National Institute of BUILDING SCIENCES™

2024 Moving Forward Report

Prepared by the NIBS Consultative Council

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Prepared by the NIBS Consultative Council

Introduction

The National Institute of Building Sciences (NIBS) serves as the unbiased forum for solving common issues and identifying opportunities within the building community. The NIBS Consultative Council assembles high-level building community leaders to make collective recommendations directly to policymakers to improve our nation's buildings and infrastructure. Members of the council include organizations representing consumers, architects, engineers, government officials, contractors, researchers, and housing officials. The goals of the council are three-fold:

- Convene Thought Leaders: bringing together industry leaders and experts from across the built environment to improve our nation's infrastructure and buildings.
- Identify Challenges: assembling experts who identify key issues they believe will be facing the industry in the years ahead.
- Find Solutions: developing and publishing a yearly report that offers solutions to key challenges the built environment faces.

In 2024, the Consultative Council is investigating three critical Access challenges facing the building industry: (1) Clean Water and Sanitation, (2) Housing Affordability, and (3) Safe Schools. For each topic, the Council will evaluate the state of the industry, identify key issues, and make recommendations to industry actors and policymakers to help overcome these challenges. NIBS and the Consultative Council intend to revisit each topic periodically, to track progress and discuss potential new challenges and solutions.

Access to Clean Water and Safe Sanitation: Recommendations Summary

As part of the 2024 Moving Forward Report, the Consultative Council is exploring the topic of "Water and Sanitation Access and the Built Environment," examining key concepts, challenges emerging from climate change impacts and population growth, and considerations that can help to inform decisions about how to plan for, mitigate, and potentially solve water access issues from the perspective of the built environment. This report focuses specifically on the way in which commercial and residential buildings access and use water resources.

The points below summarize the topics and recommendations discussed in this report. Detailed recommendations from the NIBS Consultative Council can be found on page 18. The Council's recommendations supplement other necessary actions to adapt the built environment to a changing climate and make our buildings and communities healthier and more resilient.

- **Data:** Improve and increase data collection efforts regarding water access, quality, and use in households and buildings.
- **Efficiency:** Increase market share for WaterSense and other efficiency programs, expand use of alternate water sources, and bring increased focus to water efficiency as it relates to energy efficiency.
- **Funding:** Continue to increase funding for centralized and decentralized water and sanitation infrastructure, especially for projects in underserved communities, and support strong water treatment standards.
- **Research:** Support implementation of the newly authorized NIST Plumbing Research Program and increase the role of EPA, DOE, and other relevant Federal and industry stakeholders in collecting data on water usage, improving efficiency in system design, and identifying safe alternate water sources for use in the built environment, while maintaining public health and safety, especially in regions facing water scarcity and quality challenges due to climate change.

- **Strategy:** Develop a national strategy for providing sustainable water and sanitation services to rural and disadvantaged communities, particularly focused on those that rely on decentralized systems.
- **Workforce:** Increase funding for workforce programs for the water sector, to ensure a pipeline of future workers.

Water Use and the Built Environment

Water is essential to health, safety, hygiene, and productivity. Americans today are facing a water crisis, with over 2.2 million people nationwide surviving without access to running water or sanitation services.[1] Water use in buildings and households is an often underexamined and underappreciated aspect of the water crisis, and of the built environment generally.

According to 2015 estimates, Americans use approximately 322 billion gallons of water per day. Four states--California, Texas, Idaho, and Florida--account for more than one-quarter of all fresh and saline water withdrawn in the US. Water withdrawals are generally broken down into eight categories, as the image below from the United States Geological Survey makes clear:

2015 withdrawals by category, in billion gallons per day

- Public supply **39.0**
- Self-supplied domestic **3.26**
- Irrigation **118**
- Livestock **2.00**
- Aquaculture **7.55**
- Self-supplied industrial **14.8**
- Mining **4.00**
- Thermoelectric power **133**

Source: USGS[2]

Interestingly, American water use has declined since 2010, with overall withdrawals now at levels not seen since the 1970s. Declines from 2010-2015 represented a nearly 9% decline overall in water use. These decreases were primarily driven by declines in thermoelectric power use (18%) -- due to efficiency improvements, environmental protection rules, and closures--and public supply (7%), primarily from appliance improvements.

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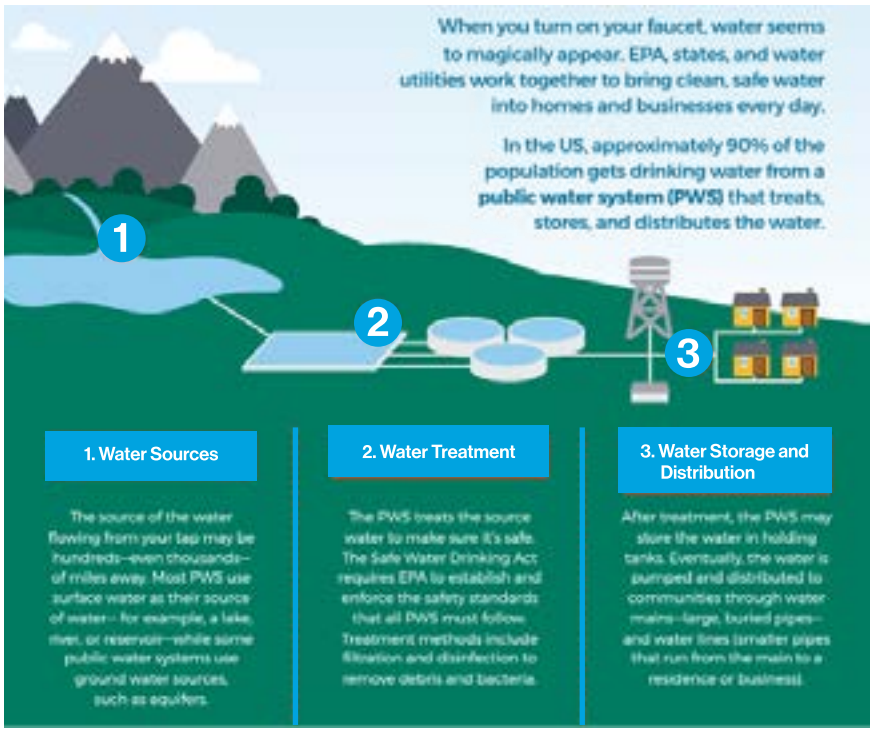
[1] "Close the Water Access Gap." DIGDEEP. www.digdeep.org/close-the-water-gap.

[2] U.S. Geological Survey. "Total Water Use." March 3, 2019. https://www.usgs.gov/mission-areas/water-resources/science/total-water-use?qt-science_center_objects=0#qt-science_center_objects

How Are Buildings Supplied with Water?



Access to clean and safe water is often taken for granted; as the US Environmental Protection Agency (EPA) states, "when you turn on your faucet, water seems to magically appear."[3] However, the systems underpinning water distribution and use in residential and commercial buildings are extremely complex, and standards and enforcement governing their use vary by region, state, and even within localities. More than 300 million Americans, 95 percent of the population, receive part of their water from community water systems.[4] Of the 300 million people served by community water systems, 257 million are served by just 9% of systems. Nearly 91% of systems serve communities of under 10,000 people. The 151,000 public water systems in this country lead to incredible variation in access, quality, and outcomes important to population health and wellbeing.

The primary Federal law governing water access and quality is the Safe Drinking Water Act (SDWA), which was passed in 1974 and subsequently amended in 1986 and 1996.[5] The SDWA tasks the EPA with setting "national health-based standards for drinking water to protect against both naturally occurring and man-made contaminants that may be found in drinking water," and covers every public water system in the US. The SDWA, through amendments in 1996, also provides additional protection for drinking water sources. While the EPA is responsible for setting standards for quality, testing, treatment, and enforcement, direct oversight of water quality is primarily provided by state drinking water programs.

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[3] U.S. Environmental Protection Agency. "How Does Your Water System Work?" https://www.epa.gov/sites/default/files/2017-10/documents/epa-ogwdw-publicwatersystems-final508.pdf

[4] U.S. Environmental Protection Agency. "Population Served by Community Water Systems with No Reported Violations of Health-Based Standards." 2022. https://cfpub.epa.gov/roe/indicator.cfm?i=45#:~:text=Community%20water%20systems%20(CWS)%20are,drinking%20water%20from%20a%20CWS

[5] US EPA. "Regulatory Guidance Information by Topic: Water." Updated March 7, 2023. https://www.epa.gov/regulatory-information-topic/regulatory-and-guidance-information-topic-water

Funding For State Drinking Water Programs

There are multiple Federal programs that provide regular funding to state and local governments to make upgrades to water programs. The Drinking Water State Revolving Fund (DWSRF), a financial assistance program to help water systems and states to achieve the health protection objectives of the Safe Water Drinking Act.[6,7] Funding for the DWSRF is appropriated by Congress, and EPA awards capitalization grants to each state based upon the results of the most recent Drinking Water Infrastructure Survey Needs Assessment. The state is required to provide a 20% match. EPA and state programs have provided over $41 billion for water systems to:[8]

- Improve drinking water treatment
- Fix degrading infrastructure or old pipes
- Improve the source of water supply
- Replace or construct finished water storage tanks
- Other infrastructure projects to protect public health

Additionally, EPA's State Water Infrastructure Finance and Innovation Act program is a Federal loan program for state water and wastewater infrastructure projects.[9] The program was created and funded by Section 4201 of America's Water Infrastructure Act of 2018.

How is Water Used and Controlled in Buildings?

On centralized systems, homes and businesses are connected to public water infrastructure via service lines and (within the building) via premise plumbing, defined as "the portion of a water system, including both hot and cold water, various devices (e.g., hot water heater, HVAC humidifier), fixtures (e.g., showers, faucets), and drains (e.g., sinks, toilets) connected to the main distribution system via service lines."[10] These systems are responsible for providing clean, potable water and removing wastewater through a sanitary drainage system that is connected to a public sewer.[11] Fire protection systems (automatic sprinkler systems, fire pumps, etc.) are also a key component in ensuring building occupant safety and security.

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[6] US EPA. "How the Drinking Water State Revolving Loan Fund Works." Updated November 17, 2023. https://www.epa.gov/dwsrf/how-drinking-water-state-revolving-fund-works#tab-1

[7] Ibid

[8] Ibid

[9] US EPA. "What is SWIFIA?" Updated May 23, 2023. https://www.epa.gov/wifia/what-swifia

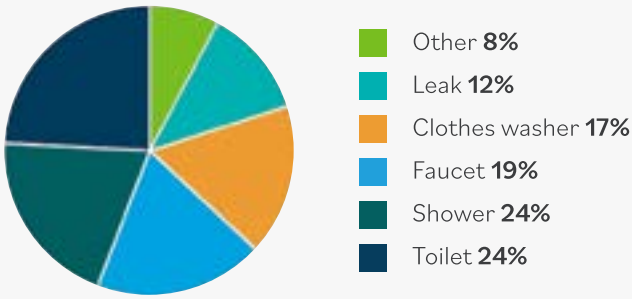
[10] US EPA. "Premise Plumbing Decontamination." Updated March 6, 2023. https://www.epa.gov/emergency-response-research/premise-plumbing-decontamination

[11] National Institute of Standards and Technology. "Premise Plumbing Systems. Updated July 31, 2023. https://www.nist.gov/el/energy-and-environment-division-73200/premise-plumbing-research-nist/current-activities-0

Water use in commercial and institutional facilities, including office buildings and hospitals, accounts for 17% of publicly supplied water use in the US.[12] While water use in commercial buildings obviously differs greatly in volume and by building type, most commercial buildings use water for kitchens, restrooms, laundries, showers, heating and cooling, and landscape irrigation.

According to the US EPA, the average American family uses more than 300 gallons of water per day at home, with roughly 70% of that use occurring indoors, and the remaining 30 percent for landscaping and irrigation.[13] This graphic from a 2016 Water Research Foundation Report details how water is typically used within a residence.

How much water do we use?



Source: Water Research Foundation, Residential End Uses of Water, Version 2. 2016

Within a typical building, plumbing codes set minimum standards and requirements for plumbing systems. This includes requirements for the design, construction, installation, inspection, repair, and alteration of plumbing systems. Plumbing codes are adopted at the state and local levels depending on the jurisdiction. Model plumbing codes used by these jurisdictions are primarily developed by the International Association of Plumbing and Mechanical Officials (IAPMO) or the International Code Council (ICC).

Plumbing design usually depends on collaboration among an architect, civil engineer, plumbing engineer, and (possibly) a mechanical engineer, electrical engineer, and structural engineer, depending on building size and type. These disciplines work together, using relevant codes, to develop a design and piping diagram. Pipe sizing requirements are based on flow rate and velocity limitations calculated using model codes. Plumbing engineers assess water demand for the entire building, and pressure loss through the supply system is calculated. Drain and vent systems are properly sized to remove wastewater and discharge into a public sewer or onsite wastewater treatment system where a public sewer is not available in accordance with model plumbing codes. Fire protection engineers will assess fire protection demand/water supply and design piping sizes and drains for functionality of these systems.

As part of a collaborative design process, architects and engineers work with the building owner to solve multiple challenges for the project to use water wisely, addressing efficiency and consumption while matching water quality to appropriate use. Additional factors that can be addressed during design include resilience for the building, infrastructure and ecosystems, such as how the project's water systems can maintain function during emergencies or disruption, handle rainfall and stormwater responsibly, and contribute to a healthy regional watershed. Design

[12] US General Services Administration. Sustainable Facilities Tool. "Buildings' Water Use." https://sftool.gov/learn/about/183/buildings-water

[13] US EPA, WaterSense. "How We Use Water." Updated April 24, 2023. https://www.epa.gov/watersense/how-we-use-water

considerations for water, as well as additional resources and recommendations, are outlined in AIA's "Design for Water – Framework for Design Excellence" toolkit.[14]

Challenges to Water Access and Water Quality

It is undoubtable that the US has one of the most robust water systems in the world. However, the US Center for Disease Control and Prevention (CDC) estimates that millions of Americans get sick from a waterborne illness each year.[15] Water issues disproportionately fall on poor and marginalized communities and have grown in recent years as funding for water access, quality, and sanitation has lagged. While recent Federal actions to upgrade water infrastructure are a big step forward, more work is needed to better understand water access and sanitation issues.

Water Access and Equity

The CDC defines water access as the "percentage of the population having access to and using improved drinking water sources."[16] In this context, improved drinking water sources are defined by the World Health Organization as "those that are likely to be protected from outside contamination, and from fecal matter in particular,"[17] and include multiple types.

DigDeep, a non-profit focused on water access in the US, defines residential safe water access as having three primary components:

1. Safe, reliable, running water
2. A tap, toilet, and shower in the home
3. A safe system for removing and treating wastewater

Per DigDeep's analysis, more than 2.2 million people in the US live without running water and basic indoor plumbing. This gap in water access can be explained primarily by certain communities being "left behind" during major infrastructure investment booms, as well as funding that has not been appropriately targeted to affect the communities hardest hit. This access gap has significant impacts on human health, wealth, and well-being, as well as severe consequences for our national economy. Each year that the water access gap remains open, the US loses an estimated $8.6 billion per year in GDP. Parsed out by household, each American family facing these challenges loses nearly $16,000 every year, sometimes more than their annual income.[18]

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[14] American Institute of Architects. "Design for Water – Framework for Design Excellence." https://www.aia.org/design-excellence/aia-framework-for-design-excellence/water

[15] U.S. Center for Disease Control and Prevention. "Waterborne Disease in the United States." Updated January 4, 2023. https://www.cdc.gov/healthywater/surveillance/burden/index.html

[16] U.S. Center for Disease Control and Prevention. "Assessing Access to Water and Sanitation." Updated March 24, 2022. https://www.cdc.gov/healthywater/global/assessing.html

[17] World Health Organization. "Improved sanitation facilities and drinking-water sources." https://www.who.int/data/nutrition/nlis/info/improved-sanitation-facilities-and-drinking-water-sources#

[18] "Draining — DIGDEEP." DIGDEEP, www.digdeep.org/draining.

Water equity and environmental justice loom large in consideration of all aspects of water quality, access, and scarcity. Water inequality exists on both sides of the building enclosure and needs to be addressed in the context of existing environmental justice laws. Executive Order (EO) 12898 defines environmental justice as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

DigDeep's study also uncovers significant disadvantages for impoverished communities, rural communities, and communities of color. Native American households are 19 times more likely than White households to lack access to clean running water and sanitation, and Black and Latino households are twice as likely as White households. Access to indoor plumbing is correlated with household income, educational attainment, and unemployment rates. Households without running water are likely to be stuck in a cycle of poverty, as yearly income is spent on accessing alternative water sources (i.e. bottled or trucked-in water) or forced to be dispersed for water insecurity-related medical issues, like increased health risks from unregulated water sources.

On the public supply side, while water inequality may be more glaringly apparent on the world stage, an extensive 2021 analysis by The Guardian newspaper of the public water systems in the US crossed with US Census data shows water inequality rampant in this country as well. Public water systems not in compliance with Federal regulations were assigned violation points. The study found that geography, race, and income all affect access to clean water. The study further indicated that areas made up of 25% or more Latino population violated the standard at twice the national rate. The worst performing of the public water systems provide water to 25 million people, some 5.8 million of whom are Latino. Interestingly, violation points in rural counties surpass metropolitan counties by 28 percent. Compounding the problem are severe under-reporting by county water managers of EPA violations and lack of transparency in reporting, spurring public mistrust in both the process and the water supply.

The study also indicates that water quality testing usually occurs only at the water source. This limited method of testing does not account for the pollution from chemicals, such as lead, that come from the building's plumbing as the water travels to the tap. This method of testing also does not detect corrosion, such as microbiologically induced corrosion.

"Overall, rigorous enforcement of federal and state standards coupled with adequate testing is the key to curbing water inequality," according to Save the Water,™ a 501(c)(3) non-profit organization dedicated to conducting research and raising public awareness about water contamination and its health impacts. "This is especially true for local water authorities in areas where Federal and state oversight is lacking."

Decentralized Access to Water and Sanitation

Many homes and buildings rely on decentralized access to water and sanitation services. According to the US Geological Survey, more than 43 million people—about 15 percent of the U.S. population—rely on domestic (private) wells as their primary source of drinking water. The quality and safety of water from domestic wells are not regulated by the Federal Safe Drinking Water Act or, in most cases, by state laws. Instead, individual homeowners are responsible for maintaining their domestic well systems and for monitoring water quality.[19]

Further, it was reported that in 2021 only 84.5% of occupied housing units (108,574,000 housing units) are connected to public sewer and 15.2 % of occupied housing units (19.5 million housing units) used septic tank systems or

[19] https://www.usgs.gov/mission-areas/water-resources/science/domestic-private-supply-wells

cesspools).[20] But industry experts do not view these data as accurate and that the true number of households that rely on decentralized wastewater systems is significantly higher.[21]

Many of the households that rely on decentralized water and sanitation access are located in rural or disadvantaged communities. These households are significantly more likely to have very limited resources to maintain, repair, or to replace their onsite water and wastewater systems. As a result, many of these homes have failing or inadequate water and sanitation infrastructure and face significant health challenges.[22] Poor access to water and sanitation represents a public policy failure and it impacts human health, dignity, and quality of life.

The number of decentralized systems continues to grow each year. According to the National Association of Homebuilders, about 10% of new single-family homes started in 2022 were served by individual wells and 18% had private septic systems. These shares, however, vary widely across the nine Census divisions with the corresponding shares reaching 38% and 46% in New England – the highest occurrence rates in the nation.[23]

In 2005, EPA created a Memorandum of Understanding (MOU) to improve the overall performance and management of decentralized wastewater systems through facilitated collaboration among EPA, state and local governments, and industry practitioners. These MOU partners have effectively worked together to facilitate information exchange on system technology, collaborate to support training efforts, and promote public awareness on the management of decentralized wastewater systems.[24]

Rising Water Costs

Across the US, water is getting increasingly expensive. The New York Times recently noted that average water and sewer bills have increased by approximately 50% over the last decade, with additional increases forecasted.[25] These rate increases, which are likely to fall disproportionately on poor and disadvantaged communities, are driven by several

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[20] U.S. Census Bureau (2021e). 2021 American Housing Survey (AHS) - AHS Table Creator. [WWW Document]. Available at: https://www.census.gov/programs-surveys/ahs/data/interactive/ahstablecreator.html?s_areas¼00000&s_year¼2021&s_tablename¼TABLE2&s_bygroup1¼1&s_bygroup2¼1&s_filtergroup1¼1&s_filtergroup2¼1 (accessed 18 November 2022).

[21] Jillian Maxcy-Brown; Mark A. Elliott; Bennett Bearden. "Household level wastewater management and disposal data collection in the U.S.: the history, shortcomings, and future policy implications." Water Policy. World Water Council. September 2023. https://iwaponline.com/wp/article/25/9/927/97569/Household-level-wastewater-management-and-disposal

[22] Capone D, Bakare T, Barker T, Hutson Chatham A, Clark R, Copperthwaite L, et al. "Risk factors for enteric pathogen exposure among children in Black Belt Region of Alabama, USA." Emerg Infect Dis. 2023 Dec [date cited]. https://doi.org/10.3201/eid2912.230780

[23] Fu, Jing. "New Homes Built with Private Wells and Individual Septic Systems in 2022." NAHB. October 2023. https://eyeonhousing.org/2023/10/new-homes-built-with-private-wells-and-individual-septic-systems-in-2022/

[24] US EPA. "EPA's Decentralized Wastewater Partnership." Updated January 18, 2024. https://www.epa.gov/septic/epas-decentralized-wastewater-partnership

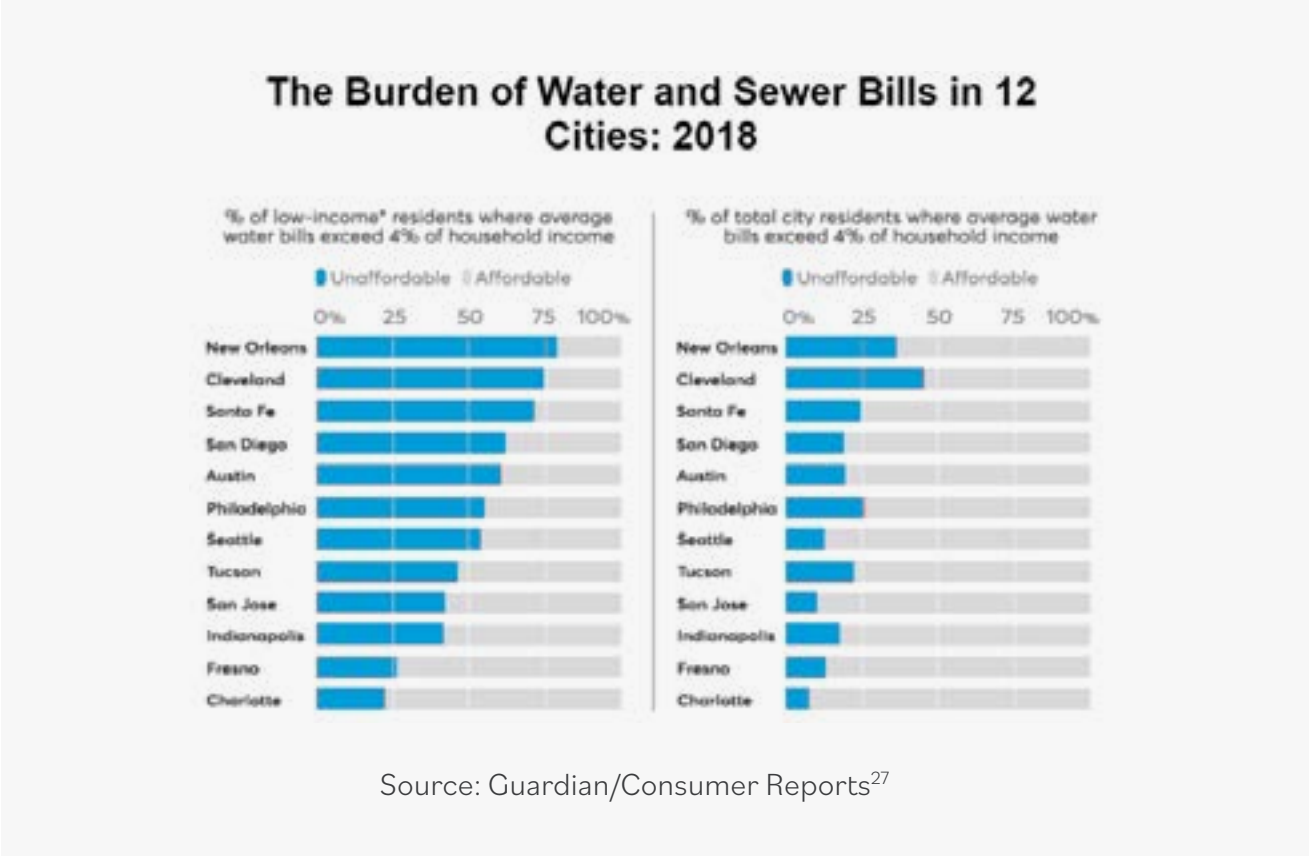
[25] Carrns, Ann. "Water Bills Are Rising. Here's What to Do About It." The New York Times. July 14, 2023. https://www.nytimes.com/2023/07/14/your-money/water-bills-tips.html

factors:

- Increasing costs resulting from climate change, especially ongoing drought conditions and increased rates of wildfires in the American Southwest.
- Delayed rate increases from the COVID-19 pandemic.
- Inflation and supply chain disruptions impacting service upgrades.

According to McKinsey, water bills contribute significantly to many household budgets. In 2019, nearly 20 percent of American households were paying more than 4.5 percent of their income on water bills, a level considered unaffordable.[26]

The rising unaffordability of water is also not spread evenly. Certain cities and metro areas have been harder hit than others, and in all cases the burden falls heaviest on poor and low-income residents. The image below from the Guardian/Consumer Reports highlights the growing burden of accessing potable water on the nation's poor:



Source: Guardian/Consumer Reports[27]

[26] Bielenberg, Aaron et. al. "US water infrastructure: Making funding count." McKinsey and Company. November 24, 2012. https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/us-water-infrastructure-making-funding-count

[27] Lakhani, Nina. "Millions of Americans Can't Afford Water, as Bills Rise 80% in a Decade." The Guardian. July 10, 2020. https://www.consumerreports.org/money/personal-finance/millions-of-americans-cant-afford-water-as-bills-rise-80-percent-in-a-decade-a8273700709/

Water Efficiency and Reuse

Water consumption in the US has actually declined over the last 10 years, in part driven by the increased efficiency of water products in homes, businesses, and the water system generally. The primary government program supporting water efficiency is WaterSense, a voluntary labeling program sponsored by the US EPA. WaterSense-labeled products and services are "certified to use at least 20 percent less water, save energy, and perform as well as or better than regular models." [28]

According to a study commissioned by Plumbing Manufacturers International, equipping homes and non-residential commercial facilities with WaterSense-labeled products could save Americans nearly $26.4 billion annually.[29] The market for WaterSense-labeled products continues to grow over time as the figure below makes clear. The increases in market share for WaterSense-labeled products are driven primarily by the replacement market.[30]

WaterSense Products	2015 market penetration	2019 market penetration
Tank-type residential toilets	7.0%	16.8%
Bathroom sink faucets	25.4%	40.1%
Showerheads	28.7%	45.4%
Flushing urinals	Not included	1.8%
Flushometer-valve toilets	Not included	2.0%

The WaterSense program has been incredibly successful, but funding for the program is not on par with other issues related to efficiency, such as energy. Continuing to improve market penetration of WaterSense products will improve water access via increased efficiency, reduced energy demand, and better managed cost control for the end user.

Additionally, increasing pressures on water resources have led to greater water scarcity and a growing demand for alternative water sources. Onsite water reuse is one solution that can help communities reclaim, recycle, and then reuse water for non-drinking (and limited potable) water purposes. Onsite water reuse systems capture and treat water sources generated from within or surrounding a building, such as rainwater, wastewater, greywater, or stormwater. The treated water is then reused onsite or locally.[31]

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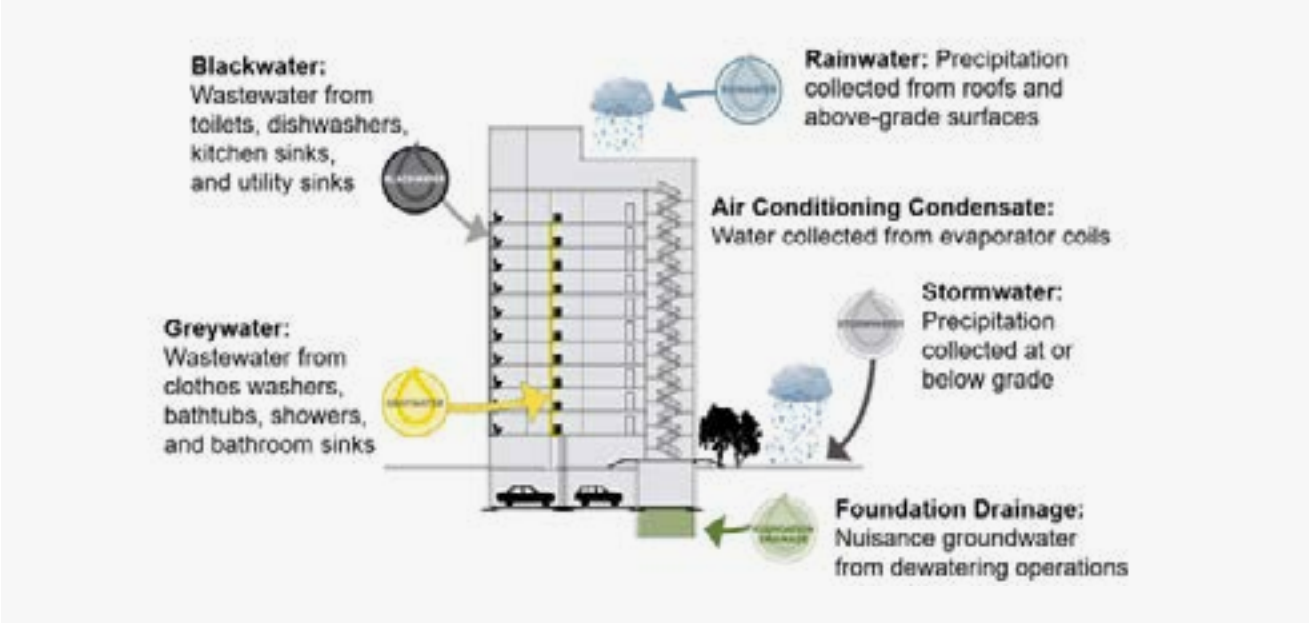
[28] EPA. "About WaterSense." June 6, 2023. https://www.epa.gov/watersense/about-watersense

[29] GMP Research, for Plumbing Manufacturers International. "2019 WaterSense Market Penetration." June 2019. https://www.safeplumbing.org/files/safeplumbing.org/documents/misc/2019-WaterSense-market-penetration-study.pdf

[30] Ibid.

[31] US EPA. "Onsite Non-Potable Water Reuse Research. Updated February 2023. https://www.epa.gov/water-research/onsite-non-potable-water-reuse-research

Recycling water on site or nearby reduces the energy needed to move water longer distances or pump water from deep within an aquifer. Tailoring water quality to a specific water use also reduces the energy needed to treat water. For example, the water quality required to flush a toilet is less stringent than the water quality needed for drinking water and requires less energy to achieve. Using recycled water that is of lower quality for uses that don't require high quality water saves energy, money, and chemical inputs by reducing treatment requirements.[32]



Lack of Data

Data on water access and water quality in buildings is not collected by the Federal government in a comprehensive, systematic way and fails to provide an adequate picture of the state of water and sanitation usage, access, and quality in the US. Multiple Federal surveys provide questions related to water, but in totality the information gleaned from US communities (especially lower-income and minority communities) does not provide enough information on those without access to clean and safe drinking water and sanitation. In addition, data collection is not done on a consistent enough basis, leading to significant gaps in knowledge that make it virtually impossible to assess changes over time.

According to DigDeep, the decennial census "used to collect detailed information on household water and wastewater access, but the questions about wastewater were removed after 1990."[33] The last question on water and sanitation in the American Community Survey was removed by the Census Bureau in 2016, so data is actually becoming more

[32] WateReuse. "How Can Water Reuse Support the Environment." https://watereuse.org/educate/types-of-reuse/environmental-restoration/

[33] Roller, Zoe, et. al. "Closing the Water Access Gap in the United States: A National Action Plan." DigDeep. 2019. https://static1.squarespace.com/static/5e80f1a64ed7dc3408525fb9/t/6092ddcc499e1b6a6a07ba3a/1620237782228/Dig-Deep_Closing-the-Water-Access-Gap-in-the-United-States_DIGITAL_compressed.pdf

inaccurate, unreliable, and problematic for communities that still face the most acute water insecurity issues. Additionally, questions related to water usage were dropped from the 2018 Commercial Building Energy Consumption Survey.[34] Another area where the effect of water shortages is apparent but not well studied is fire protection systems.[35] A coordinated Federal and state and local effort to better understand water use in households and other buildings is needed.

In 2017, Lawrence Berkeley National Laboratory (LBNL) issued a report with support from EPA's Office of Water.[36] The report found that despite water shortages caused by drought and unmet (and growing) water infrastructure needs, little is known on the national scale of water demand within each economic sector. LBNL reviewed federal government water data collection efforts by the US Geological Survey (USGS), US Department of Agriculture (USDA), and the US Energy Information Administration (EIA). These efforts in their current form were found to be intermittent and too narrowly focused when examining water usage in the built environment. It further looked at the utility of non-national studies, which were limited by collection frequency, sample size, and geographical coverage. Ultimately, LBNL concluded that collecting and publishing national water demand data, with a level of detail similar to that in the EIA surveys, would allow for the development of metrics to gauge the water use and efficiency in buildings across economic sectors in the same manner the EIA survey instruments have enabled energy metrics and analysis.

There have been positive developments made in this area. In 2022 Congress passed the CHIPS and Science Act of 2022. This legislation included the formal creation of a National Institute of Standards and Technology (NIST) program, in consultation with EPA, for premise plumbing research – a federal policy recommendation that NIBS included in previous Moving Forward reports. With the formal authorization of this program, Congress still needs to provide NIST with adequate resources to support the research needs that NIST has identified in partnership with industry stakeholders. NIST should also be empowered in its coordination with other Federal stakeholders, including EPA and DOE, to carry out this important research agenda.

Water Quality

Minimum water quality standards for public water systems, defined by the Safe Water Drinking Act and EPA regulations, include guidelines for quality, testing schedules, and testing methods. These actions have, on average, made notable improvements in the use efficiency and quality of US water systems.[37]

While EPA and other government agencies provide standards and regulations governing supply, there are also

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[34] U.S. Office of Management and Budget. "2018 CBECS Supporting Statement A 03-26-19." March 26, 2019. https://omb.report/icr/201812-1905-004/doc/88419203

[35] Charter, Virginia R., et al. "Water Supply & Climate Change: The Impact of Water Stress on Fire Protection Systems." SFPE Foundation. December 2022. https://higherlogicdownload.s3.amazonaws.com/SFPE/c2f91981-c014-4bec-97f4-1225586937ac/UploadedImages/Water_Supply_and_Climate_Change_Report_2022.pdf

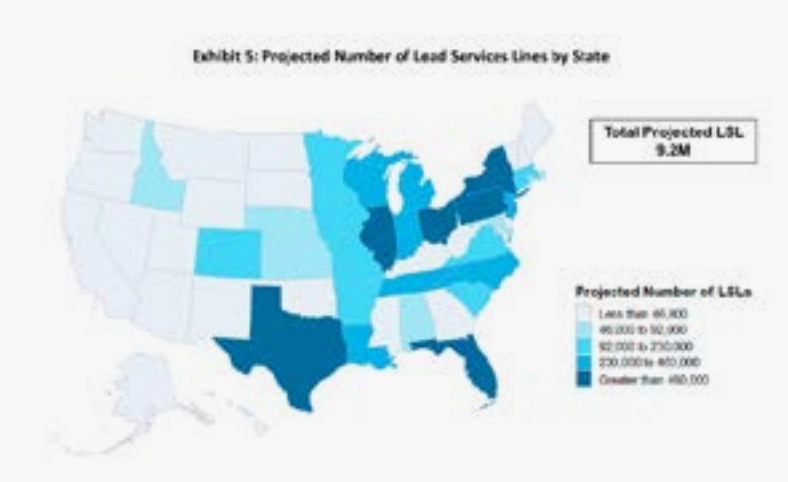
[36] Dunham, Camilla; Fuchs, Heidi; Stratton, Hannah. "Benefits of a National Survey on Water Demand." Lawrence Berkeley National Laboratory. December 2017. https://eta-publications.lbl.gov/sites/default/files/lbnl-2001085.pdf

[37] Persily, Andrew et al. "NIST Technical Note 2088: "Measurement Science Research Needs for Premise Plumbing Systems." National Institute of Standards and Technology. May 2020. https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.2088.pdf

[38] Ibid.

numerous standards that maintain water quality standards for buildings. Within the building, water quality concerns fall into three main categories: metallic, chemical, and biological.[38] Two examples of these standards are:

- ASHRAE/NSF 514: Prevention of Injury and Disease Associated with Building Water Systems
- ASHRAE 188: Legionellosis: Risk Management for Building Water Systems



According to the US EPA, there are an estimated 9.2 million lead service lines in the US, with the highest concentration in the Midwest, Texas, and Florida.[39] Replacing these lines should be a priority. The Bipartisan Infrastructure Law did allocate additional funding for the replacement of lead service lines in the Drinking Water State Revolving Fund.

The recent COVID-19 pandemic brought the issue of water quality within buildings to the fore. Buildings that sat unused for long periods of time faced issues of stagnant water, which can introduce and/or optimize the growth of pathogens (such as Legionella bacteria) or cause harmful changes in water chemistry that may cause corrosion or leaching of metals, both of which can be harmful to occupant health.

Aging Infrastructure

America's water distribution infrastructure, which supplies potable water to our homes and offices, is under tremendous stress. As noted by the University of Michigan Water Center, "the useful life-cycle of much of the water and sewer infrastructure is coming to an end."[40] Water main breaks are currently a constant feature of a strained infrastructure system, with nearly 250,000-300,000 breaks per year, the equivalent of water break every 2 minutes.[41] Some of the older systems in the US, which include some of the larger systems supplying major population centers, utilize pipes and other infrastructure that were laid at the end of the 19th century. The CDC data shows that Legionnaires' Disease cases in most states have doubled in the five-year period from 2014-2019. Furthermore, the CDC reports 96% of those cases were individual and sporadic, meaning they were not contracted in a cluster of related cases tied to a specific building, equipment, or plumbing fixtures. Instead, they were individual isolated

[39] US EPA. "Fact Sheet: 7th Drinking Water Infrastructure Needs Survey and Assessment." April 2023. https://www.epa.gov/system/files/documents/2023-04/Final_DWINSA%20Public%20Factsheet%204.4.23.pdf

[40] University of Michigan Graham Center for Sustainability. "Water and Sewer Infrastructure Funding and Gap." April 2022. https://graham.umich.edu/system/files/pubs/Water-Sewer-Infrastructure-Funding-Gap.pdf

[41] American Society of Civil Engineers. "Chronic Underinvestment in America's Water Infrastructure Puts the Economy at Risk." August 26, 2020. https://www.asce.org/publications-and-news/civil-engineering-source/society-news/article/2020/08/26/chronic-underinvestment-in-americas-water-infrastructure-puts-the-economy-at-risk

cases contracted in homes, businesses, healthcare facilities, etc. This indicates systemic issues with the source water supplied to the buildings and a need to reevaluate and improve the stringency of requirements of the Safe Drinking Water Act and to address aging and neglected distribution infrastructure.

A lack of investment in updating infrastructure carries substantial costs. Per McKinsey, nearly 14-18% of treated potable water is lost through leaks, with some systems reporting losses of 60%.[42] According to ASCE, leaking pipes lost the equivalent of $7.6 billion worth of treated water in 2019, with that loss rate projected to double over the next 20 years. ASCE further notes that businesses and homes most reliant on water will spend $250 billion in 2039 on water service disruptions.[43] Coupled with increasing threats from drought, natural hazards, and climate change, the nation's aging water infrastructure is projected to be a significant threat to the nation's public health, as well as to the budgets of America's families.

While recent Federal legislation has dramatically increased the available funds for water infrastructure improvements, funding for water infrastructure improvements and upgrades does not match the current need, at any level. As noted by McKinsey, this is especially true in light of new regulations from the EPA to limit or remediate certain man-made chemicals in the water system.[44]

Workforce

Per Brookings Institute, in 2016 there were 1.7 million workers across 212 occupations involved in designing, constructing, and operating the nation's water infrastructure.[45] As with workforce across much of the building sector, the water supply and plumbing industry is facing a shortage of skilled workers, as well as a lack of workers in the pipeline. In its annual "State of the Water Industry" survey, the American Water Works Association found that an "Aging workforce/anticipated retirements" ranked sixth out of 20 Water Sector Challenges.[46] As noted by the US EPA, more than one-third of the water industry workforce is expected to retire in the next 10 years, indicating the critical need to invest in the nation's water workforce. It is also important that the next generation of workforce be properly trained for adaptation and deployment of the latest in best practices and technological innovations that are prescribed in the most up-to-date model codes and industry standards when delivering solutions to communities in the decades ahead.

Finding, hiring, and retaining qualified professionals continues to affect many trades, including plumbing. In

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[42] Bielenberg, Aaron et. al. "US water infrastructure: Making funding count." McKinsey and Company. November 24, 2012. https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/us-water-infrastructure-making-funding-count

[43] American Society of Civil Engineers. "Chronic Underinvestment in America's Water Infrastructure Puts the Economy at Risk." August 26, 2020. https://www.asce.org/publications-and-news/civil-engineering-source/society-news/article/2020/08/26/chronic-underinvestment-in-americas-water-infrastructure-puts-the-economy-at-risk

[44] Bielenberg, Aaron et. al. "US water infrastructure: Making funding count." McKinsey and Company. November 24, 2012. https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/us-water-infrastructure-making-funding-count

[45] Kane, Joseph W.; Tomer, Adie. "Renewing the water workforce: Improving water infrastructure and creating a pipeline to opportunity." Brookings Institute. June 2018. https://www.brookings.edu/articles/water-workforce/

[46] American Water Works Association. "State of the Water Industry 2023." https://www.awwa.org/Portals/0/AWWA/ETS/Resources/2023-SOTWI-Full-Report.pdf

construction, builders report a 55% shortage of plumbers available for work training. The US Bureau of Labor Statistics estimates there will be 42,600 plumber, pipefitter, and steamfitter vacancies in the country each year between now and 2032.[47] This lack of skilled labor is straining current plumbers on multiple fronts, from demanding longer hours to having to decline work opportunities because they don't have the bandwidth to complete the jobs.

Recommendations from the Consultative Council

Data: The Federal government must coordinate and consolidate how data on water access, use, and quality in buildings is measured. Current Federal data-gathering efforts regarding water are irregular and uncoordinated, with primary efforts at measuring water access and quality in buildings mainly driven by the EPA's surveys of drinking water systems. A more comprehensive effort to understand water systems and water use in buildings is needed, with input from multiple Federal agencies, and must be provided on a consistent and regular basis. The White House should convene a multi-agency working group to develop and implement a coordinated water data strategy including funding needs. Congress should appropriate funding to support this strategy.

Efficiency: The WaterSense program should be expanded, with a focus on improving water efficiency for those with the least access to water-efficient products. This includes ensuring that when promoting "Efficiency," water is given similar imperative as energy. In addition, water needs to be better integrated into, or given increased focus by, Federal efficiency efforts, emphasizing how it relates to energy efficiency. This also includes expanding the use of alternate water sources in Federal buildings, including rainwater, stormwater, and greywater. In addition, better understanding the interplay of energy efficiency, carbon reduction strategies, water efficiency, and current plumbing codes and standards is critical to ensuring safe water for occupants.

Funding: In addition to recent legislation providing additional funding for water infrastructure, including the Infrastructure Investment and Jobs Act, the Federal government must continue to increase its share of funding to water infrastructure projects. McKinsey estimates that, despite recent increases in funding, a 22 percent gap remains between the capital required to properly update America's water infrastructure and the funds available. Additionally, funding should be provided to ensure and increase equity and affordability among the most vulnerable. While funding should be made available to all systems, targeting funding to improve water access and quality for lower-income and traditionally marginalized communities should be made a priority. Many existing funding mechanisms are currently focused on the capital costs for installing the water and wastewater systems; there also needs to be consideration for

[47] U.S. Department of Labor. "Plumbers, Pipefitters, and Steamfitters." Occupational Outlook Handbook. Last Modified September 6, 2023. https://www.bls.gov/ooh/construction-and-extraction/plumbers-pipefitters-and-steamfitters.htm

the long-term sustainability of systems that are installed. Many of the systems will serve low-income residents who are unable to afford the ongoing operation and maintenance expenses, which could potentially prevent long-term access to clean drinking water and safely managed sanitation. Congress and the Administration should prioritize the following programs and initiatives through funding commensurate with their impacts:

- WaterSense
- Drinking Water State Revolving Fund (including potential reduction in match requirements for disadvantaged jurisdictions and a focus on long-term operations and maintenance of systems)
- NIST Plumbing Research Lab

Prioritizing Research: In 2019, the National Institute of Standards and Technology developed a list of prioritized research required for overcoming technical research knowledge gaps for providing plumbing systems to provide access to clean water.[48] The Council supports actualizing the research outlined in the report through the effective implementation of the recently authorized NIST Plumbing Research Act. This includes supporting NIST in developing an appropriate Roadmap with goals and funding to see the research through. It also includes strengthening NIST's coordination with DOE, EPA, and other Federal agencies, as well as state and local actors, and private industry in carrying out this research agenda. Congress and the Administration should prioritize research as identified in the roadmap through appropriations and budgets.

Strategy: Currently, there is no national strategy working towards providing universal access to clean drinking water and effective sanitation to many communities. The Council supports the development of a national strategy for providing sustainable water and sanitation services to rural and disadvantaged communities, including those that rely on decentralized systems. EPA should lead (with Congressional approval as needed and with the engagement of other relevant agencies) development of a national strategy for sustainable water and sanitation services in rural and disadvantaged communities. This should be linked to EPA's existing decentralized wastewater initiative.

Updated Regulations: Increased rates of waterborne illness, like Legionnaires' Disease, over the last decade indicate a need to reevaluate Federal water treatment standards in the Safe Drinking Water Act and make adjustments as needed. Frequent water line breaks and disruptions can compromise the water entering all types of buildings and necessitate the testing of water further downstream in the distribution system than water providers have typically done. The Federal government should support communities in the regular update to plumbing codes and related standards and support their effective implementation, providing technical assistance and grant funding (similar to funding provided for energy code adoption and implementation through IIJA and BIL).

Workforce: Federal and state and local governments should work together to invest in the water workforce. This includes plumbers and other individuals who work to ensure water access and quality both within the larger systems as well as within the building itself. This includes investment in attracting new skilled workers into the water sector, as well as continued education and training for the current workforce to ensure that today's workers are up-to-date on the latest technologies and practices. For example, EPA should expand the Water Industry Workforce Initiative to increase the scope and breadth of the program and continue to attract top talent into the building water workforce.[49]

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[48] Persily, Andrew et al. "NIST Technical Note 2088: "Measurement Science Research Needs for Premise Plumbing Systems." National Institute of Standards and Technology. May 2020. https://nvlpubs.nist.gov/nistpubs/TechnicalNotes/NIST.TN.2088.pdf

[49] US EPA. "America's Water Workforce Initiative: A Call to Action." https://www.epa.gov/sites/default/files/2020-11/documents/americas_water_sector_workforce_initative_final.pdf

National Institute of BUILDING SCIENCES™

2024 Moving Forward Report: Housing Affordability

Prepared by the NIBS Consultative Council

Introduction

The National Institute of Building Sciences (NIBS) serves as an unbiased forum for solving common issues and identifying opportunities within the building community. The NIBS Consultative Council assembles high-level building community leaders to make collective recommendations directly to policymakers to improve our nation's buildings and infrastructure. Members of the council include organizations representing consumers, architects, engineers, government officials, contractors, researchers, and housing officials. The goals of the council are three-fold:

- Convening Thought Leaders: bringing together industry leaders and experts from across the built environment to improve our nation's infrastructure and buildings.
- Identifying Challenges: assembling experts who identify key issues they believe will be facing the industry in the year ahead.
- Finding Solutions: developing and publishing a yearly report that offers solutions to key challenges the built environment faces.

For the 2024 Moving Forward Report, the Consultative Council investigated two critical challenges facing the building industry: access to clean water and housing affordability. For each topic, the Council evaluated the state of the industry, identified key issues, and made recommendations to industry actors and policymakers to help overcome the challenge. NIBS and the Consultative Council intend to revisit each topic periodically, to track progress and discuss potential new challenges and solutions.

On November 6, 2023, NIBS and the Consultative Council hosted a full-day, three-part hearing focused on housing affordability at the National Press Club in Washington, DC. The hearing brought together leading experts from trade associations, think tanks, academia, and practitioners to discuss the state of housing affordability and potential solutions to address the affordability and availability of housing for America's families. A hearing summary, including speaker bios, presentations, and a recording of the event, can be found here: https://www.nibs.org/events/housing-affordability-hearing.

Housing Affordability: Recommendations Summary

As part of the 2024 Moving Forward Report, the Consultative Council examined the fundamental problem of housing affordability in the United States. This report examines the issue of affordability of both rental and for-sale homes and its impact on all levels of society, along with a range of potential solutions to ease the strain of housing expenses on households.

The U.S. Department of Housing and Urban Development's standard measure of affordability for renters and homeowners is to spend 30% or less of their gross income on housing costs. In recent years, the combination of a housing shortage, inflation, and higher interest rates increased the cost of both rental and purchase housing faster than wage growth, leading to higher percentages of consumers paying more than 30% and even 50% or more of their income for housing.

The third quarter 2023 Housing Affordability Report by ATTOM Data Solutions showed that median home prices in 99% of counties throughout the U.S. were less affordable than historical averages.[1] From early 2020 to early 2023, rents in professionally managed buildings increased by 24%, according to The State of the Nation's Housing 2023 report by the Joint Center for Housing Studies (JCHS) at Harvard University.[2] While steep housing costs impact lower income households more significantly than higher income households, the issue is pervasive throughout all income levels in every community.

The points below provide a summary of the recommendations discussed in this report. Detailed recommendations

"There's no silver bullet to fix the affordable housing crisis. You need silver buckshot."

– Chris Herbert, Managing Director of the Joint Center for Housing Studies at Harvard University

from the NIBS Consultative Council can be found on page 17. The Council's recommendations are meant to supplement other actions that must be taken to stabilize the housing market for renters and homeowners, increase the supply of housing, and create lasting change for the continued production and rehabilitation of residential buildings for all age groups, income levels, and needs.

Summary Recommendations:

Regulations:

Codes and standards are essential for life safety and promoting sustainability and energy efficiency, as well as ensuring resilience to natural disasters and other phenomena. The National Institute of Building Sciences believes that code adoption is a critical aspect of moving the industry forward. However, given the perception among developers and policymakers that codes may contribute to increased housing costs, NIBS supports a non-biased, scientifically rigorous study of the benefits and costs of codes and standards adoption on housing affordability, from both a first-cost and lifecycle cost perspective. In addition, regulations or requirements that may impede alternative or innovative forms of construction, such as permitting and inspection as it currently relates to offsite methods, should be examined for possible streamlining or updating.

Zoning and Land Use:

Revise zoning codes to allow accessory dwelling units (ADUs), increase density, and allow multifamily buildings in neighborhoods previously restricted to single-family homes.

Financial Investments:

On the supply side, provide low-interest construction loans, increase the availability of Low-Income Housing Tax Credits (LIHTC), reduce or eliminate tariffs that contribute to the high cost of building materials, and consider taxing investment properties at a higher rate to reduce the prevalence of predatory investors. On the demand side, increase the availability of homeownership programs that help low- and moderate- income households buy homes, and address the impact of rising insurance premiums and property taxes with exemptions and subsidies for seniors and low-income households.

New Construction:

Invest in alternative methods of construction, including industrialized off-site production, along with new materials such as 3D printing or insulated concrete form construction to speed construction time and lower costs and assure regulations are updated to support their effective use. Encourage the design and production of smaller homes,

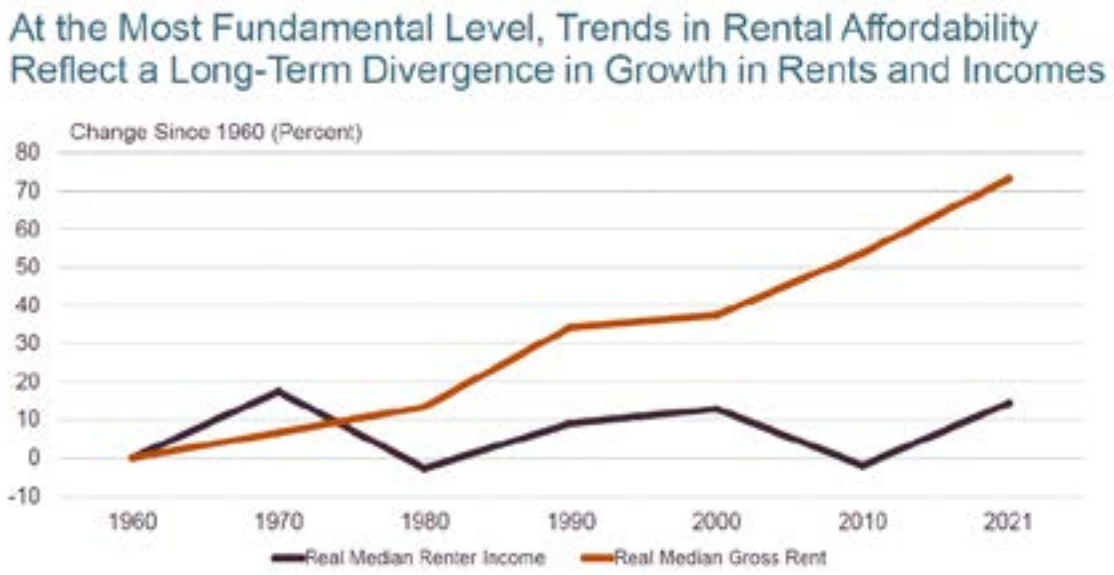
small multifamily units for homeowners to share with tenants, and the conversion of obsolete commercial spaces for residential use.

Workforce:

Develop model programs and provide incentives to increase recruitment, training, and retention in construction and related fields to address the long-term shortage of labor.

The Challenge: Housing Affordability for Renters

The housing affordability crisis is not a new phenomenon, but one that has steadily worsened over decades of divergence between housing costs and incomes. In 1960, approximately 25% of renters were cost-burdened, meaning they spent more than 30% of their income on rent, according to the Harvard JCHS. That share has grown over the past six decades and today stands at approximately 50% of all renters. The wide gap between wage growth and rents is partially to blame. Between 1960 and 2021, real incomes grew by 15% among renters, while rents increased by 70% during that same period.



Note: Underlying values are adjusted for inflation using the CPI-U for all items.
Source: Chris Herbert, Harvard Joint Center for Housing Studies. Presentation to NIBS Consultative Council, November 6, 2023.

The combination of rising housing costs and income losses during the COVID-19 pandemic, which hit lower income households hardest, generated the most significant decline in rental affordability in years. A record 21.6 million households paid more than 30% of their income on rent in 2021, with 11.6 million of those households spending more than 50% of their income on housing. The share of cost-burdened renters rose to 49% of renter households in 2021, nearly reaching the peak of 51% in 2011 following the Great Recession.

Another trend impacting renters is the proliferation of affordability issues, which are no longer confined to the lowest tier of household incomes. While 86% of renters with incomes below $15,000 and 68% of renters with incomes

between $15,000 and $29,999 are rent-burdened, the share of cost-burdened renters is rising fastest among middle income households. Between 2019 and 2021, the largest increase in the share of cost-burdened renters was in the income group earning between $45,000 and $74,999, up 4% to 34% of renter households in that income bracket. The share of cost-burdened renters earning $30,000 to $44,999 increased 3% to 63%.

The Challenge: Housing Affordability for Buyers

Homeownership has become increasingly difficult for the average U.S. wage earner over the past two years, according to ATTOM's report.[1] The increase in home prices and residential mortgage rates combined have pushed the average percentage of wages needed to buy a typical home up to 35%, a level considered unaffordable. Common lending standards recommend a 28% debt-to-income ratio for housing costs. The third quarter 2023 average of 35% is the highest level since 2007 and above the 21% average in early 2021, just before mortgage rates rapidly increased from their historic lows.

While rising prices and mortgage rates impact all buyers, first-time buyers feel the effect most acutely since they need to save for a down payment. Repeat buyers typically have equity from their previous homes to fund their next purchase. High rents make saving a challenge for prospective first-time buyers.

The number of renters with the income and savings to qualify for the median-priced home was nearly cut in half, from 8.8 million in March 2022 to 4.9 million in September 2023, according to JCHS research. The analysis is based on a 3.5% down payment and closing costs, which require approximately $25,000 cash for the median-priced home, which was $379,300 in March 2022 and $394,300 in September 2023. The annual income needed for the median priced home in March 2022, when mortgage rates were 4.2%, was $97,400 to keep the monthly housing costs of $2,500 at 31% of income. That compares to $129,500 needed for a median priced house in September 2023 at a 7.2% mortgage rate with housing costs of $3,300.

The Number of Renters with Incomes High Enough to Qualify to Buy the Median Home Has Been Nearly Cut in Half

	March 2022	March 2023	September 2023
Median US Home Price (Dollars)	379,300	375,400	394,300
Interest Rate (Percent)	4.2	6.5	7.20
Downpayment and Closing Costs	24,700	24,400	25,600
Total Monthly Owner Costs	2,500	3,000	3,300
Annual Income Needed @ maximum 31% debt to income	97,400	117,100	129,500
Renter Households in 2022 with Income Needed	8.8 million	6.1 million	4.9 million

Note: Estimates assume a 3.5% downpayment on a 30-year fixed-rate loan with zero points. 0.85% mortgage insurance, 0.35% property insurance, 1.15% property taxes, 3% closing costs, and a maximum 31% debt-to-income ratio.
Source: Chris Herbert, Harvard Joint Center for Housing Studies. Presentation to NIBS Consultative Council, November 6, 2023.

For homebuyers, the affordability challenge is two-fold: they need the income to qualify and the cash for the down payment. While saving $25,000 to buy a median-priced home can be difficult for most buyers, significantly more cash is needed in high-cost housing markets. As demonstrated above, the income required to qualify for a loan is affected by mortgage rates as well as home prices. In 2000, the ratio of home prices to incomes in 70% of metro areas was under three, which means that the median home cost less than three times the median income in that area, according to JCHS research. In 2022, due to rising prices over the past two decades, 75% of metro areas had a price to income ratio of four or more, and more than 50% of metro areas had a price to income ratio of five or more. In other words, in half of the country, the median home costs five times the median income.

Still, affordability issues for prospective homebuyers are not new. The gap between income growth and housing costs has been building for decades, according to researchers at the Joint Center for Housing Studies at Harvard University. Between 1960 and 2021, the average income of homeowners grew 60%, while average homeowner costs increased by 160%.[2]

Supply Side Issues and Solutions

The extreme shortage of housing to rent and to purchase is a prime driver of affordability issues. Estimates of the housing shortage vary from 1.5 million to as high as 5 million housing units. While housing construction varies according to household formations and demand, since 2014 the degree of underbuilding compared to demand has been stark, at nearly half of the number of units built in previous decades, according to the National Association of Home Builders (NAHB).

Multiple factors contribute to the lack of construction, including lending, labor, legal issues, lumber, and land issues. The limited availability of financing and its high cost have slowed the availability of land for developers, along with overly restrictive zoning regulations. Construction loans currently carry mortgage rates of 12% to 13%, which is one reason there is less than a one-year supply of buildable lots. The NAHB estimates that it can take as long as five years to prepare land for development in areas with a lengthy zoning approval process including a community review, compared to the average of two to three years, so this shortage may have a big impact as the housing market is anticipated to rebound in 2024 and 2025 as mortgage rates ease.

"We need to add more than 720,000 skilled labor workers annually, which is more than two million in the next three years."

– Robert Dietz, Chief Economist and Senior Vice President For Economics and Housing, National Association of Home Builders

Labor shortages, which have been exacerbated by a decline in immigration and limited investment in encouraging young people to enter trade professions, slow construction and increase costs. The shortage of skilled labor has been building since the Great Recession when construction slowed, and many people left the industry. NAHB estimates that at least two million new skilled laborers will be needed over the next three years.

Source: Robert Dietz, National Association of Home Builders. Presentation to the NIBS Consultative Council. November 6, 2023.

In recent years, building materials have exponentially increased in cost, partly due to tariffs, regulations, and supply chain disruption, along with increased demand for remodeling and new construction. For example, 90% of single-family homes are built with wood framing, but the U.S. has a 9% tariff on wood from Canada. To address materials costs, the U.S. could encourage more domestic production of lumber, reduce tariffs, and encourage investment in industrialization and using alternative materials and methods, including 3D printing.

Legal issues refer to regulatory constraints from local, state, and federal jurisdictions that limit or slow construction and add to costs. The full combined impact of regulatory issues is not well understood, and in need of further study. Regulations and zoning issues can be used as a form of exclusionary zoning, such as when specific architectural design standards must be met, which also contributes to higher housing costs.

Housing policies that fail to address all these challenges will fail to solve the affordability crisis, according to NAHB.

Some potential solutions include incentives to encourage building more attainable homes, such as smaller single-family homes and townhouses. In 1999, 37% of newly built homes had less than 1,800 square feet, while in 2022, just 23% of newly built homes were that size or smaller. Townhouses offer a medium density solution that fits between single-family homes and multifamily development and are generally more affordable than a single-family home. Currently 16% of new homes are townhouses, and NAHB anticipates this will rise to 20% in the next year or so.

Teardowns of older homes that would cost too much to renovate but are located in desirable areas represent about 9% of the market now but are expected to rise to 15% within the next five years. The advantage of teardowns is the lot is already prepared for housing and the infrastructure is in place, which can reduce costs. In addition, there may be opportunities to increase density by building two houses on a lot that once held one property.

Modular and panelized construction, currently just 2% of single-family housing starts, offer an opportunity for economies of scale, especially in higher density markets.

HUD recently revised its code for manufactured housing and will launch a competitive grant program to revitalize manufactured housing and manufactured housing communities.

One million multifamily apartments are currently under construction, the highest level since 1973. However, the apartments being built are primarily upscale buildings. A missing component of multifamily housing is duplexes and small buildings for two to four families, construction of which has not rebounded since the Great Recession. A recent survey by Zillow found that more than half of Millennial and Gen Z renters would prioritize buying a house with more than one unit so they can rent part of it for income.[3]

"We almost need to solve all the problems to solve any of the problems. Innovation by itself is not addressing many of the long-standing issues in the housing industry."

-Tyler Pullen, Senior Technical Advisor, Terner Center for Housing Innovation, UC Berkeley & The Housing Lab

Housing Crisis for Low-Income Households

Households with extremely low income, defined as less than 30% of area median income, and with very low income, defined as less than 50% of area median income, are impacted the most by the lack of supply of affordable housing. The U.S. has consistently underfunded programs that provide housing vouchers and subsidies for these households. In addition, the supply of affordable housing is limited, even for those who qualify for special programs.

The COVID-19 pandemic exacerbated these issues. Between 2019 and 2021, there were 950,000 more households that met the definition for very low income, while the number of affordable and available units for this group decreased by 463,000 during that period, according to HUD. Similarly, the number of extremely low-income households increased by 571,000, while the number of affordable and available units for that cohort decreased by 252,000.

Only an estimated one in four eligible households receive federal rental assistance, according to HUD. In 2021, 8.5 million renter households did not receive assistance even though they qualified for it. Many people in low-income households wait years for subsidized housing to become available.

Seniors in low-income households are particularly at risk, typically needing assistance at home with limited resources to pay for housing and care, according to a JCHS report.[4] A record high number of seniors – nearly 11.2 million – were cost-burdened in 2021, an increase of 1.5 million people in five years. The number of people aged 80 and older will double between 2023 and 2040, which means that policies to support seniors retrofitting their homes to age in place or to move to new homes that meet their needs should be under consideration now. If solutions include moving, this could in turn make more housing available for younger renters and buyers.

Solutions: Federal Actions to Produce, Preserve and Protect Affordable Housing

In May 2022, the White House Housing Supply Action Plan was launched with multiple policies meant to boost housing supply and reduce housing costs, such as:[i]

- Issued joint guidance with the Department of the Treasury on the use of State and Local Fiscal Recovery Funds for affordable housing.
- Restarted the Federal Finance Bank's Risk Share Program (HUD/Treasury).
- Allocated $5B in HOME-ARP funds to develop housing for vulnerable populations.
- Launched $85M Pathways to Removing Obstacles to Housing (PRO Housing)
- Created new lending authority for residential development via TIFIA and RRIF (DOT)

HUD has also collaborated with NIBS and MOD X on the development of the Offsite Construction for Housing Research Roadmap, and funded research on removing barriers to off-site construction and boosting supply through land use and zoning reforms.

In addition, recent programs including some that are part of the Inflation Reduction Act (IRA) provide resources to preserve and improve affordable housing, such as:[ii]

- Green and Resilient Retrofitting Program: $800M in grants and up to $4B in loans
- Choice Neighborhoods: 50 communities and nearly $7B invested since inception.
- Rental Assistance Demonstration: over $16B in capital investment to improve or replace nearly 193,000 deeply rent-assisted homes since inception.
- Updated CDBG notice to promote acquisition, preservation, and other supply uses.
- Launched HUD Funding Navigator to identify IRA and BIL resources for climate resiliency and energy efficiency improvements.

HUD has also taken steps to improve the Housing Choice Voucher Program.

State and local governments have also taken steps to improve access to affordable housing. For example, in Montana, a land planning reform act was passed with bipartisan support for an array of changes, such as statewide legalization

"We need a sense of urgency and to recognize that housing is a core part of our economic health."

– Solomon Greene, Principal Deputy Assistant Secretary for Policy Development and Research, HUD

[i] Greene, Solomon. Testimony to NIBS Consultative Council. November 6, 2023. https://www.nibs.org/sites/default/files/pdfs/NIBS_Housing-Hearing.pdf

[ii] Greene, Solomon. Testimony to NIBS Consultative Council. November 6, 2023. https://www.nibs.org/sites/default/files/pdfs/NIBS_Housing-Hearing.pdf

of accessory dwelling units (ADUs) and zoning changes to allow duplexes to be built on single-family home lots. In Washington, D.C. and San Francisco, tenants in multifamily buildings have the right of first refusal to purchase their building, and both cities have housing trust funds to provide assistance in those efforts. Many states and localities maintain an affordable housing preservation database similar to the national database. In some communities, a land trust is used to buy and renovate homes to make them available to first-time buyers rather than to investors.

Private-sector activities to produce, preserve, and protect affordable housing are supported by federal initiatives, including IRA tax credits and rebates.

The Department of Transportation provides guidance to developers as well as to government agencies that can access more than $35 billion in funds available for low-interest loans through the Transportation Infrastructure Finance and Innovation Act (TIFIA) and Railroad Rehabilitation & Improvement Financing (RRIF) programs for transit-oriented development projects, including conversion projects.[5]

HUD offers numerous opportunities for low-cost funding to increase the supply of housing, including incentives to convert underutilized office buildings to housing.[6]

While there is no direct housing production funding in the IRA bill, it includes $15 billion in federal grants and approximately $36.5 billion in tax credits over the next 10 years that can be used for spending related to energy efficiency and decarbonization efforts that can lower overall costs for housing development.[7]

Although multiple research reports have found that modern model building codes do not appreciably impact housing affordability, some builders raise a concern that retrofitting housing and building new homes to meet higher energy-efficiency standards and to increase resilience to the impacts of climate change may require initial investments that add to construction costs in the short term. Just as initial investment costs bear consideration for affordability consideration, it is important to ensure that residents can afford to stay in that housing over the long-term. Focusing on total cost of ownership/rental accounts for lower utility bills and insurance premiums and a reduced likelihood of damage by disaster events, supporting long-term affordability as discussed below. Federal funding through the IRA and the Bipartisan Infrastructure Legislation (BIL) may be available to offset some of those investments. An interactive HUD funding navigator tool is available for HUD participants to identify resources for their projects.

Solutions: Financial Actions to Improve Access to Affordable Housing

Multiple steps have been taken to help homeowners keep their homes, such as foreclosure prevention programs, and to assist prospective buyers. For example, the mortgage interest premiums for FHA loans were lowered to reduce costs. Rent payments can be used for credit profiles to improve borrower credit scores, and income from ADUs can be included in debt-to-income ratios.

Renovation loan programs that allow borrowers to wrap home improvements into their purchase mortgage may be revised to increase their accessibility to borrowers.

State and local governments can increase the availability of homeownership assistance, such as down payment help and low interest loans, and provide homeownership education and counseling to prospective buyers in their communities.

Solutions: Lower Energy Consumption and Housing Affordability

While housing expenses are often the largest component of a household budget, addressing other costs, such as energy bills, can relieve overall financial pressure. Energy bills average about 3% of the budget of most households,

but average nearly three times that (8.6%) for low-income households, according to the Department of Energy. Depending on their location and income, some households spend as much as 30% of their budget on energy costs.[8] Programs such as the Department of Energy's Affordable Home Energy Earthshot direct funds for research and development and to target retrofitting the approximately 50 million single-family homes, multifamily homes, and manufactured homes rented or owned by people in low-income households.[9] The goal of that program is a 50% reduction in the cost of retrofits to reduce energy consumption by an average of 20% over the next 10 years. Other programs such as Building America focus on making energy and decarbonization improvements in new construction, particularly those built for low-income households.

Solutions: Designing for Affordability

Numerous builders, building scientists, and architects work constantly to innovate construction and design practices that can streamline housing production and contribute to affordability. While some of these solutions involve technology, others can be as simple as designing smaller yet more efficient homes with features such as pocket doors and flexible rooms.

"The Affordable Home Energy Earthshot program is targeting a 50% cost reduction for retrofitting and to reach an average 20% energy consumption reduction in homes within 10 years."

– Eric Werling, Building America National Director, Building Technologies Office, U.S. Department of Energy

Designing specifically for co-living with communal and private spaces meets the needs of young adults as well as seniors who need affordable accommodations and social connection. Even simply repeating the same design for single-family homes and townhouses can increase affordability by eliminating the need for new designs and allowing for streamlined production. As further examined below, off-site construction presents an opportunity to leverage a systems-based approach to design and construction.

Aligning code requirements from one jurisdiction to the next can allow for easier replication of designs, which in turn lowers costs.

Solutions: Increase Off-Site Housing Production

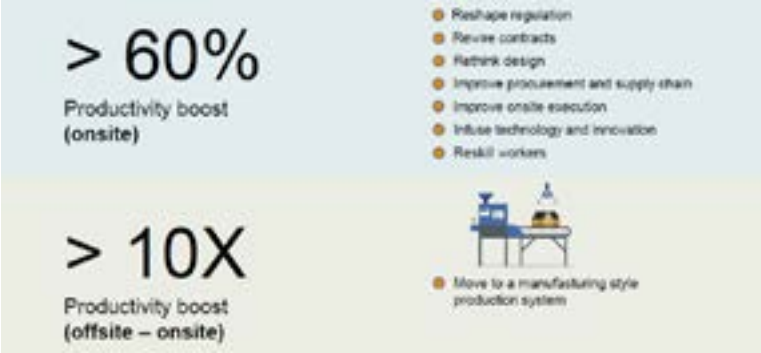
A core strategy for increasing the supply of affordable housing is to encourage off-site production such as modular, panelized, prefabricated, or manufactured housing. This could speed construction by 20% to 50%, compared to on-site production and potentially save as much as 20% in costs.[10] Off-site built homes typically offer energy efficiency benefits that lower operational costs for homeowners, too. Currently, a barrier to off-site housing production is the typical distance from factories to homesites. The greater the distance between the factory and the site, the higher the transportation costs, resulting from both the freight costs themselves as well as the patchwork of regulations and requirements that must be followed from jurisdiction to jurisdiction. Programs to incentivize off-site manufacturing and reduce regulatory costs could relieve this issue and increase the percentage of homes built in this environmentally friendly and more affordable way.

"There are 19,000 jurisdictions in the U.S. with different codes, so it should not be surprising that innovation is difficult in this regulatory environment."

– Tyler Pullen, Senior Technical Advisor, Terner Center for Housing Innovation, UC Berkeley & The Housing Lab

In addition to not enough factories to produce off-site housing, another obstacle to increasing the percentage of this type of construction is the patchwork of regulations. Eleven states leave the entire process for plan review and inspection of off-site projects to local governments, which may not have the resources, experience, or expertise to effectively perform these functions—particularly in factories outside their jurisdiction. The remaining 39 states and the District of Columbia have statewide off-site construction programs, but each operates under different requirements. Varied requirements typically raise costs, particularly for factories looking to deliver projects on a regional basis. The International Code Council and Modular Building Institute have developed standards and best practices that could be used to improve the compliance process.[11]

Discussions are currently underway with HUD to create an innovation framework to encourage solutions to obstacles slowing off-site housing production.



Source: "Improvements to Productivity: Manufacturing Style Production." McKinsey Global Institute. Presented by Ivan Rupnik, MOD X. Presentation to the NIBS Consultative Council. November 6, 2023.

"We've deindustrialized the manufacture of housing since the 1970s."

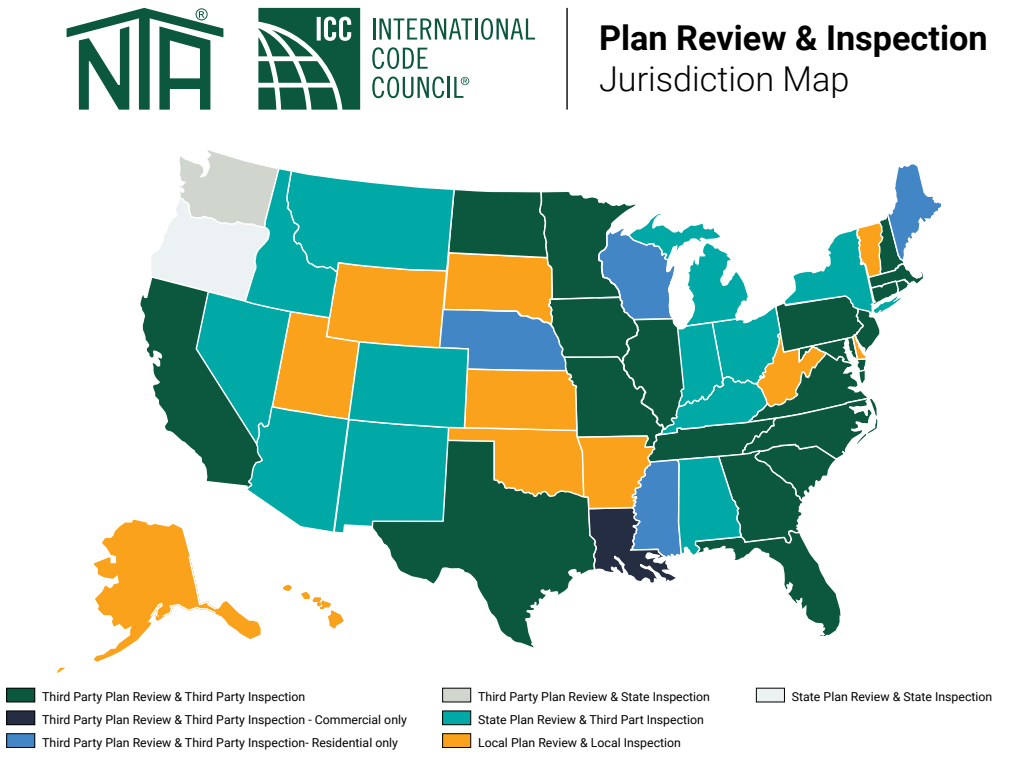
– Ivan Rupnik, Founding Partner of MOD X and an associate professor at Northeastern University

(Paraphrased slightly) You can choose to innovate the production of housing with a performance-based regulatory framework, which focuses on the outcomes or goals of a building as opposed to prescriptive codes that specify exact methods and materials.

– Ivan Rupnik, Founding Partner of MOD X and an Associate Professor at Northeastern University

Solutions: Zoning as a Housing Affordability Tool

Local governments are responsible for zoning codes, but state governments assign different levels of authority to cities, counties, and townships that can impact their ability to make changes. In addition to zoning codes, jurisdictions can use tools such as impact fees, development incentives, and other tools to control housing policies. Nationally,



Source: Ivan Rupnik, MOD X. Presentation to the NIBS Consultative Council. November 6, 2023

women, people of color, renters, and people in low-income households typically have less influence over zoning decisions, as they are generally less available to advocate at zoning hearings and are less likely to be appointed to zoning commissions. Increasing their participation in zoning decisions could change the conversation and result in decisions leading to greater density and the development of more affordable housing.

Zoning codes that limit construction to single-family homes, set a minimum lot size, and require parking often contribute to a lack of affordable housing. Zoning changes can be used to encourage diversity of housing in a community and increase density, both of which contribute to the supply of affordable housing. For example, more jurisdictions can allow the construction of accessory dwelling units (ADUs), which offer numerous options including

"Zoning is really one of the big reasons why the U.S. isn't building enough housing."

– Yonah Freemark, a Senior Research Associate with the Metropolitan Housing and Communities Policy at the Urban Institute

multigenerational living. Other zoning tools include allowing duplexes and triplexes to be built on land formerly occupied by single-family homes. A regional approach rather than a metro area approach to zoning could be used to expand opportunities for zoning changes that could increase housing supply.

"Land use isn't the only thing that matters when it comes to housing affordability. There's no silver bullet to solve affordability issues or broader social issues."

– Yonah Freemark, a Senior Research Associate with the Metropolitan Housing and Communities Policy at the Urban Institute

Addressing the Affordability Challenge: Recommendations from the Consultative Council

The availability of affordable housing is a prime concern for Americans at all income levels, in every demographic group, and in every geographic location. A large majority (80%) of Americans said they are very or somewhat concerned about the lack of affordable housing in the U.S., while 76% are concerned about it in their state, and 74% are concerned about it in their community, according to a recent survey by NeighborWorks America, a nonprofit organization that works to strengthen communities and create opportunities for people to live in affordable housing.[12]

Untangling the complexity of affordable housing issues requires a multifaceted approach that addresses challenges

"Labor unions and trade associations are doing outreach, such as tours and exhibits about apprentice programs, to make them more attractive to people from non-traditional backgrounds and show them that this is a viable pathway to the middle class."

– Justice Favor, Director of Strategic Partnerships of the Greater New York Laborers-Employers Cooperation and Education Trust

for renters, homebuyers, and homeowners. There's not one simple solution to the problem, but numerous actions can improve supply, lower costs, and increase access to affordable housing for every income level. The recommendations below are designed to promote collaboration between the public, private, and nonprofit sectors and focus attention on solutions to longstanding challenges that have led to today's affordable housing crisis.

Regulatory Reform

A full and comprehensive study of the impact of buildings codes and other regulations on housing affordability is needed. Additionally, jurisdictions should seek ways in which their regulatory frameworks may bias against or discourage alternative forms of construction, such as offsite construction.

As a starting point, we encourage the Administration to consider updating the statutory definition of manufactured housing. This will help provide manufactured homebuilders with more design flexibility and consumers with more options beyond local site-built for single-family homes and the newly HUD-approved duplex. We believe this update will greatly benefit Americans in rural and low-income communities, which has become increasingly important as our population ages.

Zoning and Land Use

Local agencies responsible for zoning regulations should ease restrictions and eliminate single-family-home-only districts to allow for greater density, such as reducing minimum lot sizes and allowing two-unit or three-unit buildings to replace an obsolete single-family home. Zoning authorities should also reduce or eliminate restrictions to make it easier for existing homes to be expanded with an accessory dwelling unit (ADU).

HUD's Pathways to Removing Obstacles to Housing program (PRO) incentivizes housing-forward actions to further develop, evaluate, and implement housing policy plans. PRO addresses restrictive zoning and land-use policies and improve housing strategies that will advance housing and community plans. This includes allowing accessory dwelling units (ADUs), incentivizing the development of vacant lots and the conversion of commercial properties to residential and mixed-used properties, and reducing off-street parking requirements. We urge Congress to increase funding for PRO to help knock down the barriers we face in the housing affordability crisis.

Financial Investments

The Federal government should increase funding for state housing finance agencies so they can invest more money in homeownership programs, such as down payment assistance, low interest loans, and tax credits.

The Federal government should increase the use of Low-Income Housing Tax Credits (LIHTC) to build affordable rental housing. LIHTC use has declined since 1990, and the tax credits are used to produce just 3% to 5% of new housing.

Federal agencies should encourage lenders to ease lending requirements and fund reduced mortgage rates for builders, particularly for land development and construction loans. According to NAHB, construction loan interest rates are currently in the 12% to 13% range.

Federal, state, and local jurisdictions should develop incentives to encourage the construction of two-to-four family buildings that allow homeowners to offset their mortgage with rental income and that contribute to the availability of rental housing.

The Federal government should reduce or eliminate tariffs that contribute to the cost of building materials, which are up 41.46% over the past five years, according to the Q4 2023 Gordian Quarterly Construction Cost Insights Report's Historical Cost Index Material Value metric, which tracks the change in the cost of raw materials, such as lumber and steel.[14]

Federal, state, and local governments should introduce incentives such as tax abatements and low-cost financing to offset the cost of converting underutilized office buildings for residential use, which could in turn contribute to the revitalization of downtown communities.

State and local jurisdictions should consider taxing investment properties at a higher rate to stop predatory investors that compete against first-time buyers and impact affordability. Investors have purchased approximately 25% of single-family homes in the past two years, according to CoreLogic, a real estate data analytics firm.[15]

State and local jurisdictions should address the impact of rising insurance premiums and property taxes, particularly on seniors and low-income households with exemptions or subsidies.

LIHTC, the largest incentive for affordable housing construction and rehabilitation, has led to an increase in affordable housing stock since its creation in 1986. In particular, this program has led to housing units being built in low-income communities, and we ask Congress to increase the number of credits they make available to each state this year.

The Consultative Council encourages members of Congress to pass the bipartisan Neighborhood Homes Investment Act (NHIA). The NHIA establishes a Federal tax credit targeted at the new construction or substantial rehabilitation of affordable, owner-occupied housing in distressed urban, suburban, and rural neighborhoods. This program would marshal private investments to build and substantially rehabilitate affordable homes for moderate to middle income homeowners over the next decade.

New Construction

Government agencies, building scientists, academic researchers, and private companies should collaborate and invest in nontraditional forms of housing production, such as modular, prefabricated, and manufactured housing, as well as in new materials including 3D printing to speed construction times and reduce construction costs. These groups should focus on expanding the development of factories for modular homes in multiple locations to reduce expense and lessen the environmental impact of transporting housing components long-distance. Further, these groups should champion the adoption of standards that support greater consistency in how off-site construction is regulated.

Congress can support new construction and the rehabilitation of affordable rental housing by continuing to fund the HOME Investment Partnerships Program (HOME). This program provides homeownership opportunities not seen before HOME's inception in 2021.

Workforce

Government agencies, nonprofit organizations, academic institutions, and builders should provide outreach and incentives to encourage more people to enter the construction profession, particularly women, who represent just 11% of construction workers. More programs need to be in place to train, recruit, and retain employees for construction and related industry jobs to address the ongoing shortage of skilled labor in numerous housing markets.

We encourage the Administration to utilize funds provided by the Workforce Innovation and Opportunity Act (WIOA) and to seek increased funding from Congress to combat the workforce shortage in the built environment.

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