Congressional Testimony

"Expanding Choice and increasing Supply: Housing Innovation in America." Dr. Andrew P. McCoy Housing and Insurance Subcommittee Wednesday, May 14th, 2025, 10am - 1pm

Introduction

I want to first thank Chairman Hill and Ranking Member Waters and the Housing and Insurance Subcommittee for inviting me here today. *It is an honor to be here and discuss the role of housing innovation in driving the past and future of our industry*. My goal is to provide a brief history of challenges and successes, set the stage for current market conditions, discuss emerging technologies and propose ways we could increase the probability of innovation success.

The housing industry faces *both opportunities and challenges* for innovation. Drivers include increasing risk, demand, environmental pressures, and the presence of emerging technologies. However, barriers like skilled labor shortages, fragmented industry practices, restrictive zoning and regulations, and limited investment in R&D continue to hinder progress. Despite these challenges, housing innovation is a vital tool for economic development that serves industry, government, our education system and main street America.

How did we get here, including federal innovation housing program *successes and challenges*?

In many ways, homebuilding technologies are a public event: the processes of U.S. homebuilding are visible to the general public every day. Innovation creates benefits for consumers (or market spillovers), and the knowledge created by one firm creates value for other firms and their customers (or knowledge spillovers). The combination of this knowledge transfer results in economic and social returns from innovation. Our policy dilemma is that the nation is not reaping the economic and social returns when the industry is not innovating as much as possible. We tend *to think of housing* as an economic indicator while we *need to see housing innovation* as an economic driver.

Over time, several key policy milestones and market events have influenced the role of technology in the housing industry. Following World War II, the GI Bill and available financing fueled a massive suburban housing boom, making homeownership newly accessible to millions. The U.S. government actively began supporting housing advances, including housing technology, through housing policy in the 1949 American Housing Act. It codified the "goal of a decent home and suitable living environment for every American family." In 1970, the Housing and Urban Development Act created the US Department of Housing and Urban Development (HUD) and provided additional authority to improve the physical quality of housing through technological change, effectively mandating housing

technology as public policy. By the 1980s and 1990s, housing affordability emerged as a public concern, prompting the introduction of the Low-Income Housing Tax Credit (LIHTC) program.

Examples of public programs that concentrate solely on housing innovation at the national level include: the 1962 Civilian Industrial Technology Program (or CITP), the late 1960s Operation Breakthrough program, and late 1990s Partnership for Advancing Technology in Housing program (or PATH).

CITP was created during the Kennedy Administration by the U.S. Department of Commerce. The program studied technological needs for adjacent industries, creating an industry-university service for information diffusion and technical aid, similar to land-grant universities and Cooperative Extension systems. Ultimately, perceived competition between researchers and private industry became a challenge for this program.

Operation Breakthrough was developed during the Nixon Administration by the Department of Housing and Urban Development (or HUD). The program focused on mass-production of technology and housing at-scale and faced challenges from the vertically integrated process that could not overcome the locally regulated and market-specific nature of the industry.

PATH was developed during the Clinton Administration as a collaboration between the Department of Energy (DOE), the Environmental Protection Agency (EPA) and HUD. PATH was a cooperative effort by the federal government and the building industry to improve housing affordability and value using innovative technologies developed through DOE's Building America program, EPA's ENERGY STAR for homes program, and HUD's PATH program umbrella. PATH integrated research, development and implementation with the tradition-bound practices of construction while charting new ways to increase innovation adoption. In 2010, funding was discontinued.

What are current housing industry challenges and opportunities?

More recently, the 2008 financial crisis significantly affected the housing industry, and it has still not recovered. The financial crisis immediately led to a dispersion of trades away from construction, a loss of production, and resulted in a decade of underproducing new homes. While existing housing sales recovered by 2017, the percentage of new home construction, which provides the majority of housing's economic impact (jobs, materials, and services), was still half of its pre-2008 level. In terms of technology, the energy crisis of 2008 also raised concerns about housing infrastructure, propelling growth in high-performance building technologies and driving updates in building energy code.

Over the last decade, the combination of labor shortages, a lack of available land, cost inflation (both labor and materials), supply chain disruptions, and rising costs of financing have resulted in few options the median homebuyer can afford. The National Association

of Homebuilders estimates that 103.5 million households, or 76.9% of all U.S. households, are not able to afford a median priced new home. Further, every \$1,000 increase in the median price of a new home removes an additional 106,031 households from the market¹.

As a result, attention has shifted toward the promise of innovation. Recent housing innovation has focused on better building performance, optimized design and construction practices, widely adopted digital simulation, and advanced construction workforce training. While some developers and startups have piloted innovations, few have been able to scale.

On the opportunity side, these same pressures have opened the door for innovative reform. The increased visibility of the housing crisis has prompted renewed interest from policymakers, industry, localities and philanthropic organizations who are exploring partnerships that promote innovation. Many are proposing solutions that augment labor, increase productivity, reduce costs and timing of construction, maintain quality and safely deliver more housing that is attainable to more Americans. Technologically, emergent solutions include advanced manufacturing, 3D printing, digital twins, sensors and robotics.

By example of the Commonwealth of Virgina, local agencies and governments are implementing zoning reforms, funding options, and regulatory reform that reduce barriers to innovation. Virginia localities are using "design templates" that expedite the permitting process, allowing zoning variances for different types of housing (i.e. Accessory Dwelling Units or ADUs), increasing density options for builders and sharing infrastructure to incentivize homebuilding at specific income levels. The Virginia Housing Development Authority (termed "Virginia Housing") has particularly leaned in to housing innovation. For example, their Qualified Allocation Plan (QAP) scoring incorporates points for developers who integrate innovation into their Low-Income Housing Tax Credit (LIHTC) developments. Doing so makes them more competitive to receive funding. Virginia Housing has also created Community Innovation Grants (CIG), up to \$500,000, that de-risk the adoption process for builders willing to try emergent technologies. Our 3D concrete printing program has recently benefitted from CIG funding, producing four (4) workforce housing units with industry partners and beginning an additional ten (10). Virginia's Department of Housing and Community Development (DHCD) also recently modified parts of the building code to facilitate the use of modular and manufactured housing, getting out of the way and making these technologies more accessible to the market. For example, the City of Danville, in southside Virginia, recently changed its zoning to allow for manufactured and modular housing units to reduce costs and provide options. Also, Governor Youngkin's "permitting dashboard" at the Department of Environmental Quality is an example of streamlining and speeding up process.

¹ Zhao, N. (March 2024). "Nearly 77% of U.S. Households Cannot Afford a Median-Priced New Home." Special Study for Housing Economics, Economics and Housing Policy, National Association of Home Builders. Link here

Promoting innovation in the labor market is an example of another opportunity. Recent funding from the Appalachian Regional Commission's (ARC) Appalachian Regional Initiative for Stronger Economies (ARISE) is comprehensively developing industrialized construction workforce training. It aims to reduce costs and waste, while expanding US manufacturing capabilities. Another goal is to change the perception of construction and excite the next generation of workers. The work is a combined effort and combines funds across all levels of education, cross-sector industry partners, trades programs, local government and regional policymakers. Without these partnerships and innovative funding models, the housing industry could continue to stagnate.

Housing industry innovation is also successful in the non-profit sector. For example, Habitat for Humanity is partnering with universities, localities, and volunteers every day to incorporate innovative building technologies. Across America, non-profit organizations like Habitat for Humanity are utilizing wall preassembly, prefabrication, 3D printing, and innovative funding models to build financial stability for low-income households. This is often a difficult market to serve financially, making these successes even more effective.

Nevertheless, the cumulative result of our housing choices is a persistent underproduction, currently estimated between 3.4 and 6.4 million units nationally. Underproduction has increasingly reduced access to homes at almost all levels of income. Without access, it becomes difficult for the public to maintain resilience, achieve stability, and ultimately build a financial basis for the future. The path forward will require coordinated investment in industrialized building systems, regulatory modernization, workforce development, innovative funding and cross-sector collaboration to overcome the systemic barriers that have limited housing production. In doing so, homebuilding technologies could expand from a public event to a public opportunity.

Why is technology such a great option right now?

As previously mentioned, the housing sector is under intense pressure from rising costs, labor shortages, and an overwhelming supply-demand imbalance. Technology offers tools to meet this moment: automation, digital modeling, prefabrication, and data-driven planning can streamline design, reduce costs, waste, and compress construction timelines. These efficiencies make it possible to scale housing production without compromising quality.

Construction technology is especially compelling right now because it doesn't replace human workers, it amplifies them. Innovations like augmented reality for training, robotic assistance in repetitive tasks, and digital project coordination platforms allow skilled tradespeople to be more productive, safe, and precise. For example, a framer using layout tools tied to digital plans with augmented reality can complete work faster with fewer errors. Mechanical, electrical and plumbing trades can see into walls and equipment, making their work more precise and safer. A factory-built wall panel utilizing computercontrolled (CNC) machines still depends on a crew for assembly, finishing, and adaptation to site conditions.

Keeping humans at the center means using technology to elevate craftsmanship, reduce back-breaking work, and expand access to meaningful careers, especially for young people. It also means involving community voices in planning through tools like digital twin simulations and participatory design software. Ultimately, the goal isn't to automate people out of housing, but to build a better industry around them. Technology isn't just a solution to supply constraints, it transforms housing into a modern, human-centered economy that can meet today's urgent needs at home while building capacity to become exporters to the world.

What technologies are making a difference?

A range of technologies have begun reshaping our industry. Offsite construction and prefabrication allow homes and components to be built in controlled environments, cutting build times and reducing waste. Building Information Modeling (BIM) and digital twin technology improve coordination across trades, reducing costly errors and rework. 3D printing has emerged as a promising method for quickly producing parts of a home and reducing labor and materials involved, particularly in areas with severe shortages. Robotics and on-site automation tools now assist with repetitive tasks like drywall finishing, painting and building layout, improving productivity while reducing strain on workers. Robots can also work after hours.

Artificial intelligence is streamlining estimating, permitting, and scheduling processes, making projects faster to launch and easier to manage. Field management apps, wearable safety tech, and cloud-based software platforms are improving job site communication and oversight. Finally, performance-based design and building systems, including energyefficient materials, are helping deliver homes that are more affordable to operate. Efficient building operation reduces strain on our infrastructure.

How will housing technologies shape the future?

The space race was one of the biggest boons to housing technology: it advanced materials, like insulation, that we now take for granted. In the future, transformative technologies will reshape housing by making it better performing, more attainable, and responsive to human needs. Industrialized construction methods, such as fully integrated modular systems and robotics-assisted sites and factories, allow homes to be built faster, with greater precision and less waste. Artificial intelligence and machine learning will play an increasing role in automating design, optimizing land use, predicting maintenance needs, and accelerating permitting processes, helping reduce delays and lower costs. Smart materials, including advanced concrete formulas, phase-change insulation, self-cleaning paints, and nanoparticles, will lower the risks and costs of housing. Emerging innovations like digital twins, real-time construction monitoring, and data processing will offer predictive control

and assurance for quality, costs, operations and maintenance. On the occupant side, homes will increasingly integrate adaptable spaces, embedded sensors, and responsive systems that personalize comfort, enhance health, and balance or reduce resource consumption. Importantly, these technologies will not remove the need for people—they will expand opportunities for skilled work, increase accessibility, and empower a new generation of construction professionals with digital tools, automation support, and creative control. The future of housing technology will be human-centered, scalable, and capable of meeting economic and social demands.

Summary

In summary, and to unlock the full impact of housing innovation, several opportunities exist for policymakers:

- 1. Develop sources of supportive funding that focus specifically on innovation in the residential construction sector, as opposed to waiting for the industry to catch up;
- Incentivize state and local zoning and regulatory reform through matching grants or funding tied to comprehensive updates of codes, zoning and permitting processes. In the process, emphasize existing housing types while working with industry stakeholders to incentivize new housing products and options;
- 3. Reduce fragmentation and strengthen collaboration through public-private partnerships that reduce risks for key phases of innovation commercialization, like early-stage manufacturing and digital-tool investments;
- 4. Support industrialized workforce development through programs that address current gaps and excite the next generation; and
- 5. Support those who embrace the exciting nature of this industry and its future at all levels, including our younger generations;
- 6. Establish clear metrics and accountability for programs with requirements that successful models must transition to commercially financed, private-sector–led deployments within defined timelines.

Such actions would turn scattered successes into a cohesive national strategy, ensuring that federal innovation programs not only seed breakthroughs but also shepherd them to market scale, making homeownership more attainable and homeowners more resilient through financial stability in the American dream.