green certifications. In other words, the extent to which the green bond is 'verified' or independently reviewed as green may result in increased costs for the bond issuer.

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[78] *Ibid.*
[79] *Wu, Y. 2022. "Are Green Bonds Priced Lower Than Their Conventional Peers?" Emerging Markets Review 52, 100909. https://doi.org/10.1016/j.ememar.2022.100909.*
[80] *Ibid.*

5.2.4 Debt vs. equity financing

In consideration of green project financing strategies that exist within the global landscape for climate-smart housing, the two main pathways taken are debt or equity financing. Debt financing provides the investor with the distinct advantage of decreased exposure and, in turn, decreased risk. If the debtor organisation or project makes losses, the capital will still need to be returned to the investor at the stipulated time.

In some cases, equity financing is preferred. Holding an equity position provides an investor with an ownership interest in the debtor organisation or project. For foreign financing or investors, equity financing may be preferable, because if the value of the organisation rises sufficiently to compensate for foreign exchange losses over time, the investor can more comfortably invest in developing countries with volatile currencies. In addition, an equity interest also allows an investor to sell their stake and recuperate their finances if needed. However, as this is speculative, equity financing is not without significant risks for the investor.

In many cases, the needs of the debtor organisation or project will influence the type of financing required from the investor. For instance, Reall Ltd. has historically used a 'partnership' process whereby a partnership is entered into on a per-project basis with actors in the climate-smart housing value chain. The first step in this process is to identify like-minded organisations with which to partner. These organisations, operating in emerging markets in Africa and Asia, must already have a viable business model for the investment to be sustainable. Internal investment committees oversee the partnership process, and finance (whether equity or debt) is provided based on the business model and barriers faced by the partner. In direct contrast to a 'one-size-fits-all' investment approach, Reall is open to funding activities ranging from land acquisition to end-user finance within the scope of a partnership. The choice of where to inject finance is contingent upon which project activities are barriers to scale for the partner in question.

5.2.5 Recommendation: The 'ecosystem' development approach

The long-term goal for any investment into Pakistan's climate-smart low-income housing landscape should be the creation of a self-sustaining ecosystem that can continue to operate without external or concessional investment. This is the only way to ensure scalability—by going beyond short- and medium-term solutions (such as providing funding for only one location or aspect of the value chain) and instead using financing to create long-term linkages between actors.

One such 'long-term' solution is entering into 'integrated' offtake agreements. For Reall, offtake agreements are enabled by its partnership model, whereby Reall has entered into agreements with local developers in emerging markets and agreed to purchase a certain quantity of homes. While this approach limits offtake risk that would otherwise constrain capital for developers, the purchase does not ensure that these homes will be occupied by beneficiaries, and as a result, an offtake agreement cannot be considered a scalable solution in and of itself. Scalability is addressed by connecting Reall partners with one another. For instance, in Pakistan, Reall has previously connected the developers with which it has partnered (AMC, EPL, and ModulusTech) with other Reall partners engaged in housing finance (Trellis). In turn, companies like Trellis have helped ensure that developer homes are delivered to creditworthy beneficiaries.

In this way, Reall uses an ‘integration’ method to solve supply-side issues whilst increasing access to finance and affordability, effectively investing in the sustainability (and scalability) of the entire ecosystem for climate-smart low-income housing.

Learnings from Reall’s experience point to the notion that to sustainably promote sector activity, Financial institutions must work alongside value chain actors to build an understanding of the barriers to scale at an organisational or project level.

6. CONCLUSION AND RECOMMENDATIONS

To conclude, the climate-smart low-income housing value chain in Pakistan is critically restricted due to a lack of awareness and proper incentivisation. Most formal banks remain highly conservative in their creditworthiness assessments of potential borrowers, leaving the undocumented unable to access financing for affordable housing, let alone housing that is also climate-smart. Without an enabling environment provided by the public sector, developers are perversely incentivised to continue selling undeveloped land to the one percent as opposed to constructing affordable climate-resilient homes for the B40. The delivery of climate-smart housing is, therefore, inhibited by an underdeveloped value chain.

For the widespread promotion of climate-smart housing to take place at a national level, end-user attitudes must be addressed through measures that enhance awareness and adequately solve ground realities for the poor. Pakistan's shortfall of 12 million homes provides ample opportunity for green investors to influence market dynamics by potentially addressing this shortfall by funding the development of affordable homes that are climate-resilient, whether through the utilisation of global investment or expertise. This, in turn, could act to raise awareness around the significance and need for climate-sensitive housing and create demand within the B40.

In the absence of public-sector awareness in Pakistan, limited sector activity is likely to be an issue that only increased green investment can overcome in the short term. As an increasing number of organisations are committing to carbon neutrality, the market for green investment is growing, with particular importance being placed on emerging economies like Pakistan. The underdeveloped climate-smart low-income housing value chain provides opportunities to these organisations or impact-conscious investors to sequester their emissions more cost-effectively than they could elsewhere, meaning that there is unrealised demand at a global stage that Pakistan could meet. Consequently, as witnessed with affordable housing, promoting sector activity for climate-smart low-income housing may just be possible if the right mix of financial incentives is made available for industry stakeholders and beneficiaries, as well as if opportunities are created for industry players to collaborate for the greater good.

However, the effectiveness of financial intervention in achieving increased sector activity will be limited by the extent to which systemic issues persist in the landscape. Thus, for landscape development to occur evenly and sustainably, green financing must be only one part of a multi-faceted effort to address these issues. The long-term goal for any investment into Pakistan's climate-smart low-income housing landscape should be the creation of a self-sustaining ecosystem that can continue to operate without external, concessional investment. This is the only way to ensure scalability. Ensuring scalability entails going beyond short- and medium-term solutions (such as providing funding for only one location or aspect of the value chain) and instead using financing to create long-term linkages between actors.

Table 9: Recommendations

Category	Recommendation	Locus of implementation
Policy and regulation	A clearly defined regulatory structure with an executing body established specifically for the regulation of buildings in accordance with the ECBC. The nominated body (whether city development authorities like the CDA, LDA, and KDA or provincial energy efficiency agencies like PEECA and PEDO) should be made explicit to all regulators	Federal, provincial, and city and development authorities
	Capacity-building initiatives and training are needed for regulators to address institutional knowledge gaps and strengthen awareness about the adaptation and mitigation potential of climate-smart housing	All government climate action stakeholders/regulators
	To enable green investment, a shared understanding of what climate smartness means in the Pakistani context should be established between all actors in the affordable housing value chain	Climate action stakeholders, developers, and provincial agencies
	Legislative reform to address and minimise the treatment of land as a commodity is needed to discourage developers from selling empty plots in housing societies as speculative investments	Provincial and city and development authorities
	Fast-tracking options for government authorisations for climate-smart housing projects (such as NOCs) should be implemented for developers to incentivise green construction by ensuring that they are not subject to regular delays	Land development authorities
Finance	Financial incentives introduced through green subsidies or financing at favourable interest rates are needed to cover the high costs of climate-smart innovations for developers and encourage the construction of climate-smart homes at scale	• Federal government • SBP
	Any financial interventions must follow an 'ecosystem approach' towards developing the climate-smart low-income value chain, focusing on the creation of market linkages and addressing barriers to scale at the organisational/project level	Green investors/financiers
Data and evidence	Formalised data collection mechanisms for measuring the carbon output of buildings—across building types and industries—should be made available and compulsory to aid in the tracking of carbon emissions	Federal and provincial governments
	Collaborations between academia and the housing/construction sector are needed to promote the creation of indigenous market-based solutions that are climate-smart—e.g., low-impact cement, high-performance glass, etc.	Construction sector stakeholders

A HOME FOR HUMAN POTENTIAL

Reall

Reall is an innovator and investor with 30+ years of organizational heritage and expertise in sustainable urban development, working with public and private sectors across Asia and Africa. Reall has a proven track record of pioneering and developing housing models that unlock the political will, capital investment and end-user finance needed to creat the conditions for hardworking families to be secure in their homes.

Reall has been addressing barriers to scale in a global context and is an experienced investor in the climate-smart affordable housing sector within Pakistan. To date, Reall has delivered over 1000 EDGE certifiable homes across Khyber Pakhtunkhwa, Punjab, and Sindh.

Impetus

The Impetus Advisory Group is a management consulting firm founded in 2019 in Islamabad by leading transformation specialists with extensive experience within Pakistan's public and private spheres. Impetus is currently supporting critical transformation excercises in health, education, agriculture and housing across Pakistan.

Impetus' expertise in data analytics, strategy development, and institutional optimization has facilitated the successful mapping of the affordable housing sector in Pakistan, and more recently, Pakistan's climate-smart housing landscape carried out in tandem with Reall.

About Karandaaz

KARANDAAZ PAKISTAN is a not-for-profit special purpose vehicle set up under Section 42 in August 2014. Karandaaz is the implementation partner of the Enterprise and Asset Growth Programme (EAGR) and Sustainable Energy and Economic Development (SEED) programme of UK's Foreign, Commonwealth & Development Office (FCDO). SEED is grant funded by FCDO whereas EAGR is co-funded by FCDO and Bill & Melinda Gates Foundation on grant basis.

Karandaaz promotes access to finance for micro, small and medium-sized businesses through a double bottom line investment platform and financial inclusion for individuals by employing technology enabled solutions. The company has four verticals:

Karandaaz Capital

Provides wholesale structured credit and equity-linked direct capital investments to micro, small and medium enterprises (MSMEs) that demonstrate compelling prospects for sustainable business growth and employment generation in Pakistan.

Karandaaz Digital

Focuses on expanding the poor's access to digital financial services in Pakistan by working across the ecosystem with all stakeholders.

Karandaaz Innovation

Manages the Innovation Challenge Fund and Women Ventures, providing risk capital and grants to partners with the aim to generate innovative solutions in areas of financial inclusion and entrepreneurship.

Karandaaz Knowledge

Supports the company's core financial inclusion goal by developing and disseminating evidence-based insights and solutions.

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