BUILD CHANGE

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Saving Embodied Carbon Through Strengthening Existing Housing

Executive Summary

The most sustainable house in the world is the home that has already been built.

Assuming, of course, that the house has been made disaster-resilient.

Buildings and construction together account for almost 40 percent of energy-related carbon dioxide emissions, with housing accounting for at least 17 percent of the total[1]. While the benefits of retrofitting housing have long been known for increasing homeowner satisfaction, reducing construction-related costs, and strengthening local economies, little attention has been given to the environmental impact of a housing improvement intervention.

For housing built in informal markets, that is, housing constructed outside of regulation and government oversight, this study answers the question: how much embodied carbon can be saved by improving houses for disaster resilience?

This publication is the latest in a series authored by Build Change on strengthening and upgrading existing housing. Published in 2021, *The Build Change Guide to Resilient Housing: An Essential Handbook for Governments and Practitioners* serves as an operational manual and series of case studies in the operationalization of resilient housing programs. *The Cost of Improving Vulnerable Housing*, published in 2022, outlines the cost benefits and savings associated with improving existing housing for resilience.

As the third in this series, and informed by cases drawn from Build Change's work in Colombia, Haiti, Honduras, Nepal, Philippines, and Sint Maarten and a total of 335 built projects, *Saving Embodied Carbon Through Strengthening Existing Housing* provides compelling evidence that **improving existing housing significantly avoids carbon emissions in the housing construction value chain, thereby having substantial implications for achieving net zero in the built environment.**

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1 United Nations Environment Programme (2021). *2021 Global Status Report for Buildings and Construction: Towards a Zero-emission, Efficient and Resilient Buildings and Construction Sector.* Nairobi

Our intention is to contribute to global knowledge and research on the embodied carbon resulting from housing retrofits, upgrades, and improvements as well as new housing construction. In doing so, stakeholders across the housing value chain, including engineers and construction officials, policymakers, financiers, and advocates, can advance sustainable solutions to reduce the qualitative housing deficit and ensure provision of resilient housing.

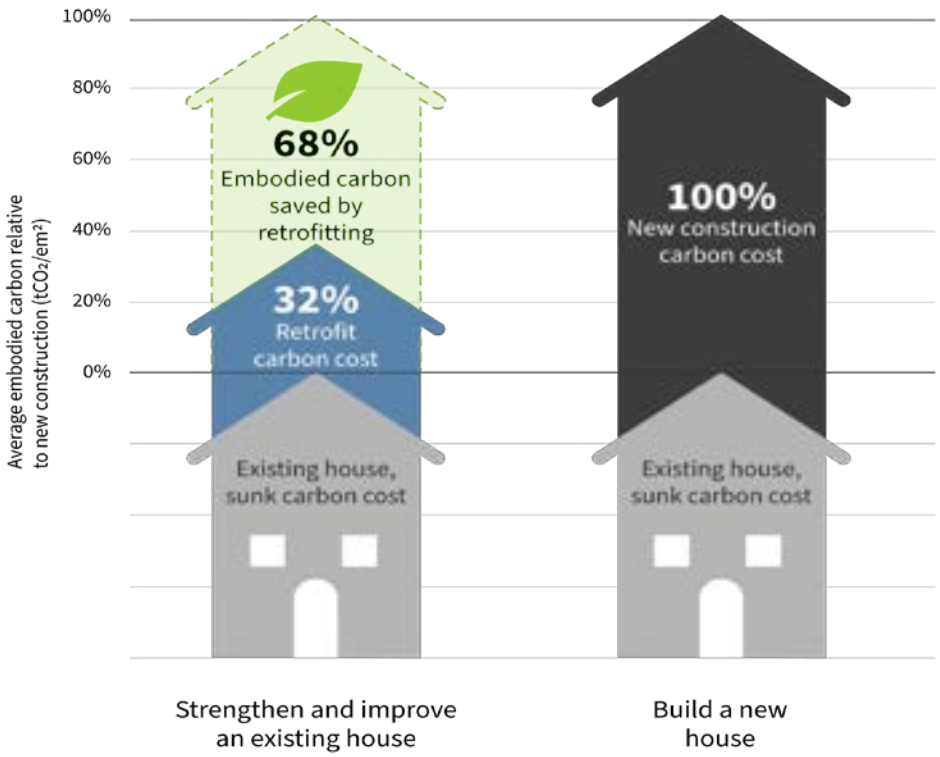
KEY FINDINGS INCLUDE:

- **Improving a house instead of building a new one saves two-thirds of embodied carbon of an equivalent new house, and, on average, saves 18 metric tons of carbon dioxide.** For the same embodied carbon budget of one new house, more than three houses can be improved and made safer.

- **Even if vertical expansion is included in the intervention, creating an additional living space or unit, it is still more carbon-efficient to improve existing housing rather than build new.** With vertical expansion (i.e. adding a second story), improving existing housing still uses, on average, 47 percent less embodied carbon than an equivalent new house. In some cases, vertical expansion simply makes the existing home larger to accommodate growing families or home businesses. In other cases, vertical expansion creates an additional, independent housing unit. By transforming one housing unit into two, the emissions savings are doubled.

- **It is more carbon-efficient to improve an existing house *before* a disaster—even when the house is also expanded—than wait until it is destroyed and has to be rebuilt.** Embodied carbon savings for a preventative upgrade are, on average, 61 percent higher than a post-disaster upgrade (without expansion). When the house is also expanded vertically, savings are still 26 percent higher if the upgrade is done preventatively.

Figure 1: The Costs of Inaction



RECOMMENDATIONS

Policymakers play a critical role in shaping the regulatory environment for prioritization of embodied carbon reduction in the housing sector through retrofitting. Based on the findings from this study there are a number of important actions that can be taken to advance overall resilience and embodied carbon savings in the housing sector. Most critically, these include:

- **Retrofit houses to withstand disaster.** Policymakers should prioritize retrofitting existing housing as an effective strategy for both climate change adaptation ***and*** mitigation. The best way to balance the urgent needs for more housing, resilient housing, and green housing, while minimizing greenhouse gas (GHG) emissions, is to upgrade the existing housing stock.

- **Act now!** Governments and homeowners should retrofit preventatively, before a disaster, to save even more emissions. The additional materials required for building repair in post-disaster scenarios significantly increases the emissions. Policies should incentivize mitigation before the next disaster.

- **Advance actions which prioritize housing upgrades within climate commitments, such as NDCs or building sector roadmaps, as well as national urbanization frameworks.** With the next round of updates to Nationally Determined Contributions (NDCs) in 2025, the moment is ripe for integrating ambitious goals into climate planning. Governments should include housing upgrade plans within national frameworks for urban development and climate mitigation and adaptation, as well as within provisions for incremental upgrading within building codes. Advancing data through this study, and subsequently promoting action and leadership to reduce embodied carbon in the built environment—and in housing specifically—will be critical to shape the future of mitigation efforts, as well as provide the housing needed to meet the increasing requirements of a changing environment and global population.

Build Change is the global leader in systems change for resilient housing. Build Change's engineers, builders, coders, policy advocates, and lending partners are providing urgently needed housing solutions in the world's most disaster-prone countries.

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