

**SOLVING THE CLIMATE CRISIS:
CLEANER, STRONGER BUILDINGS**

HEARING
BEFORE THE
**SELECT COMMITTEE ON THE
CLIMATE CRISIS**
HOUSE OF REPRESENTATIVES
ONE HUNDRED SIXTEENTH CONGRESS
FIRST SESSION

HEARING HELD
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**SOLVING THE CLIMATE CRISIS: CLEANER, STRONGER
BUILDINGS**

THURSDAY, OCTOBER 17, 2019

HOUSE OF REPRESENTATIVES,
SELECT COMMITTEE ON THE CLIMATE CRISIS,
Washington, DC.

The committee met, pursuant to call, at 9:03 a.m., in Room 2020, Rayburn House Office Building, Hon. Kathy Castor [chairwoman of the committee] presiding.

Present: Representatives Castor, Bonamici, Brownley, Huffman, Casten, Graves, Griffith, Palmer, Carter, and Miller.

Ms. CASTOR. The committee will come to order.

The chair is authorized to declare a recess at any time of this committee, without objection.

I would like to start off the committee hearing this morning with a moment of silence for one of our colleagues. We have very heavy hearts this morning due to the passing of our colleague, Congressman Elijah Cummings of Maryland.

He was a champion for the people, an outspoken advocate for fairness, equality. He was a true hero to his district in the Baltimore area, and everyone can take a page out of his life.

So would you join me at this time in a moment of silence for this great American champion?

[Moment of silence.]

Ms. CASTOR. Thank you.

Well, good morning, everyone.

This year, our committee has discussed ways to reduce emissions in the transportation sector, the power sector, the industrial sector. And, today, we are looking at the building sector.

Whether it is houses or apartment complexes or office buildings, the places where we live and work use a lot of energy, and they are responsible for a significant share of carbon pollution. In fact, just last year, residential and commercial buildings were the source of more than one-fourth of all carbon dioxide emissions in the United States.

When Americans think of pollution, they usually think of smokestacks, but the reality is more complicated. About three-fourths of electricity sold in the United States is used in building, and natural gas, oil, and propane are used to heat up showers or keep homes and offices warm. Even the manufacturing, transportation, and construction of building materials are contributing to carbon pollution.

The climate crisis also leaves us with a resiliency problem. Many existing homes, businesses, and hospitals were not built to with-

stand the sorts of extreme events made worse by climate change, including extreme heat, flooding, storms, and wildfires. Over the last decade, extreme weather events have caused more than \$750 billion in damage, with many of these losses occurring to buildings.

We have a big challenge before us. In the United States, most of the homes and commercial buildings that we have right now will remain standing in 2050. They have already been built. By that year, scientists say we need to have hit zero net emissions to avert the worst impacts of the climate crisis. We need nothing short of an ambitious national plan to make sure new buildings are net-zero energy—that is, that they produce as much energy as they use.

We also need to help property owners and business owners make existing buildings more energy-efficient, helping them rely more and more on clean energy rather than on fossil fuels.

Of course, we must also work to make sure our homes and buildings don't end up as storm debris, and that starts by making them resilient to the physical impacts of climate change. In Florida, we saw the importance of strong building design codes and standards in the devastating aftermath of Category 5 Hurricane Michael that hit the Florida panhandle. The storm leveled many homes, but some were able to withstand the strong winds and the flooding because they incorporated more resilient building techniques.

There is also an economic incentive to act. More resilient and efficient buildings not only pollute less, they also cost less to operate and to insure. That is more money in the pockets of homeowners and business owners across America. When we talk about constructing new buildings and retrofitting old ones, that means construction jobs—lots of well-paying, often unionized jobs. Many innovations already have been developed by businesses large and small, entrepreneurs, and our academic research centers and more, and we need to scale them up.

Buildings are the foundation of our communities, so it is not surprising that State and local governments have taken the lead in developing a climate smart-building policy. In May, New York City set carbon emissions caps for energy use in buildings over 25,000 square feet. Last year, California created a program to incentivize the use of low-carbon technologies in new building construction. And we have seen how cities facing an existential threat from climate change, like Boston, Miami, and Norfolk, are at the forefront of developing resilient strategies to protect vulnerable communities.

Now we must step up to help them. An ambitious national plan for cleaner, stronger buildings requires national leadership. And Congress needs to offer smart incentives to set a direction for the numerous Federal, State, and local officials involved in the building sector. We also have the responsibility to ensure communities on the front lines of climate change, including low-income and communities of color, are front of mind when we craft policy.

I look forward to learning from our witnesses today. Welcome to all of you. We look forward to hearing your ideas for an ambitious, equitable building policy.

At this time, I recognize the ranking member, Mr. Graves, for 5 minutes for an opening statement.

[The statement of Ms. Castor follows:]

Opening Statement of Chair Kathy Castor (As Prepared for Delivery)

**Hearing on “Solving the Climate Crisis: Cleaner, Stronger Buildings”
Select Committee on the Climate Crisis**

October 17, 2019

This year, our committee has discussed ways to reduce emissions in the transportation sector, the power sector, and the industrial sector. Today, we’re looking at the buildings sector.

Whether it’s houses, apartment complexes, or office buildings, the places where we live and work use a lot of energy. And they’re responsible for a significant share of carbon pollution. In fact, just last year, residential and commercial buildings were the source of *more than one-fourth* of all carbon dioxide emissions in the United States.

When Americans think of pollution, they usually think of smokestacks. But the reality is more complicated. About *three-fourths* of the electricity sold in the United States is used in buildings. And natural gas, oil, and propane are used to heat up showers, or to keep homes and offices warm. Even the manufacturing, transportation and construction of building materials are contributing to carbon pollution.

The climate crisis also leaves us with a resiliency problem. Many existing homes, businesses, and hospitals were not built to withstand the sorts of extreme events made worse by climate change, including extreme heat, flooding, storms, and wildfires. Over the last decade, extreme weather events have caused more than \$750 billion in damage, with much of those losses occurring to buildings.

We have a big challenge before us. In the United States, most of the homes and commercial buildings that will be standing in 2050 have already been built. By that year, scientists say we need to have hit zero net emissions to avert the worst impacts of the climate crisis.

We need nothing short of an ambitious national plan to make sure new buildings are net zero energy—that is, that they produce as much energy as they use. We also need to help property owners and business owners make existing buildings more energy-efficient, helping them rely more and more on clean electricity, rather than fossil fuels.

Of course, we must also work to make sure our homes and buildings don’t end up as storm debris. And that starts by making them resilient to the physical impacts of climate change. In Florida, we saw the importance of building design, codes, and standards in the devastating aftermath of Category 5 Hurricane Michael. The storm leveled many homes, but some were able to withstand the strong winds and the flooding because of more resilient construction techniques.

There’s also an economic incentive to act. More resilient and efficient buildings not only pollute less—they also cost less to operate and to insure. That’s more money in the pockets of homeowners and business owners. And when we talk about constructing new buildings and retrofitting old ones, that means construction jobs. Lots of well-paying, often-unionized jobs.

Many innovations already have been developed by businesses—large and small—entrepreneurs, our academic research centers, and more. We just need to scale them up.

Buildings are the foundation of our communities, so it’s not surprising that state and local governments have taken the lead in developing climate-smart building policy. In May, New York City set carbon emissions caps for energy use in buildings over 25,000 square feet. Last year, California created a program to incentivize the use of low-carbon technologies in new building construction. And we’ve seen how cities facing an existential threat from climate change—like Boston, Miami, and Norfolk—are at the forefront of developing resilience strategies to protect vulnerable communities.

Now we must step up to help them. An ambitious national plan for cleaner, stronger buildings requires national leadership. And Congress needs to offer smart incentives, to set a direction for the numerous federal, state, and local officials involved in the buildings sector. We also have the responsibility to ensure communities on the frontlines of climate change—including low-income communities and communities of color—are front-of-mind when we craft policy.

I look forward to learning from our witnesses today, and hearing their ideas for ambitious, equitable building policy.

Mr. GRAVES. Thank you, Madam Chair.

And, Madam Chair, first, I want to thank you for recognizing our colleague, Elijah Cummings, and just the shock that we all learned this morning of his passing. I, like everyone, had the opportunity to work with him, and I respected the fact that he did fight for the people that he represented. And had very good, respectful interactions with him. And a loss to this Congress and to the State of Maryland, and I am just really devastated by the loss there.

Secondly, I want to thank you for holding this hearing. I think this is a really important topic. I do. I think it is a really important topic.

Third, I would like to thank you for—you put out an inquiry to the public asking for feedback on climate, and you and your staff, you all have been great about sharing that information and the feedback. And I do think it is important that we have those open lines of communication to ensure that we are looking at the same data and information to make sure that, as we move forward to a report, that we are seeing the same stuff so we can move in the same direction and ensure that we are being constructive moving forward.

Madam Chair, you know I am from Louisiana, and you probably get aggravated listening to me talk about all the experiences from home, but we have in the last several years been through Hurricanes Katrina, Rita, Gustav, Ike, Isaac, and it has caused just really unbelievable consequences to our community.

And, more recently, in 2016, we had this unnamed storm that was projected to be a 1,000-year storm. I think that our friends at NIFP at the time said that it was looking to be the fourth-most-costly flood disaster in U.S. history, and it was an unnamed storm. What was it? Thirty-two inches of rain in 36 hours in some areas. I mean, where do you put that? Louisiana is as flat as can be; there is no way to evacuate the water. And it caused devastating consequences.

In a previous life, I worked on resiliency measures. I helped to rebuild south Louisiana after Hurricanes Katrina and Rita, specifically rebuilding the coastal wetlands, rebuilding the levees, and just focused on resiliency and sustainability in communities.

And one of the things we learned in all that process, through that \$25 billion effort, one of the largest civil works programs in U.S. history, is we learned that we have more tools than just levees and restoring wetlands; that you have barrier islands and the dunes that go along with those. You have, of course, wetlands, which are really important. You have cheniers or ridges that are native to coastal Louisiana and many other coastal communities.

You do have structural protection like levees and flood walls. You have pump stations. You have elevation of homes. You have zoning. You have building standards.

And that last group of them, those are important tools, but they are not tools that are often in the tool chest of the Congress, of the Federal Government. But they are really important tools, and they need to be integrated into this overall objective of our desire to achieve certain resiliency standards.

And I know that Mr. Wright has been outspoken about this issue and ensuring that we properly use those tools, and I think you are

right on that. They are an important set of tools that we need to make sure we are properly investing in.

And it is not just about the resilient construction and making sure of the right elevation and right materials. It also is ensuring that we are conveying lessons learned and successes in energy efficiency and conservation. That is important as well, and I think it is part of our overall resiliency.

But, but, but, as I have said at other hearings, we have to make sure we get it right. And that means that we don't come in and tell these people, oh, you have to have this gold-plated shingle and this gold-plated window and other things that are going to make homes unaffordable.

That is part of our overall resiliency goal, is making sure that we make safe houses affordable and accessible and that we are not going to be punitive to low-income folks and prevent them from having access to houses. And so we have to make sure that we are not sole-sourcing different building materials or standards to where there is only one company that makes a product.

So I do think it is an important tool in the tool chest in terms of building standards and resiliency and elevation of homes and other things, but we have to be careful about how we are proceeding to ensure that the standards, the recommendations that we move forward with—and whether it is through the Flood Insurance Program reauthorization or other tools—that we do it in a way that truly advances the goal of resiliency, of affordability, of energy efficiency, conservation. I think that we can achieve multiple goals.

I want to say it again. I really appreciate you holding this hearing. I think this is a great topic for us to be working together on.

I want to thank all the witnesses for being here today, and I am looking forward to hearing your testimony.

I yield back.

Ms. CASTOR. Perfect.

Without objection, members who wish to enter opening statements into the record may have 5 business days to do so.

Ms. CASTOR. Now I would like to welcome our witnesses. I will proceed with an introduction, and then we will go to each one of you.

Welcome, Anica Landreneau. She is a senior principal and director of sustainable design for the architecture firm HOK. Anica also serves on Washington, D.C.'s Green Construction and Energy Commercial Technical Advisory Group as well as on Mayor Bowser's Green Building Advisory Council.

Kara Saul Rinaldi is vice president of government affairs and policy for the Building Performance Association. She is a leading energy and climate policy expert with more than 20 years of experience. Previously, she was the director of government and public affairs for Owens Corning.

Jimmy Rutland is president of Lowder New Homes and is on the board of directors for the National Association of Home Builders. He also serves on the State of Alabama Energy and Residential Codes Board and is a Certified Green Professional and a Green Energy Key Builder.

Khalil Shahyd is a senior policy advocate for the Healthy People and Thriving Communities Program at the Natural Resources De-

fense Council. Khalil works to advance Federal policy supporting energy-efficiency programs targeting the affordable multifamily housing sector.

And Roy Wright is the president of the Insurance Institute for Business and Home Safety. Previously, he was the Chief Executive of the National Flood Insurance Program and Deputy Associate Administrator for Insurance and Mitigation in FEMA's Federal Insurance and Mitigation Administration.

Without objection, the witnesses' written statements will be made part of the record.

And, with that, Ms. Landreneau, you are now recognized to give a 5-minute presentation of your testimony.

STATEMENTS OF ANICA LANDRENEAU, SENIOR PRINCIPAL, DIRECTOR OF SUSTAINABLE DESIGN, HOK; KARA SAUL RINALDI, VICE PRESIDENT OF GOVERNMENT AFFAIRS AND POLICY, BUILDING PERFORMANCE ASSOCIATION; JAMES RUTLAND, PRESIDENT, LOWDER NEW HOMES, ON BEHALF OF THE NATIONAL ASSOCIATION OF HOME BUILDERS; KHALIL SHAHYD, SENIOR POLICY ADVOCATE, HEALTHY PEOPLE/THRIVING COMMUNITIES, NATURAL RESOURCES DEFENSE COUNCIL; AND ROY WRIGHT, PRESIDENT, INSURANCE INSTITUTE FOR BUSINESS AND HOME SAFETY

STATEMENT OF ANICA LANDRENEAU

Ms. LANDRENEAU. Thank you, Chair Castor and Ranking Member Graves, as well as members of the committee, for recognizing the important role our built environment has to play in providing a safe, resilient future for our country.

In order to leverage the opportunity we have in the building sector, we need to reduce emissions from the built environment by at least 50 percent by 2030 and 100 percent by 2050. We do this by addressing energy efficiency in new and existing buildings, electrification, grid harmonization, renewable energy, and embodied carbon.

New buildings and alterations to existing buildings are subject to building codes, which have been developed since the 1800s to protect people and communities. Building codes are updated in 3-year cycles by members of the building industry in a public stakeholder engagement process.

And while model codes are updated every 3 years, they are not adopted uniformly across the United States. There are 11 States with no statewide adoption or codes that predate the 2006 Commercial International Energy Conservation Code, or IECC. In fact, nearly half the country is still on the 2009 or an older energy code at the State level. Half the country is building buildings that will consume energy for 60 or more years on decade-old energy codes.

The U.S. is projected to construct 45 billion square feet over the next decade. The first step is simply to bring all of our States and cities up to the most current code.

Many jurisdictions do not advance the code more consistently because they are challenged to maintain a sufficient code enforcement workforce or funds for training to address the new codes every 3

years. Analysis indicates \$6 are lost for every \$1 we don't spend on code compliance.

Congress can provide assistance to jurisdictions who wish to convert to an e-plan review process or leverage integrated technology solutions to streamline permitting and inspections, enabling better code enforcement for more consistent code updates.

Congress can also incentivize jurisdictions by replicating a highly successful program implemented under the 2009 American Recovery and Reinvestment Act that provided free training and resources along with strong incentives for jurisdictions to adopt the 2009 IECC.

I also serve on the 2021 IECC Commercial Development Committee. That is up for a final vote in November, and it is estimated to be 10 to 15 percent more efficient than the 2018 code.

In addition to cost-effective efficiency measures, it includes a Zero Code appendix. This is built into the code enforcement framework of the IECC but is voluntarily adopted by jurisdictions and may be adjusted locally. The provisions contained in the appendix only become mandatory when specified as such in the jurisdictions adopting ordinance.

Congress can offer incentives to state and local governments to increase the rate of adoption and encourage use of the Zero Code appendix. Congress can link existing Federal tax incentives to zero-energy and zero-carbon goals. Congress can maintain and increase Federal tax incentives for renewable-energy technologies, including storage.

A few cities and states are phasing in zero-energy and zero building codes already, including Santa Monica, California; Oregon; Washington, D.C.; and Cambridge, Massachusetts; among others.

Energy codes address new construction and alteration projects that require a permit. However, in most established U.S. cities, 80 to 90 percent of the buildings that will be consuming energy in 2050 already exist. Therefore, other complementary policy solutions, such as transparency and benchmarking, are required.

Transparency and benchmarking policies have been implemented in over two dozen jurisdictions: Austin, Chicago, Denver, Portland, Salt Lake City, and San Diego, just to name a few. These policies encompass nearly 92,000 properties at 11 billion square feet of floor area reported every year, and, through transparency alone, they are seeing an average of 4 to 13 percent improvement in energy efficiency.

Investment in energy efficiency is an investment in local jobs. The city of Atlanta determined such investment returned \$41 in local benefits for every \$1 invested, and they now require commercial buildings over 25,000 square feet and larger to report annual Energy Star scores and perform energy audits every 10 years.

Once jurisdictions have created transparency infrastructure, they may want to require buildings to take additional steps beyond reporting. Washington, D.C., Washington State, and New York City have already passed legislation to address existing building performance standards, elevating existing building performance through Energy Star, energy use intensity, and greenhouse gas emissions per building type.

Congress can incentivize States and cities to adopt these policies, particularly when they are linked to national benchmarking platforms such as Energy Star Portfolio Manager. Support could include co-funding of staff or providing resources, tools, and training.

Local policy can serve as a laboratory for innovative policy ideas that can be leveled up to State and eventually Federal policy. Eighty-two percent of the U.S. population lives in urban areas, and that number is growing. This growth in migration means we will see investment in new construction as well as reinvestment in our existing neighborhoods and communities.

Thank you.

[The statement of Ms. Landreneau follows:]

Testimony of Anica Landreneau

Senior Principal, Director of Sustainable Design, HOK

Before the U.S. House of Representatives, Select Committee on the Climate Crisis

Solving the Climate Crisis: Cleaner, Stronger Buildings

October 17, 2019

Thank you for recognizing the important role our built environment has to play in meeting our climate goals and providing a safe, resilient future for our country.

Why Buildings?

Buildings and construction account for approximately 40% of global CO₂ emissions.¹ In order to leverage the opportunity we have in the building sector to meet the targets of the Paris Agreement, we need to reduce emissions from the built environment by *at least* 50% by 2030, optimally 65% by 2030, and completely eliminate emissions from the built environment by 2050.

We do this by addressing the operational efficiency in new and existing building stock—targeting net zero or net positive performance, electrification, grid harmonization, renewable energy generation onsite and offsite, land use and development policies, as well as the embodied carbon in our building materials.

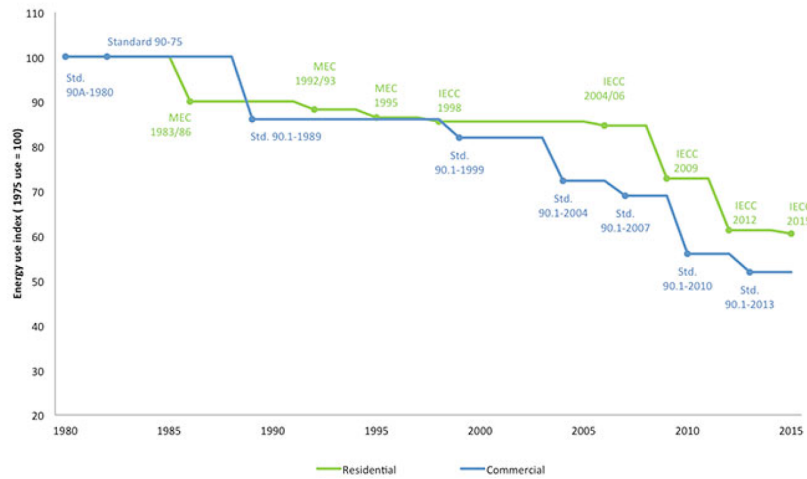
Energy Performance in New Buildings and Alterations

New buildings and alterations to existing buildings are subject to building codes through a permitting and inspections process. Building codes are regulations for issues such as fire and life safety that have been developed since the 1800s to protect people and communities.

In order to stay current and relevant, model building codes are updated in 3-year cycles by volunteer code committees comprised of members of the building industry, such as architects, engineers, manufacturers, building industry associations and building code officials. Anyone can submit code change proposals, code hearings are public and live webcast, draft code changes are subject to public comment and each new edition of the model code is ultimately voted on by members of the codes council after a lengthy stakeholder engagement process.

¹UN Environment Annual Report (2017).

Relative Energy Use under Model Building Energy Codes 1980-2015²



From 2006 to 2012, model energy codes increased energy savings potential by nearly 30%.³ While model codes are updated every three years, they are not adopted uniformly across the US. There are 11 states with no statewide adoption or codes that predate the 2006 International Energy Conservation Code (IECC). In fact, nearly half the country is still on the 2009 or an older energy code at the state level.⁴

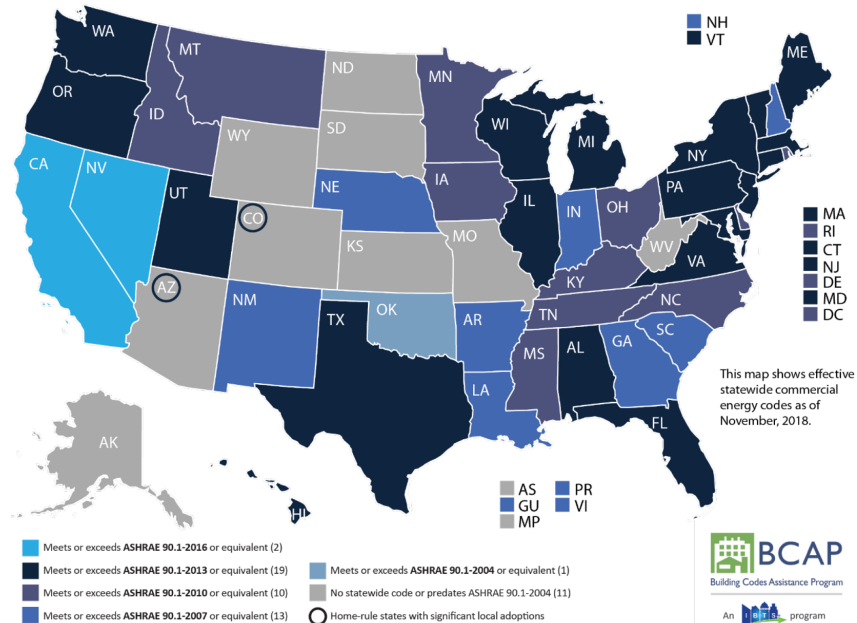
Half the country is constructing buildings that will consume energy for 60 or more years on decade-old energy codes. Fortunately, cities (or counties) are able to adopt more stringent energy codes than the state level, and there are many instances where local code adoption has significantly outpaced the state.

²<https://aceee.org/blog/2016/02/take-ride-energy-slide-building-codes>.

³Assessment Methodology for Code Compliance in Medium to Large Cities (NRDC, IMT; 2018).

⁴<http://bcapcodes.org/code-status/commercial/>.

COMMERCIAL ENERGY CODE ADOPTION



Standard/Code Cycle Equivalency

ASHRAE 90.1–2004	IECC 2006
ASHRAE 90.1–2007	IECC 2009
ASHRAE 90.1–2010	IECC 2012
ASHRAE 90.1–2013	IECC 2015
ASHRAE 90.1–2016	IECC 2018
ASHRAE 90.1–2018	IECC 2021*

*Final vote November 2019, publication 2020

The U.S. is projected to construct 45 billion square feet over the next decade.⁵ One of the biggest opportunities and one of the simplest solutions is to simply bring all of our states and cities up to the most current energy codes so that this new building stock is as efficient as possible for the next few generations.

Why don't jurisdictions adopt the newest codes more regularly? Many jurisdictions do not advance the code more consistently because they are increasingly challenged to maintain sufficient code enforcement staff to effectively provide services and to fund the training, tools, and resources necessary to maintain skills let alone the capacity to address new codes every three years.⁶

How much does it cost to enforce the energy code?

A study conducted by the Lawrence Berkley National Laboratory found the average cost of enforcing the energy code to be \$139 per commercial building and \$49 per single-family home. These figures are based on a survey of 23 local building departments with an average time to conduct plan review and on-site inspections of five hours for commercial projects and 1.9 hours for residential projects. The authors of the study acknowledge that the cost estimates are only representative of personnel time and are exclusive of overhead, benefits, or travel cost (for on-site inspection), which could triple or quadruple the figures. Larger cities with higher overhead and labor costs may need to spend \$400–\$500 per new commercial building and

⁵U.S. Energy Information Administration Annual Energy Outlook 2019.

⁶The Future of Code Officials: *Results and Recommendations from a Demographic Survey* (NIBS, ICC; 2014).

\$150–\$200 per new single-family residential home as the full cost of enforcing the energy code.

How much does it cost *not* to enforce the energy code?

The direct result for building owners of legacy energy codes or a lack of code enforcement is higher utility bills. Analysis indicates for every dollar invested in energy code compliance six dollars are saved.⁷ That is six dollars lost for every dollar we *don't* spend on code compliance. In addition to monetary savings, adoption of and compliance with current energy code has many non-energy related benefits such as improved occupant comfort, better indoor air quality, and a more resilient building stock.

What can Congress do?

Congress can provide resources to state and local governments in many ways. Congress can provide assistance to jurisdictions who wish to convert to an **e-plan review** process or to leverage **integrated technology solutions** that work with Building Information Modeling (BIM) design tools to facilitate virtual inspections through Augmented Reality (AR), Virtual Reality (VR) or drone site visits, all of which can streamline the permitting and inspection process and creates more efficient use of staff resources, enabling better code enforcement procedures and more consistent code updates.⁸

Congress can also incentivize jurisdictions to adopt the latest codes by offering to co-fund staff or provide training for code officials using the existing U.S. Department of Energy (DOE) energy code training modules. There was a highly successful Federal program in the wake of the last recession with the **2009 American Recovery and Reinvestment Act** that provided free training and 2009 IECC code books and workbooks along with strong incentives for all jurisdictions to adopt the 2009 IECC.⁹ This incentive program is likely a major factor leading 88% of the U.S. to *at least* be on the 2009 energy code or a later edition now.

What are Outcome-Based Codes and why do they matter?

Ultimately if we want to meet our climate goals and advance our buildings to zero carbon, our codes need to move away from component-based prescriptive manuals and predictive energy models to **outcome-based codes**.

Our current model code structure has limited potential impact on overall energy use because it applies only to new construction, major renovations, and **installed building features**. The efficiency of many of these installed features is actually limited by Federal law.¹⁰ In 1975 Congress enacted the National Appliance Energy Conservation Act (NAECA) to set national standards for equipment like heaters, boilers and rooftop air conditioners, but this legislation also disallows states and other jurisdictions from setting more stringent local standards on these products. The International Code Council (ICC), the states, and or cities that adopt stretch energy codes, are still strictly limited in how much efficiency they can achieve in the products covered by NAECA.

In addition, because of the robust (and lengthy) stakeholder engagement process, codes are also slow to embrace new technologies or materials, or innovative methods. A **prescriptive code** therefore by definition isn't always keeping up with the latest available technology, material or methods. A code enforcement official has some leeway to interpret the code but may feel restricted by code language and err on the side of excluding new means or methods.

More importantly, the energy code doesn't address operations, maintenance, or occupant behavior that occurs after the issuance of a certificate of occupancy and that will impact performance over the lifecycle of a building.¹¹ While a predicted **performance compliance path** does exist in the current code structure, and energy simulation tools and processes have become more seamlessly integrated into project design and delivery, and the cost of energy modeling pays for itself in well under

⁷Assessment Methodology for Code Compliance in Medium to Large Cities (NRDC, IMT; 2018).

⁸Disruption, Evolution, and Change: AIA's vision for the future of design and construction (AIA, 2019).

⁹<http://bcapcodes.org/topics/federal-funding/>.

¹⁰Federal Preemption as a Barrier to Cost Savings and High-Performance in Local Codes (NBI, 2017).

¹¹Implementing an Outcome-Based Compliance Path in Energy Codes (NIBS, 2017).

a year of operational savings,¹² simulation tools often don't account for the wide variation in **operations and maintenance, occupant behavior or plug-loads**.

Outcome-based codes establish a target energy use level or energy allowance, then require measured and reported actual energy use in relation to that target once the building is completed and occupied. At a minimum, an outcome-based energy code requires 12 consecutive months of post-occupancy performance within the allowed energy or carbon budget, typically within the first 18–36 months of use to normalize for weather and allow for commissioning. If the building doesn't meet performance requirements, the builder or owner forfeits a financial penalty.

Many jurisdictions do not have the personnel or fiscal resources to adequately ensure compliance with energy requirements. By focusing on the outcome, code officials and communities can be assured that requirements are being met while not incurring additional enforcement burdens. Outcome-based codes mean that there would be less reliance on design documentation to obtain a permit, alleviating the pressure on a diminishing code enforcement workforce and freeing that workforce up to focus on building lifecycle performance policies such as transparency (annual benchmarking) and building performance standards. Typically, communities that are prepared for an outcome-based code already have adopted public and commercial building benchmarking policies, thus establishing an annual communication channel between building owner and building performance oversight agency.¹³

This simplification of the energy code would allow for more rapid escalation of performance expectations without the burden of retraining the entire code enforcement workforce every code cycle. It will also link escalation design expectations to more rigorous oversight of **construction quality** and **ongoing performance optimization** as an integral part of operations and maintenance activities. The National Institute of Building Sciences (NIBS) and New Building Institute (NBI) have provided energy code appendix language in the guide *Implementing an Outcome-Based Compliance Path in Energy Codes* to help jurisdictions interested in moving towards an outcome-based code.

What can Congress do?

Congress can incentivize states and cities to be early adopters of outcome-based codes by supporting the transition of staff and permitting infrastructure, public education and engagement programs, annual benchmarking and reporting infrastructure and the development of shared tools and lessons learned.

Congress can also link existing **Federal tax incentives** to outcomes, such as target Energy Use Intensity (EUI) metrics or **Zero Energy and Zero Carbon** goals. By leveraging existing financial incentives but tying them to outcome-based requirements, Congress not only uses its buying power to reduce carbon emissions in the built environment but also creates a replicable framework that smaller jurisdictions can emulate and normalizes the expectation of performance outcomes.

Where is the model Energy Code now?

The proposed International Energy Conservation Code (IECC) 2021 has concluded public comments and is up for final hearings in October and final vote in November 2019. It is estimated the proposed model code is approximately 10%–15% more efficient than the 2018 IECC. It includes cost effective advances in enclosure efficiencies, lighting, building commissioning and smart building operation infrastructure.

The 2021 model energy code includes a **Zero Code appendix**, a platform that jurisdictions can opt into to incentivize or make mandatory for certain building types or sizes to help them meet their climate goals. As an appendix it is built into the code enforcement framework of the IECC but is voluntarily adopted by jurisdictions and could be adjusted locally to align with a step code or other local programs. The provisions contained in this appendix will become mandatory when specified as such in the jurisdiction's adopting ordinance.

The Zero Code appendix to the 2021 IECC is constructed to require that new commercial, institutional, and mid- to high-rise residential buildings install or procure enough renewable energy to achieve zero net carbon annually.¹⁴ The appendix encourages on-site renewable energy systems when feasible but also supports off-site procurement of renewable energy through a variety of methods. This appendix does not allow renewable energy to be traded off against the energy efficiency required

¹² Architect's Guide to Building Performance: Integrating performance simulation in the design process (AIA, 2019).

¹³ Implementing an Outcome-Based Compliance Path in Energy Codes (NIBS, NBI; 2017).

¹⁴ Understanding Code Change Proposal CE264–19 Zero Code Renewable Energy Appendix (AIA, 2019).

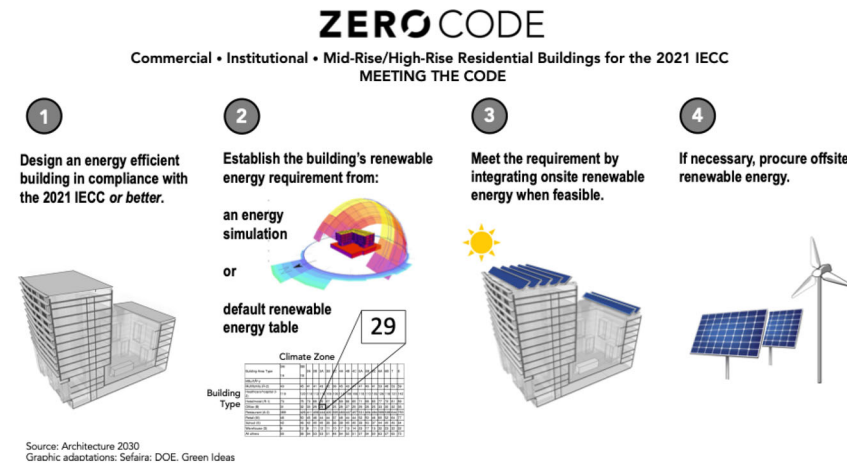
by the 2021 IECC. Buildings are required to comply with the 2021 IECC using either the prescriptive or performance approach. When the prescriptive approach is used, the renewable energy that must be installed or procured is specified based on building type and climate zone.

The ZERO Code Renewable Energy Appendix is unique because of its:

1. Incorporation into the 2021 IECC, a highly efficient national building energy code;
2. Availability of sophisticated easy-to-use code compliance tools and software (developed by the U.S. Department of Energy) such as **COMcheck**, **EnergyPlus**, and a multitude of private sector energy performance programs;
3. Renewable energy default table and calculator for all US locations that determines the renewable energy required and estimates the potential on-site renewable energy production and off-site renewable energy procurement needed to achieve zero net carbon; and
4. Recognition of off-site renewable energy options that result in renewable energy generation that exceeds what utilities are already required to provide by their mandated RPS.

Once the IECC 2021 model code is published Congress can offer incentives to state and local governments to increase speed of adoption and encourage use of the **Zero Code appendix**.¹⁵

The entire draft 2021 energy code has been endorsed by the U.S. Conference of Mayors¹⁶ as a key part of getting to net zero building construction by 2050.



Why do we need a Zero Code?

Zero Net Energy (ZNE) buildings are picking up momentum in the market and the early adopters have shown that our industry has the materials and technology available to complete 67 ZNE buildings and have another 415 on the way.¹⁷ These projects are located in every climate zone in the U.S. The majority of completed and verified ZNE buildings (roughly 80%) are smaller than 25,000 square feet. However, there are signs the market is ready to take on larger projects with than 40% of projects registered as 'emerging zero energy' at 50,000 sf or larger. Advancing to a zero energy or zero carbon code, particularly in jurisdictions with advanced climate policies who are ready to take on the challenge, will move the market faster than waiting for voluntary market adoption.

¹⁵ <https://architecture2030.org/wp-content/uploads/ZERO-Code-RE-Appendix-Fact-Sheet.pdf>.

¹⁶ July 1, 2019 USCM Resolution 59.

¹⁷ Getting to Zero Status Update and List of Zero Energy Projects (NBI, 2018).

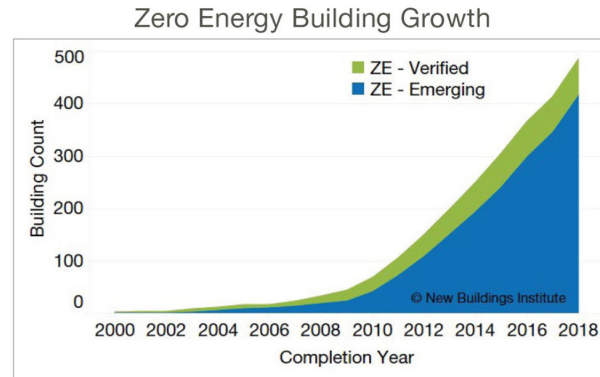


Fig 1. The Buildings List includes nearly 500 projects and is on a steep curve upward, having increased over 700% since 2012.

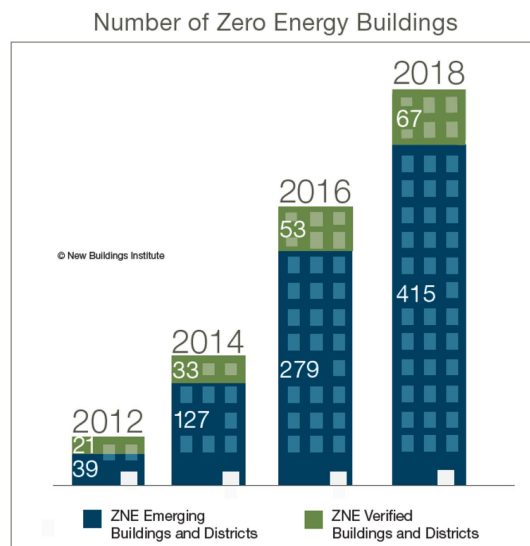


Fig 2. There are now 67 ZE Verified and 415 ZE Emerging projects documented by NBI.

Who is adopting Zero Codes and policies?

Many cities and a few states are already phasing in zero energy and zero carbon building codes. For example (see timeline, following page):

- The city of **Santa Monica, CA** started enforcing a Zero Net Energy (ZNE) Code for single family and low-rise residential buildings in 2017.¹⁸
- The **State of California**¹⁹ requires all new residential construction to be ZNE by 2030, all new commercial construction to be ZNE by 2030. California also addresses existing buildings, requiring 50% of commercial buildings to be retrofitted to ZNE by 2030, and 50% of renovations to state-owned buildings to be ZNE by 2025%. 100% of state-owned buildings by 2030.

¹⁸ https://www.smgov.net/Departments/OSE/Categories/Green_Building/Energy_Reach_Code_and_ZNE.aspx.

¹⁹ <https://www.cpuc.ca.gov/ZNE/>.

- The **State of Oregon**²⁰ requires state-owned buildings to achieve carbon neutral operations starting in 2022. The residential code must be solar-ready starting in 2020 and Zero-Energy ready in 2023. In 2022, the commercial code must be solar-ready, and parking structures, commercial or residential, are required to install a minimum of 2 Electric Vehicle (EV) charging stations. All new commercial and state-owned buildings must be Net Zero by 2030.
- In **Washington, DC**²¹ the Clean Energy DC Omnibus Act requires a Net Zero building code by 2026 and a net-zero retrofit to at least 12.5% of its building stock by 2032. DC currently has a voluntary “Appendix Z” to its proposed Energy Code update awaiting final approval to go into effect in 2020.
- **Cambridge, MA**²² has committed to be a Net Zero community, requires all new buildings to be Net Zero by 2040.
- Other cities that have signed on as part of a global C40 Cities Net Zero Carbon Buildings Declaration²³ to net zero carbon new construction by 2030 and existing buildings by 2050 include **Los Angeles, New York City, Portland, San Francisco, Seattle, San Jose**.
- The Energy Independence and Security Act of 2007 [EISA § 433] requires New Federal buildings and Federal buildings undergoing major renovations to reduce fossil fuel-generated energy consumption (baseline 2003) by 80% (2020), 90% (2025), and 100% (2030).

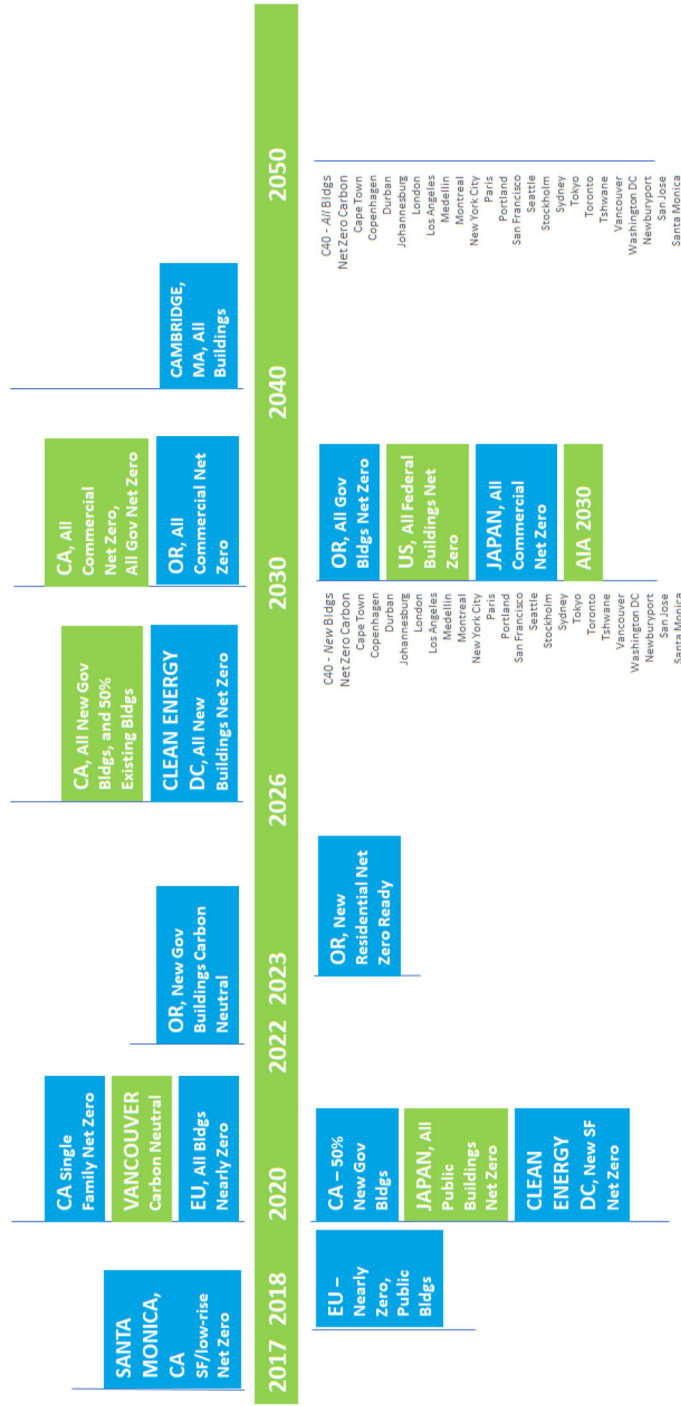
²⁰ Oregon State Climate Action EO No. 17–20.

²¹ <https://code.dccouncil.us/dc/council/laws/22–257.html>.

²² https://www.cambridgema.gov/-/media/Images/CDD/Climate/NetZero/netzero_20150408_infographic.jpg.

²³ <https://www.c40.org/other/net-zero-carbon-buildings-declaration>.

City & State: Mandatory Net Zero Energy/Carbon Building Codes



What can Congress do?

Congress can incentivize states and cities to be early adopters of **Zero Energy** and **Zero Carbon codes** by supporting the staff and permitting infrastructure, public education and engagement programs, annual benchmarking and reporting infrastructure and the development of shared tools and lessons learned.

Congress can also link existing **Federal tax incentives** to Zero Energy and Zero Carbon goals. By leveraging existing financial incentives but tying them to Zero Energy or Zero Carbon, Congress not only uses its buying power to reduce carbon emissions in the built environment but also creates a replicable framework that smaller jurisdictions can emulate and normalizes the expectation of performance outcomes.

Congress can maintain and increase Federal tax incentives for Renewable Energy technologies, including storage. As more production comes online, the ability to store energy and control how and when it flows onto the grid will be critical to maintaining our infrastructure and energy autonomy.

What do we need beyond Energy Efficiency and Renewable Energy to achieve Zero Carbon buildings?

Energy efficiency and renewable energy are key components to achieving a low carbon built environment. Another critical element is the **electrification of buildings**. While Renewable Portfolio Standards are addressing the combustion of fossil fuels at the utility level, we must also address the consumption of fossil fuels on site at the building and central plant. This means replacing fossil fuel-based cooking, water heating, space heating and cooling equipment with electric equipment in our codes for new construction and alterations, as well as in our existing buildings through retrofits.

What can Congress do?

Congress can offer incentives for the replacement of fossil fuel-based equipment, particularly water heaters, furnaces, boilers and space heating/cooling equipment (i.e. heat pumps), or rebates to buy down the cost premium for first-time installation of electric equipment. Studies indicate regional state-led incentive programs²⁴ have been successful to date.

Eliminating onsite combustion of fossil fuels can have co-benefits such as improved safety, indoor air quality and grid flexibility.

In many cases natural gas or coal is used in large central plant facilities serving multiple buildings, particularly at hospitals, airports, universities and other campuses or networks that serve our communities. Providing resources to help these facilities convert to electric districts, renewable-ready districts and zero energy-ready districts can help them to be more resilient and prepared for the future.

What is the role of Existing Buildings and how do we get to them?

Building codes in many states don't address existing buildings. The International Existing Building Code (IEBC) was created in 2003 and is adopted in approximately half of the United States.²⁵

The model energy code addresses new construction and planned alterations projects that require a permit. The construction activity triggers the code. Buildings with no planned construction activity are not typically addressed by energy codes.

In most established U.S. cities, 80-90% of the buildings that will be consuming energy in 2050 already exist. U.S. cities only see 1-2% turnover (renovation or replacement) of building stock every year on average. Even cities with a lot of construction activity, like Washington, DC, still turn over less than 3% of building stock per year. And yet, in cities, buildings represent on average 50-70% of GHG emissions inventory. Buildings are the single largest opportunity to meet climate goals. For example:

- **Boston, MA:** buildings generate 75% of emissions²⁶
- **Cambridge, MA:** buildings generate 65.8% of emissions²⁷
- **Chicago, IL:** buildings generate 53.7% of emissions²⁸
- **Minneapolis, MN:** buildings generate 63% of emissions²⁹

²⁴ <http://www.aceee.org/sites/default/files/publications/researchreports/a1803.pdf>.

²⁵ The Role of Existing Building Codes in Safely, Cost-Effectively Transforming the Nation's Building Stock (NIBS, 2017).

²⁶ https://www.boston.gov/sites/default/files/boston_ghg_inventory_2005-2015.pdf.

²⁷ <https://www.cambridgema.gov/CDD/climateandenergy/greenhousegasemissions/communityemissions>.

²⁸ https://www.chicago.gov/content/dam/city/progs/env/GHG_Inventory/CityofChicago_2015_GHG_Emissions_Inventory_Report.pdf.

²⁹ <https://lims.minneapolismn.gov/Download/PriorFileDocument/-63089/WCMSP-178225.PDF>.

- **New York City, NY:** buildings generate 71% of emissions³⁰
- **Washington, DC:** buildings generate 75% of emissions³¹

Therefore, building codes alone won't address the issue of emissions in the built environment. Other complementary policy solutions, such as energy transparency and benchmarking, as well as building performance standards are required.

Transparency and Benchmarking Policies

Energy benchmarking and transparency ordinances are being adopted by cities and states across the country, making publicly and privately-owned building annual performance data available to jurisdictions and the public. The performance of all buildings, whether newly constructed or existing in place for decades, is the focus of the transparency movement, as cities create data-driven market mechanisms and public policies to support their climate commitments.³²

Transparency and benchmarking policies have been implemented in over two dozen jurisdictions,³³ including cities, counties and states, such as:³⁴

• Atlanta, GA	• Evanston, IL	• Portland, ME
• Austin, TX	• Fort Collins, CO	• Portland, OR
• Berkeley, CA	• Kansas City, MO	• Reno, NV
• Boston, MA	• Los Angeles, CA	• Salt Lake City, UT
• Boulder, CO	• Minneapolis, MN	• Saint Louis, MO
• California	• Montgomery County, MD	• San Diego, CA
• Cambridge, MA	• New Jersey	• San Francisco, CA
• Chicago, IL	• New York City, NY	• San Jose, CA
• Denver, CO	• Orlando, FL	• Seattle, WA
• Des Moines, IA	• Philadelphia, PA	• Washington
• Edina, MN	• Pittsburgh, PA	• Washington, DC

40% of the United States are represented with benchmarking and transparency policies at city, county or state level, indicating the widespread appeal.

These policies encompass nearly 92,000 properties³⁵ at 11 billion square feet of floor area³⁶ reported every year. Through transparency alone these cities are seeing an average of 4-13% energy improvement in their existing building stock. Just starting to use the benchmarking and reporting tools, such as EnergyStar Portfolio Manager, shining a light on building performance, and introducing a comparative metric has already inspired improved operations and maintenance as well as investment in energy efficiency.

³⁰ <http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf>.

³¹ <https://doee.dc.gov/service/greenhouse-gas-inventories>.

³² Leveraging Energy Transparency (AIA).

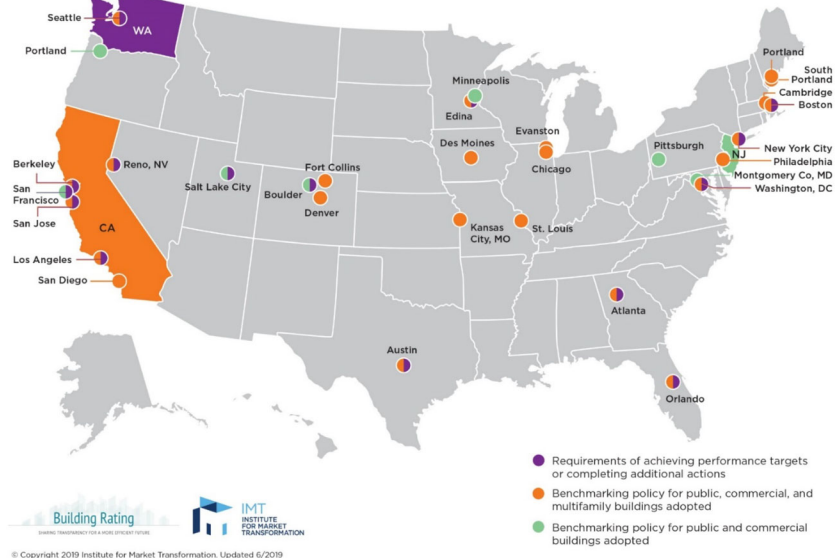
³³ <https://www.imt.org/wp-content/uploads/2019/06/IMT-Benchmarking-Map-CityCountyState-CURRENT-062019.jpg>.

³⁴ <https://www.buildingrating.org/graphic/us-commercial-building-policy-comparison-matrix>.

³⁵ <https://www.buildingrating.org/graphic/us-number-properties-covered-annually>.

³⁶ <https://www.buildingrating.org/graphic/us-building-area-covered-annually>.

U.S. City, County, and State Policies for Existing Buildings: Benchmarking, Transparency, and Beyond



Comparison of U.S. Commercial Building Energy Benchmarking and Transparency Policies

	Legislation	Public Data Available	Policy Impact			Buildings Included	Policy Schedule		Compliance		Additional Elements		
	Jurisdiction	Released	Number of Bldgs	Square Footage	Energy Savings	Types & Sizes	Reporting to Gov't	Transparency	# of Buildings	By % of Sq. Ft.	Water Tracking	Other Requirements	
Cities/Countries	Atlanta	-	2,900	402 million	-	Comm & MF ≥ 25K	Jun 1, Annual	(If Energy Star >55) Sept 2018	-	-	✓	Audits every 10 years	
	Austin	-	2,800	113 million	-	Comm ≥ 10K MF ≥ 5 units	Jun 1, Annual	Time of transaction	-	-	-	Audits & mandatory upgrades for high energy use MF buildings	
	Berkeley	-	257	13.7 million	-	Comm & MF ≥ 25K	July 1, Annual	TBD	-	-	✓	Periodic/time of sale energy reports for all buildings (timing based on size)	
	Boston	Yes	1,600	250 million	-	Comm ≥ 35K MF ≥ 35K/35 units	May 15, Annual	Oct 1, Annual	-	84% (2014)	✓	Periodic energy assessments and/or actions	
	Boulder	-	475	26 million	-	Comm ≥ 50K New Comm ≥ 10K Comm ≥ 30K Comm ≥ 20K	Aug 1, Annual	>Jun 1, 2019 >Jun 1, 2019 >Jun 1, 2021 >Jun 1, 2023	100% (2016)	100% (2016)	✓	Lighting upgrade; audits & RCx every 10 yrs (must invest in RCx measures w/ ≤2yr payback)	
	Cambridge	Yes	1,100	78 million	-	Comm ≥ 50K MF ≥ 50 units	May 1, Annual	Sept 1, Annual	95% (2015)	93.5% (2014)	✓	-	
	Chicago	Yes	3,500	900 million	2.9% (2014-17)	Comm ≥ 50K MF ≥ 50K	Jun 1, Annual	>Jun 1, Annual	85% (2017)	92% (2017)	-	Data verification by licensed professional 1 st year & every 3 years	
	Denver	-	3,000	360 million	4.5% (2017)	Comm & MF ≥ 25K	Jun 1, Annual	TBD	90% (2017)	-	-	-	
	District of Columbia	Yes	2,000	357 million	9% (2010-13)	Comm ≥ 50K MF ≥ 50K	Apr 1, Annual	>Apr 1, Annual	83% (2013)	-	✓	-	
	Evanston, IL	-	557	45.6 million	-	Comm & MF ≥ 100K Comm & MF ≥ 50K Comm & MF ≥ 20K	Jun 30, Annual Jun 30, Annual Jun 30, 2019	TBD	-	-	✓	Data verification by a certified professional 1 st year and every 3 years	
	Fort Collins, CO	-	2,250	47 million	-	Comm ≥ 20K Comm ≥ 10K MF ≥ 20K Comm ≥ 5K MF ≥ 10K MF ≥ 5K	Mar 1, 2020 Mar 1, 2021 Mar 1, 2021 Mar 1, 2022 Mar 1, 2022 Mar 1, 2023	Annual	-	-	✓	-	
	Kansas City	Yes	~1,500	~400 million	-	Comm & MF ≥ 100K Comm & MF ≥ 50K	May 1, Annual	Sept 1, 2018 Sept 1, 2019	61.8% (2017)	-	✓	-	
	Los Angeles	-	14,000	900 million	-	Comm & MF ≥ 100K Comm & MF ≥ 50K Comm & MF ≥ 20K	Dec 1, Annual Jun 1, Annual Jun 1, 2019	Annual	82% (2016)	-	✓	ASHRAE level II audit and RCx every 5 years	
	Minneapolis	Yes	625	110 million	3.4% (2014-16)	Comm ≥ 50K	Jun 1, Annual	Aug 31, Annual	-	80% (2016)	✓	-	
	Montgomery Co., MD	Yes	~1,000	~110 million	-	Comm ≥ 50K	June 1, Annual	Oct 1, Annual	77% (2016)	-	-	Data verification by licensed professional 1 st year & every 3 years	
	New York City	Yes	33,417	2.8 billion	6-14% (2010-14)	Comm & MF ≥ 50K Comm & MF ≥ 25K	May 1, Annual	Sept 1, Annual Anticipated >2018	90% (2015)	90% (2015)	✓	Audits & RCx (LL 87), lighting upgrades & submetering (LL 88)	
	Orlando	-	826	125.6 million	-	Comm & MF ≥ 50K	May 1, Annual	Sep 1, 2019	-	-	-	Energy audit or RCx every five years if ENERGY STAR <50. Benchmarking by qualified benchmarker	
	Philadelphia	Yes	2,900	390 million	-	Comm ≥ 50K MF ≥ 50K	Jun 30, Annual	>Jun 30, Annual >Jun 30, 2017	91% (2014)	91% (2014)	✓	-	
	Pittsburgh	-	861	164 million	-	Comm ≥ 50K	June 1, Annual	>Jun 1, Annual	-	-	-	✓	-
	Portland, ME	-	284	-	-	Comm ≥ 20K MF ≥ 50 units	May 1, Annual	Sept 1, 2019	-	-	✓	-	-
	Portland, OR	Yes	1,024	87 million	-	Comm ≥ 20K	Apr 22, Annual	Oct 1, Annual	-	91% (2017)	-	-	-
	Reno	-	500	25 million	-	Comm & MF ≥ 100K Comm & MF ≥ 50K Comm & MF ≥ 20K	Apr 1, 2020 Apr 1, 2021 Apr 1, 2022	Annual	-	-	✓	Bldgs not meeting performance target must do audit or retuning every 7 years	
	Salt Lake City	-	1,211	124 million	-	Comm ≥ 50K Comm ≥ 25K	May 1, 2019 May 1, 2020	Sept 1, 2019 Sept 1, 2020	-	-	-	-	Tune-ups every 5 years
	San Francisco	Commercial Municipal	2,312	203 million	7.9% (2010-14)	Comm ≥ 10K	Apr 1, Annual	>Apr 1, Annual	-	82% (2013)	-	-	ASHRAE level I/II audits or RCx every 5 years
	San Jose	-	2,500	250 million	-	Comm & MF ≥ 50K Comm & MF ≥ 20K	May 1, 2019 May 1, 2020	Annual	-	-	✓	Bldgs not up to performance std. must do audit, RCx or improvement measures	

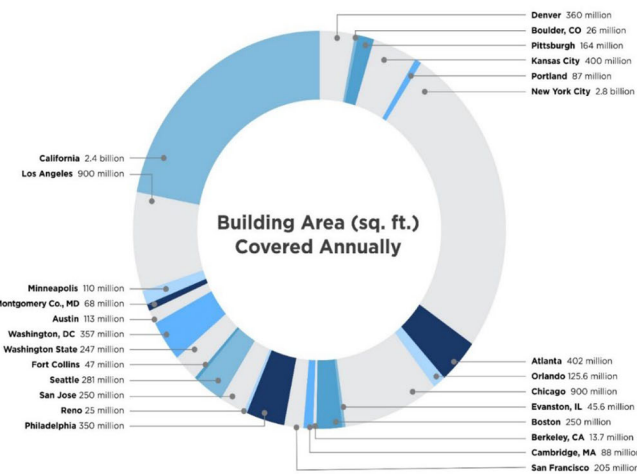
Each year,
existing policies
will impact
more than
91,800
properties

Impact of U.S. City, County, and State Benchmarking and Transparency Policies for Existing Buildings



Impact of U.S. City, County, and State Benchmarking and Transparency Policies for Existing Buildings

Totaling
approximately
11 billion
SF of floor
space in
major real
estate markets



The economic impact of investments in Energy Efficiency

Investment in Energy Efficiency is investment in local jobs and the local economy. Building improvements focused on improved energy efficiency in existing building stock cannot be shipped overseas. They are labor intensive and site-specific projects, driving the creation of local jobs in construction, renovation, installation, operations and maintenance.³⁷ According to the *2019 U.S. Energy and Employment Report*, Energy Efficiency produced more new jobs in the United States in 2018 than any other energy sector, and accounted for more than 2.3 million jobs overall, as compared with about 534,000 in renewable energy and about 200,000 in coal.

Transparency and benchmarking policies encourage the private sector to invest in energy efficiency projects. Building owners want to maintain Class ratings for their portfolio and remain competitive in the real estate market. In order to get to 100% clean energy by 2035, the **City of Atlanta** determined that an approach including investment in energy efficiency would return \$41 in local benefits for every \$1 invested.³⁸ The City of Atlanta now requires commercial buildings 25,000 square feet and larger to report annual EnergyStar scores and perform energy audits every 10 years.³⁹

What can Congress do?

Congress can incentivize states and cities to adopt transparency and benchmarking policies, by co-funding staff or providing resources and tools, particularly when policies are linked to a national benchmarking platform such as the U.S. Environmental Protection Agency (EPA) **EnergyStar Portfolio Manager** tool. Congress can ensure EnergyStar Portfolio Manager remains relevant by maintaining funding for the **Commercial Building Energy Consumption Survey** which populates the database on the backend.

Congress can leverage the National Laboratories and the U.S. Department of Energy Building Technologies Office (BTO) to provide demonstration and field validation of advanced technologies so that American businesses may foster innovative solutions to our building energy challenges, these technologies may become shelf-ready and cost-competitive, and building owners may confidently employ these technologies in existing buildings to improve their performance.

Congress can also incentivize building owners by providing financial incentives (tax incentives or rebates) for energy audits, retro-commissioning, deep green retrofits, systems or component replacement, and building operator training programs.

Building Performance Standards

Once jurisdictions have established transparency and benchmarking infrastructure with its annual communication channels between building owners and a building performance oversight agency, it is easier to put a building performance standard into place. Cities may want to require building owners to take additional steps beyond just reporting performance such as improving buildings that exceed energy- or water-consumption thresholds or fall below peer building EnergyStar scores.

There are a small number of jurisdictions that have already passed building performance standards, but many more are looking at similar policies to address their existing building stock. The next most likely jurisdictions to pass similar policies will be those with existing transparency and benchmarking policies already in effect.

Summary of existing Building Performance Standards in effect today:

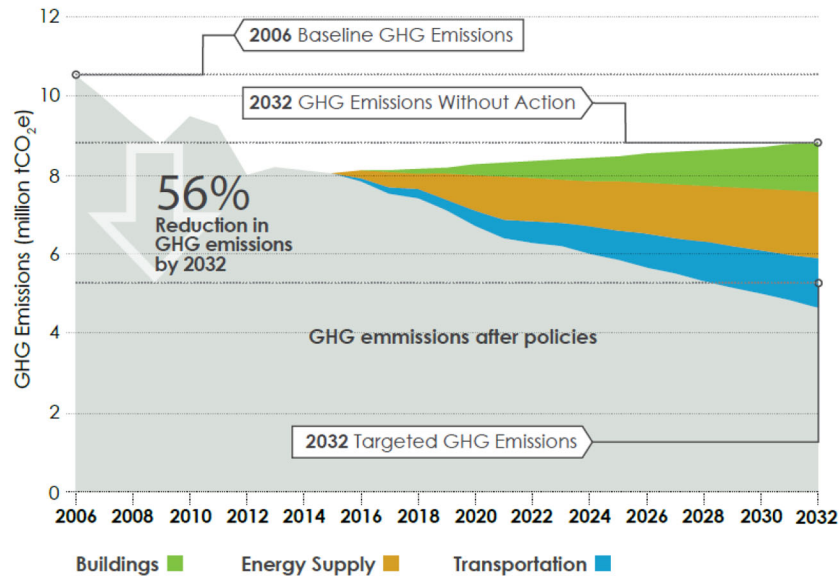
Jurisdiction	Min. bldg. size	Performance metric	Year
Washington, DC	10,000 sf	Local median EnergyStar score per bldg. type	2021
Washington State	50,000 sf	Average EUI per bldg. type, Lower EUI for new construction	2026
New York City	25,000 sf	Max GHG emissions per bldg. type	2024

³⁷Energy Efficiency in Buildings: the key to Effective and Equitable Clean Energy Action for Cities (IMT).

³⁸Clean Energy Atlanta, Resolution No. 17–R–3510 (2017).

³⁹https://atlantabuildingbenchmarking.files.wordpress.com/2019/02/nrdc_100ce_plan_021319_v8_low-res.pdf.

ESTIMATED GHG SAVINGS



The **Clean Energy DC Plan**⁴⁰ establishes a clear path to achieve over 50% reduction in GHG emissions by 2032. Savings from new Net Zero buildings are estimated to comprise 10% of the District's GHG emissions reduction plan and savings from existing building retrofits are estimated to comprise 20% of the District's GHG emissions reduction plan (see Targeted Action Areas).

⁴⁰ https://doee.dc.gov/sites/default/files/dc/sites/ddoe/page_content/attachments/Clean%20Energy%20DC%20-%20Full%20Report_0.pdf.

TARGETED ACTION AREAS

CONSTRUCTING NET-ZERO BUILDINGS
Require highly efficient and zero emission new buildings

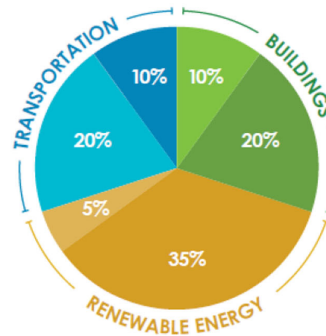
RAMPING UP RETROFITS
Expand and intensify energy use reductions in existing buildings

SHIFTING TO CLEAN ENERGY
Move from fossil fuels to clean and renewable energy

GROWING LOCAL SOLAR
Maximize local renewable energy generation

ELECTRIFYING TRANSPORTATION
Electrify bus transit, vehicle sharing, and personal vehicles

SHIFTING TRANSPORTATION
Increase the use of walking, biking, and mass transit



INCREASING EQUITY AND CAPACITY
Equip people and organizations with the tools, knowledge, support, and partnership they need

FUNDING THE TRANSFORMATION
Increase funding and financing to eliminate barriers

In order to realize the GHG emissions reduction articulated in the Clean Energy DC Plan, in 2018 **Washington, DC** passed the **Clean Energy DC Omnibus Amendment Act**⁴¹ reducing benchmarking requirements to all buildings 10,000 square feet or larger (public and private owned) and creating a **Building Energy Performance Standard (BEPS)** to address the ongoing lifecycle performance of its existing building stock. Starting in 2021, buildings must meet the BEPS (which can be no lower than the *local* median EnergyStar score for each building type), or owners will have five years to bring the building into compliance through:

a) **Prescriptive Compliance Path:** a set of previously identified measures, such as commissioning, energy audits, boiler replacement, lighting retrofits, roof replacement, building operator training, calculated to approximate 20% performance improvement. These prescriptive measures will vary by building type, as the measures will have varying levels of impact based on the load profiles of each building type. This option leaves nothing to chance—if the owner is able to document in year five proof that the required activities were conducted, and that equipment or systems were purchased and installed, the building will be deemed in compliance for that BEPS cycle. However if the building's EnergyStar score is still below the local median for its building type in year five (baseline year for the next BEPS cycle), it will be required to repeat the prescriptive compliance path or to look at another compliance path for the next BEPS cycle.

b) **Performance Compliance Path:** a 20% improvement in building performance calculated by evaluating performance in year five against performance in the baseline year. This path allows building owners to work with their consultants to evaluate different options and identify the best path forward for that building. Owners may choose to leverage **energy modeling** tools to evaluate

⁴¹ <https://code.dccouncil.us/dc/council/laws/22-257.html>.

different design options and quantify their potential impact on building energy savings as well as project simple payback. This option may work well for owners already considering or planning to undertake building renovation or repositioning projects, into which energy efficiency upgrades can be folded in. It also gives the owner more flexibility and choice. It is less predictable and requires the projects to be undertaken and completed sufficiently early in the cycle for the savings to be realized by the completion of year five so that the 20% performance improvement can be documented. If the owner is able to document in year five proof that the building has improved by at least 20% from its baseline year, the building will be deemed in compliance for that BEPS cycle. However if the building's EnergyStar score is still below the local median for its building type in year five (baseline year for the next BEPS cycle), it will be required to repeat the performance compliance path or to look at another compliance path for the next BEPS cycle.

c) **Alternative Compliance Path:** the DC Department of Energy and Environment (DOEE) is tasked by the Act to develop alternative compliance pathways. These may include third party green building certifications or ratings, such as BREEAM In-Use, LEED for Existing Buildings: Operations and Maintenance, EnergyStar, WELL or others. The alternative compliance path may allow for some combination of portfolio trade-offs for multiple building or large real estate portfolio owners, or even tradeable credits between building owners, with a combination of on-site and offsite efficiency improvements or on-site and off-site renewable energy generation. A similar construct exists now with tradeable stormwater credits, requiring buildings to meet at least 50% of their stormwater obligations onsite but allowing the remainder to be treated offsite so long as that treatment remains within the District. This alternative pathway has not yet been defined but will be developed in further detail by the DOEE and the BEPS Task Force, comprised of local building industry stakeholders.

The distinguishing characteristic of Washington, DC's building performance standard is that it is on a five-year cycle, and benchmarked against a **local median EnergyStar score**, which by definition will rise over time as new high performance and net zero buildings come on line (Net Zero Building Code required for new construction in 2026) and the existing building stock improves in its energy performance. Building owners can be impacted in consecutive BEPS cycles, so careful consideration will need to be taken into determining whether incremental building performance improvement is the right path, or deep green retrofits that position a building well ahead of the median to leapfrog over the next few BEPS cycles is the better way to go. This decision may depend on existing tenant lease agreements, financing options and how recently the building has undergone renovation.

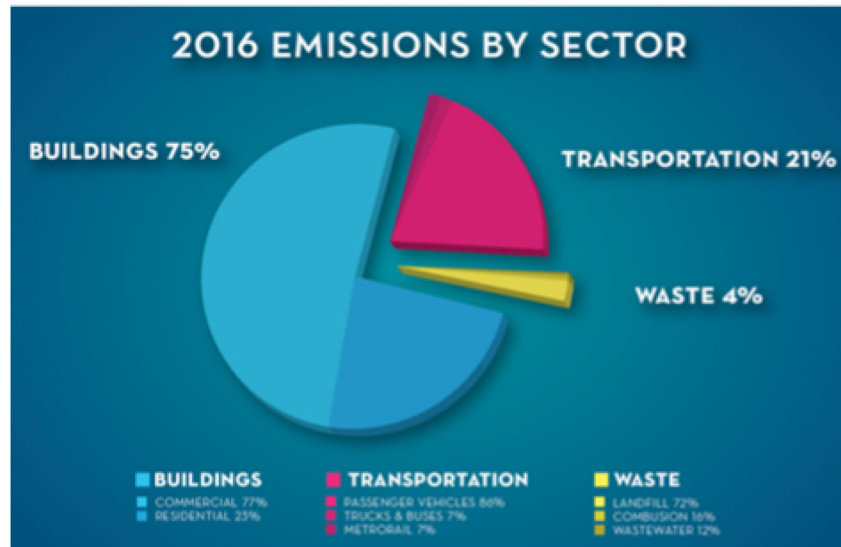
With EnergyStar scores, based on a percentile, higher is better. Therefore, the standard is in and of itself a self-improving threshold or benchmark. It will automatically rise over time, and the five-year cycle will generate economic activity in the construction industry, as well as investment in buildings, neighborhoods, communities and infrastructure that improve quality of life for all residents, and encourage infill development and growth in the District as the built environment and services improve. The Act provides other pathways for addressing the improvement in performance of Affordable Housing stock and allows for flexibility in compliance with the BEPS in order to avoid unintended consequences with displacement of low-income residents.

The Act provides funding for the newly establish **Green Bank**, a revolving green fund intended to help finance energy efficiency projects in the District, complementing **DC Pace Bonds**, the **DC Sustainable Energy Utility** and **DC Solar for All** programs that provide alternative financing for energy efficiency and renewable energy projects (in addition to private capital). If buildings failing to comply with the building energy performance requirements at the end of the 5-year compliance period shall pay an alternative compliance penalty established by DOEE.

The Act additionally calls for a **100% Renewable Portfolio Standard** by 2032 and an electrification of fleet vehicles, integral parts of decarbonizing the grid and bringing additional storage capacity to improve building and grid flexibility.

The Act also establishes a **Sustainable Energy Infrastructure Capacity Building and Pipeline Program** with the purpose of increasing the participation and capacity of certified business enterprises, directing the Office of Contracting and Procurement to include Certified Business Enterprise utilization as an evaluation factor when shortlisting and selecting businesses for professional services and when selecting contractors in best value procurements with a contract value of more than \$250,000.

In Washington, DC, buildings represent 75% of Greenhouse Gas Emissions (2016):⁴²



Washington State determined efficiency to be the 'largest, cheapest, lowest risk energy resource' and that 'with an aggressive new energy efficiency policy the region can potentially meet 100 percent of its electricity load growth over the next twenty years with energy efficiency.' A 2017 report documented that energy efficiency programs in the state had created **65,000 jobs**, primarily in the construction sector, and that the number is continuing to grow. In 2019, Washington State passed House Bill 1257⁴³ that requires a building performance standard go into effect between 2026 and 2029, affecting buildings 50,000 square feet and larger.

The standard shall establish **Energy Use Intensity (EUI) targets by building type**, require energy management plans, operations and maintenance programs, energy efficiency audits, investment in energy efficiency measures and shall be developed based on **ANSI/ASHRAE/IES standard 100-2018**. The standard must be updated every five years. In contrast to EnergyStar scores which are based on a percentile, Energy Use Intensity is a measurement of total annual energy use over the course of a year, divided by building area. It is often depicted in British thermal units per square foot per year (kBtu/sf/yr) or kilowatt hours per square foot per year (kWh/sf/yr). Therefore, **when it comes to EUI, lower is better**.

The EUI targets can be **no greater than the average EUI for building occupancy type**, and may implement lower EUI targets for more recently built commercial buildings based on the state energy code in place when the buildings were constructed. Therefore, older building stock must be brought up to at least average performance and newer building stock may be held to a higher performance standard. The standard may become higher more stringent over time, assuming the average EUI improves (lowers) with the addition of new building stock and the improvement of energy performance in existing building stock. The standard for more recently constructed buildings is not necessarily self-improving, as it requires consideration and manual calibration, but it is clear the legislative intent is that this standard keep pace ahead of the building code as well.

Buildings falling short of the performance standard must implement energy efficiency measures identified by energy audits to achieve its energy use intensity target. The bill requires investment criteria be developed that requires a building owner to adopt an implementation plan to either:

- a) Meet the energy intensity target

⁴² <https://doee.dc.gov/service/greenhouse-gas-inventories>.

⁴³ <http://lawfilesexxt.leg.wa.gov/biennium/2019-20/Pdf/Bills/House%20Passed%20Legislature/1257-S3.PL.pdf>.

- b) Implement an optimized bundle of energy efficiency measures that provides maximum energy savings without resulting in a savings-to-investment ratio of less than 1.0

Administrative penalties may be imposed upon a building owner for failing to submit documentation demonstrating compliance. The penalty may not exceed an amount equal to five thousand dollars plus an amount based on the duration of any continuing violation (may not exceed one dollar per year per gross square foot of floor area). Administrative penalties collected must be deposited into the **low-income weatherization and structural rehabilitation assistance account**.

The state is required to develop an incentive program for early adoption and for buildings whose baseline EUI exceeds its target by at least fifteen EUI units (i.e. it is 15 units lower than the target EUI). The incentive is eighty-five cents per gross square foot of floor area, excluding parking, unconditioned, or semi-conditioned spaces (such as mechanical rooms or penthouses).

The bill also requires that the building code council adopt rules for vehicle charging capability at all new buildings that provide on-site parking. Where parking is provided, the greater of one parking space or ten percent of parking spaces, rounded to the next whole number, must be provided. Electric vehicles are integral parts of decarbonizing the grid and bringing additional storage capacity to improve building and grid flexibility.

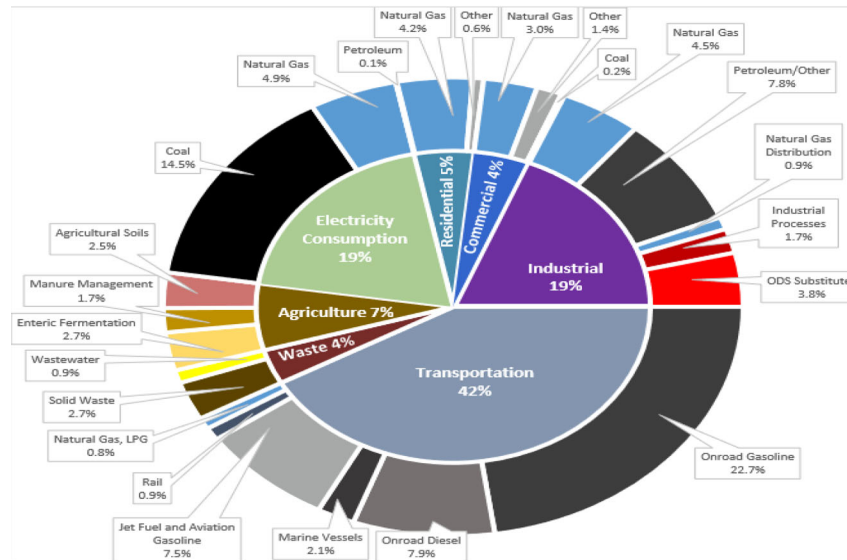


Figure 7: Washington Greenhouse Gas Emissions, 3 year average (2013-2015)

In 2015, Washington's largest contributors of greenhouse gases were:⁴⁴

- Transportation sector at 42.5%
- **Residential, commercial, and industrial sector at 21.3%**
- Electricity sector at 19.5%

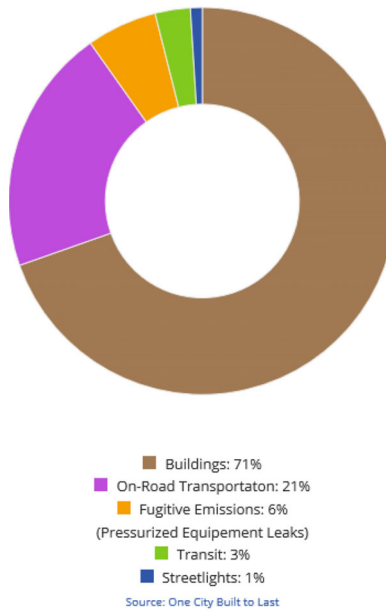
Buildings make up 71% of GHG emissions in **New York City**.⁴⁵ Energy consumption from electricity use, heating, and cooling all contribute. Building owners and managers can improve energy efficiency of building systems and operations and invest in cleaner on-site power generation. They can also support market growth for renewables through power purchase agreements and other mechanisms to procure cleaner energy that is generated off-site. Building tenants and occupants can reduce their energy consumption, which accounts for 40-60% of a building's energy use.

⁴⁴ <https://fortress.wa.gov/ecy/ublications/documents/1802043.pdf>.

⁴⁵ <http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf>.

Emissions from the city's power supply can be reduced by power suppliers switching to cleaner energy sources, and by fuel distributors offering low-carbon fuels.

Greenhouse Gas Emissions by Type



In 2019, New York City **passed the Climate Mobilization Act**, including Bill 1253 which sets emissions caps on buildings over 25,000 square feet and establishes an Office of Building Energy and Emissions Performance. The bill sets one standard to go into effect between 2024–2029 and a more stringent standard to go into effect in 2030.

The limits are calculated to require emissions reductions from the highest emitting 20% of buildings in each occupancy group for the first compliance date beginning in 2024, and the highest emitting 75% of buildings in each occupancy group for the second compliance date beginning in 2030.

The Bill includes prescriptive performance improvement requirements for rent-controlled/rent-regulated housing units in order to prevent the legislation from displacing low- residents or increasing the cost of their housing.

The Bill establishes a Property Assessed Clean Energy (PACE) program in the City. PACE is a voluntary financing mechanism that enables energy efficiency and renewable energy projects to receive long-term financing for little or no money down. Further, debt service is generally limited to the amount of money saved through the resulting reductions in energy use. Typically PACE financing is tied to property title rather than individual or company so that if a building transfers ownership before the completion of the payback period of an energy efficiency project, the new owner of the building continues to pay off the PACE bond.

Specific emissions limits for each building occupancy type in calendar years 2035–2050 have yet to be established, but the end goal by 2050 has been defined: annual building emissions limits and building emissions intensity limits applicable for calendar years 2035 through 2039 and building emissions limits and building emissions intensity limits applicable for calendar years 2040 through 2049 shall be set to achieve an average building emissions intensity for all covered buildings of no more than 0.0014 tCO₂e/sf/yr by 2050.

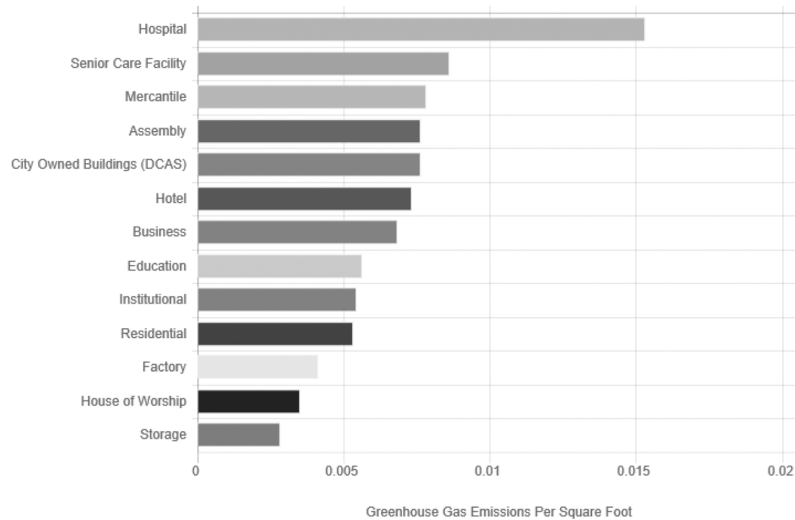
On and after January 1, 2050 building emissions limits and building emissions intensity limits shall achieve an average building emissions intensity for all covered buildings of no more than 0.0014 tCO₂e/sf/yr.

Calendar year 2024-2029	
Occupancy Type	Emissions Intensity Limit (per square foot)
Group A	0.01074 tCO ₂ e
Group B (other than Group B exceptions noted below)	0.00846 tCO ₂ e
Groups E and I-4	0.00758 tCO ₂ e
Group I-1	0.01138 tCO ₂ e
Group F	0.00574 tCO ₂ e
Group B civic administrative facility for emergency response services, Group B non-production laboratory, Group B ambulatory health care facility, H, I-2, I-3	0.02381 tCO ₂ e
Group M	0.01181 tCO ₂ e
Group R-1	0.00987 tCO ₂ e
Group R-2	0.00675 tCO ₂ e
Groups S and U	0.00426 tCO ₂ e
Calendar year 2030-2034	
Occupancy Type	Emissions Intensity Limit (per square foot)
Group A	0.00420 tCO ₂ e
Group B (other than Group B exceptions noted below)	0.00453 tCO ₂ e
Groups E and I-4	0.00344 tCO ₂ e
Group I-1	0.00598 tCO ₂ e
Group F	0.00167 tCO ₂ e
Group B civic administrative facility for emergency response services, Group B non-production laboratory, Group B ambulatory health care facility, H, I-2, I-3	0.01193 tCO ₂ e
Group M	0.00403 tCO ₂ e
Group R-1	0.00526 tCO ₂ e
Group R-2	0.00407 tCO ₂ e
Groups S and U	0.00110 tCO ₂ e

What distinguishes this legislation is that it does explicitly allow for **renewable energy credits** (RECs), **greenhouse gas offsets**, or **clean distributed energy resources**. To be eligible, the source of the renewable energy credits must be considered by the New York independent system operator to be a capacity resource located in or directly deliverable into zone J load zone for the reporting calendar year. For calendar years 2024–2029, a greenhouse gas offset can only be authorized for up to 10 percent of the annual building emissions limit. For calendar years 2024–2029, a greenhouse gas deduction can only be authorized based upon the calculated output of a clean distributed energy resource located at, on, in, or directly connected to the building.

The Act also included Bill 1318, which requires a feasibility assessment of replacing the City's gas-fired power plants with battery storage powered by renewable energy sources, as well as Bills 276 and 1032 which equip the roofs of smaller new residential buildings and non-residential buildings with solar photovoltaic systems or green roofs.

The bill acknowledges that of these use groups, hospitals have the highest GHG emissions per square foot in New York City, but that by law hospitals are required to maintain certain ventilation and exhaust rates, which is energy intensive. In addition, plug loads for mission-specific equipment such as MRIs also contribute to high energy demand. Therefore, the bill includes provisions to ensure hospitals reduce emissions without impeding their mission.



New York City's average GHG emissions intensity by building use type

What can Congress do?

Congress can incentivize states and cities to adopt Building Performance Standards, particularly when policies are linked to a national benchmarking platform such as the U.S. Environmental Protection Agency (EPA) **EnergyStar Portfolio Manager** tool. Support may include co-funding staff or providing resources, tools and training for jurisdictions.

Congress can continue to support the development and improvement of energy simulation tools that aid building owners in making financial investment decisions, as well as EPA EnergyStar Portfolio Manager platform, and ensure it remains relevant by maintaining funding for the **Commercial Building Energy Consumption Survey** which populates the database on the backend.

Congress can leverage the National Laboratories and the U.S. Department of Energy Building Technologies Office (BTO) to provide demonstration and field validation of advanced technologies so that American businesses may foster innovative solutions to our building energy challenges, these technologies may become shelf-ready and cost-competitive, and building owners may confidently employ these technologies in existing buildings to improve their performance.

Congress can also incentivize building owners by providing financial incentives (tax incentives or rebates) for energy audits, retro-commissioning, deep green retrofits, systems or component replacement, and building operator training programs.

Why should Congress Incentivize Local Policy?

Why is there such an emphasis on local policies and programs? Local policy can often be the most nimble and serve as a laboratory for innovative ideas that—once tested and proven at the local level, can be leveled up to state and eventually Federal policy. Local leadership is also where we see the most ambitious and *sustained* commitment to climate policy.

82% of the U.S. population lives in urban areas⁴⁶—and the number is growing. This growth and migration to cities means we will see investment in new construction as well as reinvestment in our existing neighborhoods and communities. More buildings could potentially mean more demand for energy but also more opportunity for density, transit-oriented development, as well as healthy, walkable and resilient cities, and transformation of our existing building stock and infrastructure.

Cities and urban counties are the loci for 85% of our Gross Domestic Product.⁴⁷ This means they are the center of economic activity and commerce. Catalyzing local policies with Federal incentives and resources can normalize low- and zero-carbon development patterns, reducing market barriers and establishing a template for any

⁴⁶ UN World Urbanization prospects (2018).

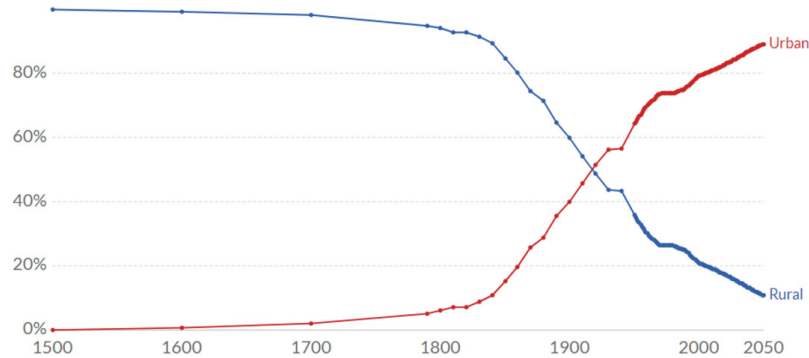
⁴⁷ www.bea.gov.

city, town, county or state that wants to focus on resource efficiency, mitigation, resiliency, economic revitalization, jobs, equity and community redevelopment.

Do more people live in urban or rural areas?, United States

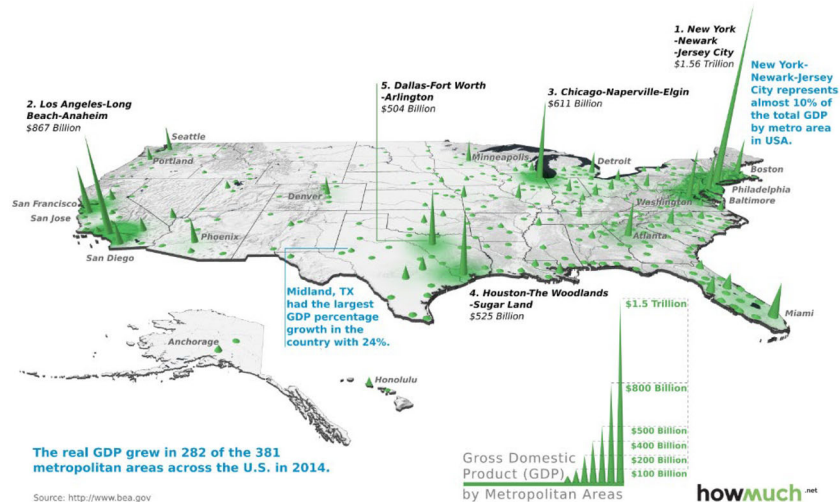
Share of the population which live in urban versus rural areas. Here, 'majority urban' indicates more than 50 percent of the population live in urban centres; 'majority rural' indicates less than 50 percent. Urban populations are defined based on the definition of urban areas by national statistical offices. This is based on estimates to 2016, combined with UN projections to 2050.

Our World
in Data



Source: OWID based on UN World Urbanization Prospects (2018) & Historical Sources (see Sources tab)

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What can the Federal Government do with its own portfolio?

Some Federal projects are procured through a **Design-Bid-Build process**. In this process, the Federal government describes the program (scope of work) and hires an architect (and its team of consultants) to design a building or project, and the design is ultimately translated into construction documents and issued for bid so that it can be awarded to a contractor for construction. The architect is typically contracted through a qualifications-based selection process, and performance metrics can be integrated into the contract documents to ensure the contractors are bidding on **minimum performance requirements**.

Starting in 2006, the U.S. General Services Administration (GSA) started requiring a minimum level of LEED Silver certification for Federally owned buildings. In 2010 this was increased to a minimum level of LEED Gold. Request for Proposal (RFP) documents or contracts do not typically reference project-specific performance metrics such as energy use intensity (EUI), water consumption or greenhouse gas (GHG) emissions. The default is usually to rely on Executive Orders and the Energy

Independence and Security Act (2007) to define those targets generally, however these performance expectations are not contractually binding if they are determined not to be cost effective' and energy efficiency, water efficiency, reduced carbon emissions or renewable energy generation can be excluded from a project with the intent of managing project costs.

Some Federal projects are procured through a **lease-back** process where the Federal government issues a Request for Lease Proposals, issues its requirements relative to location, tenant area, amenities, rental rates, and other selection criteria. The private sector competes in a design competition to win and build a project that will be leased back to a government tenant. This allows the Federal government to move into new buildings that are built to suit' without having to provide the capital for construction. The lease agreements are usually for 10-year increments and can be renewed at the end of the agreement. These buildings are often good investment vehicles for real estate investment trusts. Historically, a **Request for Lease Proposals** (formerly Solicitation for Offers) will include requirements that the base building be certified LEED Silver or EnergyStar rated and that the tenant fitout be consistent with LEED Silver as well as specific LEED credit criteria. Under the current Executive Order 13834⁴⁸ base building requirements for sustainability criteria or certifications have been omitted from solicitations for lease proposals as these requirements have been deemed unnecessary for lease agreements.

Other Federal projects are procured through a **Design-Build** contracting method, where the project will be directly awarded to a general contractor with a proposed design, and the Federal government is seeking a **Guaranteed Maximum Price (GMP)**. This is usually precipitated by the Federal government hiring a design firm to create a set of Bridging Documents, or a preliminary design, in order to get funding approval from Congress. This preliminary design defines the criteria of the Design-Build contract. But not all Design-Build contracts begin with Bridging documents. Contractors partner with a design team to develop the design enough to put together a cost estimate and submit a GMP. Although Design-Build contracts are evaluated and weighted based on many factors, including design and sustainability, the most heavily weighted factor is always price. The proposal with the lowest price is most likely to win. This encourages teams to propose a design that meets the minimum performance requirements rather than a design that meets the Federal government's climate goals.

What can Congress do to improve its procurement process?

Congress can direct the Federal government to explicitly include project-specific and binding **performance metrics in design and construction contracts**, such as Energy Use Intensity (EUI) targets, reduction in water use (from EAct 1992 baseline), reduction in fossil fuel consumption, reduction in GHG emissions, onsite renewable energy generation, Lighting Power Density (LPD), spatial daylight autonomy (sDA), or embodied carbon (GWP). These should be benchmarked at each stage of the design, included in the construction bid and any changes in the Value Engineering process should have to be cross checked against these metrics. Contractors already forfeit penalties for projects that are delivered over schedule. Performance metrics will continue to be eroded in the Value Engineering process unless they are tied to end of project contract expectations.

Congress can direct the Federal government to explicitly include **performance metrics in solicitation for lease proposals**, such as **Zero Energy** buildings, **Zero Carbon** buildings, Energy Use Intensity (EUI) targets, reduction in water use (from EAct 1992 baseline), reduction in fossil fuel consumption, reduction in GHG emissions, onsite renewable energy generation, Lighting Power Density (LPD), spatial daylight autonomy (sDA), or **low embodied carbon** (GWP). If these characteristics are prioritized in the selection process, it will incentivize the private sector to invest in advanced building technology. When the Federal government required LEED Silver in its lease agreements, it became the new default for commercial office buildings seeking Federal tenants. Furthermore, most developers went beyond LEED Silver to achieve LEED Gold or Platinum certification for their buildings. Expressing a preference or placing value on a characteristic sends a signal to the market.

Congress can direct the Federal government to solicit **stepped design options and fees** in Design-Build proposals. For example, the Energy Independence and Security Act (2007) section 433 requires a reduction in fossil fuel consumption in build-

⁴⁸ <https://www.federalregister.gov/documents/2018/05/22/2018-11101/efficient-federal-operations>.

ings by 80% in 2020, 90% in 2025 and 100% in 2030.⁴⁹ A project team might be able to show a pathway to zero fossil fuels and zero carbon emissions by 2030, but if the team can only submit a single project price and feels it would not win the project unless it submits the lowest price, then it will not be incentivized to show the lowest carbon solution. It is possible to design a project so efficiently that the design becomes reductive rather than additive. Peak loads are reduced through orientation, massing, a high-performance envelope and the result is a reduction in HVAC system sizing. A low carbon or zero carbon design might not carry as high of a cost premium or as long of a payback timeframe as anticipated. Solicitations should provide bidders with an opportunity to demonstrate a lowest price option (often the least performance option as well) as well as stepped packages that offer progress towards the Federal carbon reduction goals and the pricing of those packages. If a Zero Carbon design could be offered at a very nominal premium and with <10 year payback, procurement officers should have an opportunity to evaluate that option in concert with the lowest cost/lowest performance options.

Investment in high performance buildings has proven to have payback that benefits American taxpayers. GSA inventoried its portfolio and determined⁵⁰ that **operating expenses** in high performance buildings cost 10% less per square foot to operate than industry benchmarks and 23% less per square foot to operate than other Federal buildings (legacy stock).

Congress makes decisions about the priorities for buildings it constructs, leases or retrofits. Expressing a preference or placing value on a characteristic sends a signal to the market. If the investments Congress makes with tax dollars prioritize **low carbon** and **carbon neutral** projects, then Congress has established value and created demand. The economy is a social construct that we create through policy and priorities; matter and energy, carbon and currency exist within the larger ecosystem and are subject to its constraints.



Figure 2 - The Traditional Economic Paradigm

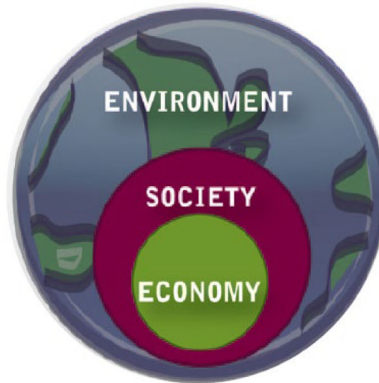


Figure 4 - The New Ecological Economic Paradigm

“The Government’s economic decision-making tools should be used in a manner that supports environmentally and socially responsible operations in programs and major acquisitions extending into the future . . . Tools and policies must support sustainable government operations, so that we can make the most preferable environmental and social choice when purchasing goods and services.”

“The traditional economic paradigm upon which our financial decision-making is based . . . assumes that the economy functions independent of the natural world, with the environment as a subset of no value except as a source of resources and a “sink” for wastes (Figure 2). Social inputs beyond labor costs are not considered at all.’

“The new *ecological* economic paradigm nests the economy within the environment, rather than independent of it. And, rather than shortchanging the role of soci-

⁴⁹ [EISA § 433]: New Federal buildings and Federal buildings undergoing major renovations shall reduce their fossil fuel-generated energy consumption (baseline 2003) by 55% (2010), 65% (2015), 80% (2020), 90% (2025), and 100% (2030).

⁵⁰ The Impact of High-Performance Buildings (GSA, 2018).

ety, as in the traditional economic model, this paradigm defines the economy as a construct of society that moves goods and services (matter and energy) through it while determining what has value and is economically viable (Figure 4). In this paradigm, solar energy sustains the ecosystem, whose products are used as factors of economic production. The economy then sends its wastes back into the ecosystem, to be broken down by natural processes. The economy can only be sustained if there are healthy societies, living in healthy ecosystems that furnish renewable resources and assimilate wastes.”⁵¹

Examples of High-Performance Federal Projects in HOK's Portfolio

HOK has designed tens of millions of square feet of building space for the Federal government, including New Construction projects, Adaptive Reuse, and Deep Green Retrofits.



NASA Building 20 in Clear Lake, TX (LEED Platinum) 83,205 sq. feet. Primarily open office environment with access to daylight and views. Measures include a highly efficient building envelope, underfloor air distribution, a total energy recovery wheel and solar hot water harvesting supplying 18% of the building's domestic hot water consumption. The project was designed to be 57% more energy efficient than a similar office building, with gross square footage 6% below program.

⁵¹ www.gsa.gov/cdnstatic/2009_New_Sustainable_Frontier_Complete_Guide.pdf.



NOAA Daniel K. Inouye Regional Center at Pearl Harbor, HI (LEED Gold, AIA COTE Top 10) 350,000 sq. feet. Located on a national historic landmark site on Oahu's Ford Island, NOAA's Inouye Regional Center features the adaptive reuse of two World War II-era airplane hangars linked by a new steel and glass building. The new complex houses a diverse range of critical programs, functions and Federal departments, including the Pacific Tsunami Warning Center. The facility has a comprehensive skylight diffuser system that virtually eliminates the need for artificial light during the day and Hawaii's first hydronic passive cooling unit (PCU) system which uses cold water drawn from a deep sea well to cool air before it is distributed through an underfloor air system. Combined these systems contribute to 42% energy use savings compared to a similarly programmed facility. A graywater system irrigates the native landscaping.



U.S. Coast Guard Headquarters at St. Elizabeths West Campus in Washington, DC (LEED Gold) 1.2 million sq. feet. HOK provided landscape architecture, sustainable design and interior design services for the Coast Guard. HOK's design for the step-down courtyards, edges and green roofs provides continuity between the surrounding woodlands and an adjacent historic government campus. Rainwater that falls onto the green roofs permeates through the plant roots and soil and into a drainage system that leads to a stormwater pond for reuse in irrigation. Advanced HVAC system, lighting controls and high-performance enclosure contributed to 33% energy use savings compared to a typical office building.



Byron Rogers Federal Building and Courthouse in Denver, CO (LEED Gold) 494,156 sq. feet. Due to its age and condition, the 18-story project was selected to receive funding for a complete remodel through the 2009 American Reinvestment and Recovery Act (ARRA). GSA received additional ARRA funding to incorporate then emerging energy-efficiency technologies such as LED lighting into the design. The building underwent deep green retrofits to enclosure, HVAC, lighting and plumbing systems. GSA articulated a *performance requirement* in the contract (Target: 39.1 kBtu/sf/yr). The Federal building renovation contributed to the combined 46% EUI reduction of the Federal building and courthouse (former combined site EUI 79.1 kBtu/sf/yr, post-renovation EUI 42.5 kBtu/sf/yr).

Ms. CASTOR. Thank you.

Ms. Saul Rinaldi, you are recognized for 5 minutes.

STATEMENT OF KARA SAUL RINALDI

Ms. SAUL RINALDI. Thank you, Chair Castor, Ranking Member Graves, and members of the committee. Thank you for inviting me to testify here today. I am pleased to represent the Building Performance Association.

Addressing climate change is critical to our future. In fact, I brought a piece of that future with me here today. My daughter, Annabella, and son, Dylan, are sitting in the audience behind me.

Ms. CASTOR. Would you all stand up?

Mr. GRAVES. Are you supposed to be in school?

Ms. SAUL RINALDI. They got a pass, just for today—just the morning.

While buildings are a significant contributor to our climate crisis, they can also be a key part of the solution. Policies aimed at retrofitting the over 115 million homes across the country will not only help reduce carbon emissions from the Nation's residential building stock but will also help homeowners save money on their monthly utility bills and improve the comfort, health, safety, and resiliency of their homes.

Ultimately, the cleanest and cheapest energy is the energy you don't use in the first place. The residential building sector remains an untapped resource of carbon-reduction goals. A new report from ACEEE found that energy efficiency alone can cut energy use and greenhouse gas emissions by half by 2050. Buildings deliver 33 percent of the total emissions from that model.

But simply put, energy efficiency creates jobs. According to this year's "Energy Efficiency Jobs in America" report released by E4TheFuture and submitted with this testimony, the energy-efficiency sector employs 2.3 million Americans, twice as many workers as the entire U.S. fossil fuel industry, and energy efficiency is leading the Nation's energy economy in new job creation, accounting for half of the entire energy industry job growth in 2018.

These local, family-sustaining jobs exist all across the country. In fact, the report found that 99.7 percent of U.S. counties have energy-efficiency jobs, and more than 300,000 of these jobs are in rural areas.

A significant portion of energy-efficiency jobs in the U.S. are in the residential sector, and approximately 56 percent of energy-efficiency jobs involve construction and repair. These are the contractors, the boots on the ground, installing energy-efficiency products and technologies and working to reduce energy waste in homes and commercial buildings across the country.

Importantly, policies that provide incentives for building efficiency retrofit, such as the HOMES Act, H.R. 2043, or tax policy like the 25C tax credit or 179D tax deduction, or legislation that supports valuing energy efficiency like the SAVE Act, which is a part of H.R. 3962, create a ripple effect on jobs. Demand for insulation, air sealing, and high-efficiency HVAC will not only create work for those who install these products but will also create jobs in manufacturing and distributing of those technologies. These cre-

ate jobs around the industrial centers where workers eat, shop, and live.

It is also important to note that the energy-efficiency industry is comprised of mainly small businesses. Eighty percent of energy-efficiency businesses in America have fewer than 20 employees.

These small businesses need resources to help train new hires and provide ongoing education to existing employees, keeping them up to date on certifications and training in the latest energy-efficiency and renewable-energy technologies. We recommend Congress pass the Blue Collar to Green Collar Jobs Development Act, H.R. 1315, which would provide a comprehensive, nationwide program to improve energy-efficiency and renewable-energy training.

In addressing climate change, policymakers must look at buildings as an integral part of the grid. Buildings not only use energy but they can generate clean power, store energy, and shift demand from times of high cost and strain on resources to times when wind and solar power are abundant and energy is cheapest.

I am the lead author of a new report on grid-interactive efficient buildings, released today by the National Association of State Energy Officials, that describes how homes with energy-efficiency measures combined with smart technologies and small-scale storage and generation resources can support grid needs and achieve carbon reductions while benefiting consumers. This report includes policy recommendations, and I have submitted the report with my testimony.

With the power of the purse in the hands of Congress, I must emphasize the important climate role this body has to advance energy-efficiency research, development, and deployment in the appropriations process. Dollar for dollar, Federal investment in energy efficiency creates more jobs than investments in the utilities sector or fossil fuels. And Federal investments in DOE programs that support energy efficiency, like the Building Technologies Office and Weatherization Assistance Program, lead to job creation and carbon reductions.

In closing, I thank you, and I ask that you consider the buildings you live and work in as a part of the solution to climate change. The built environment is one of the largest consumers of energy and, thus, emitters of greenhouse gas emissions.

With energy policy and program innovation in the building sector, we can reduce the need for new power plants, deliver more reliable energy services at lower cost, all while making homes like the ones Annabella, Dylan, and their children will live in healthier and more comfortable places to live.

Thank you.

[The statement of Ms. Saul Rinaldi follows:]

Testimony of Kara Saul Rinaldi
Vice President of Government Affairs, Policy, and Programs, Building
Performance Association

Before the U.S. House of Representatives, Select Committee on the Climate
Crisis

Solving the Climate Crisis: Cleaner, Stronger buildings

October 17, 2019

Chair Castor, Ranking Member Graves, and members of the Committee, thank you for inviting me to testify today on the important role that buildings can play in reducing America's contribution to global climate change. As you may know, the buildings sector is responsible for 31% of all U.S. greenhouse gas emissions.¹ While buildings are a significant contributor to our climate crisis, they can also be a key part of the solution. I will discuss commercial and federal buildings but will focus in particular on how the residential sector is key to carbon reductions and achieving numerous other benefits. Policies aimed at retrofitting the over 115 million homes across the country will not only help reduce carbon emissions from the nation's residential building stock but will also help homeowners save money on their monthly utility bills and improve the comfort, health, safety, and resiliency of their homes. Advancing energy efficiency in buildings across the U.S. will support climate change mitigation and resilience, while also being an engine for job growth and economic opportunity.

I am President and CEO of the AnnDyl Policy Group, an energy and environmental policy strategy firm, and I serve as the Vice President of Government Affairs, Policy, and Programs for the Building Performance Association (BPA), formerly known as the Home Performance Coalition, a national non-profit 501c3 organization that works with industry leaders in the home performance and weatherization industries to advance energy-efficient, healthy and safe homes retrofit policies, programs and standards through research, education, training and outreach. I am pleased to represent BPA here today.

Energy Efficient Buildings are a Pathway to Deep Decarbonization

There is significant opportunity to decarbonize the buildings sector by adopting policies that advance energy efficiency. Energy efficiency is a critical pathway to achieving deep decarbonization because it is cleaner and cheaper than building new low-carbon or carbon-free generation. Deploying energy efficiency reduces demand for primary energy and generating capacity needs and therefore lowers the overall costs of shifting to a low-carbon energy system.² Ultimately, the cleanest and cheapest energy is the energy you don't use in the first place. A new report from ACEEE found that energy efficiency alone can cut energy use and greenhouse gas emissions in half by 2050.³ Buildings deliver 33% of the total emissions reductions in the report's model, and upgrades to existing buildings and homes and appliance and equipment efficiency are identified as some of the largest cost-effective opportunities to achieve these reductions.

The residential buildings sector in particular remains a largely untapped resource for carbon reduction goals. I will discuss specific policy opportunities to address barriers and advance energy efficiency in the residential sector in a moment.

Energy Efficiency Creates Jobs

Energy efficiency is the largest employer and fastest growing sector in the energy industry. Put simply, energy efficiency equals jobs. According to this year's "Energy Efficiency Jobs in America"⁴ report released by E4TheFuture and attached to this testimony, the energy efficiency sector employs 2.3 million Americans, twice as many workers as the entire U.S. fossil fuel industry, and energy efficiency is leading the nation's energy economy in new job creation, accounting for half of the entire energy industry's job growth in 2018. These local, family-sustaining jobs exist all

¹ <https://www.epa.gov/sites/production/files/2019-04/documents/us-ghg-inventory-2019-main-text.pdf>.

² An NRDC study found that 80% emissions reductions in the U.S. by 2050 is achievable and cost-effective using existing clean energy technologies. Energy efficiency is the single greatest contributor to emissions reductions in the model scenario which assumes an aggressive, but technically and economically achievable, deployment of energy efficiency across the U.S. economy. <https://www.nrdc.org/sites/default/files/americas-clean-energy-frontier-report.pdf>.

³ <https://aceee.org/sites/default/files/publications/researchreports/u1907.pdf>.

⁴ <https://e4thefuture.org/wp-content/uploads/2019/09/Energy-Efficiency-Jobs-in-America-2019.pdf>.

across the country. In fact, the E4TheFuture report found that 99.7% of U.S. counties have energy efficiency jobs and more than 300,000 of these jobs are in rural areas. A significant portion of energy efficiency jobs in the U.S. are in the residential sector, and approximately 56 percent of energy efficiency jobs involve construction and repairs. These are the contractors—the “boots on the ground”—installing energy efficiency products and technologies and working to reduce energy waste in homes and commercial buildings across the country. These jobs are, by their very nature, inherently local and cannot be exported. Contractors are local—their kids go to the same schools as their clients, they sponsor baseball teams, they share in community successes and failures. Policies that encourage investment in energy efficiency can further advance growth in this industry, creating even more well-paying jobs all across America and generating economic opportunity through the decarbonization transition.

Importantly, policies that provide incentives for building efficiency retrofits, such as the HOMES act or tax policy like the 25C or 179D federal credits, create a ripple effect on jobs. Demand for insulation, air sealing, HVAC will certainly create work for those who install these products, but it also creates jobs in the manufacturing and distributing of those products. This creates jobs around those industrial centers where workers eat, shop, and live.

Not only is energy efficiency the largest employer in the energy sector, it has the most potential for even more job growth moving forward. With an aging building stock across the country we have only scratched the surface on investing in energy efficiency improvements. Addressing barriers to retrofitting these existing homes and buildings and advancing energy efficiency across the entire buildings sector will simultaneously support decarbonization and job creation.

It is also important to note that the energy efficiency industry is comprised mainly of small businesses: 80% of energy efficiency businesses in America have fewer than 20 employees.⁵ These small businesses are the heart of the American economy—creating jobs, driving growth, and saving us all money through improved energy efficiency. They are also the ones that are in need of assistance when it comes to ensuring that there are qualified workers to fill these jobs. Small energy efficiency businesses need resources to help train new hires and provide ongoing education to existing employees, keeping them up to date on certifications and trained in the latest technologies and health and safety practices. To prepare more American workers for quality jobs in energy efficiency and drive further growth in this industry, Congress should act to support workforce development and jobs training. ***The Blue Collar to Green Collar Jobs Development Act of 2019 (HR 1315)*** would create a comprehensive, nationwide program to improve education and training for workers in the energy efficiency industry, including manufacturing, engineering, construction, and building retrofitting jobs. This legislation will result in more American workers who are equipped to provide energy efficiency products and services and whose work will reduce energy waste and save money for homes and businesses across the country.

Energy Efficiency Provides Building Resilience

Energy efficiency measures not only save energy and reduce carbon pollution, they also improve the physical structure of the building. Building envelope improvements like high performing insulation and air sealing increase the durability of the building and its ability to withstand extreme weather and keep occupants safe. Studies have shown that buildings built to the latest energy code, with efficient, well-sealed structures, are able to maintain safe indoor temperatures through extreme heat and cold and allow residents to remain safe and comfortable for longer during a power outage.⁶ Beyond the durability and resilience of the physical buildings themselves, energy efficiency enhances resilience in other ways: providing health and safety benefits like improved indoor air quality, delivering cost savings to families and businesses which creates new opportunities for productive spending and local investment, and supporting the reliability and resilience of our power grid which I will discuss further in a moment.

Energy Efficiency Policy as a part of Equity Policy

Energy efficiency is a key strategy for both reducing carbon emissions and improving the lives of Americans. Legislation that advances energy efficiency in buildings, especially residential buildings, provides many benefits in addition to energy and pollution reductions including increased comfort, health, and energy affordability.

⁵ <https://e4thefuture.org/wp-content/uploads/2019/09/Energy-Efficiency-Jobs-in-America-2019.pdf>.

⁶ <http://www.aceee.org/files/proceedings/2014/data/papers/1-439.pdf>.

The occupants of the vast majority of homes in the U.S. experience building-related comfort problems, health issues, and/or high utility bills—problems which could all be significantly mitigated by proper construction techniques and energy efficiency upgrades.⁷ Studies have shown that improvements in occupant health from residential energy efficiency are strongest among vulnerable groups: lower income households and residents with pre-existing health conditions linked to housing risks.⁸

Energy costs are a significant living expense. For the nearly one-third of U.S. households who face challenges paying energy bills or sustaining adequate heating and cooling in their homes, the cost savings provided by energy efficiency are critical.⁹ Congress should advance policies aimed at helping middle income Americans make efficiency upgrades to their homes (e.g. HOMES Act) as well as programs designed to make efficiency upgrades to low income homes (e.g. Weatherization Assistance Program).

In addition to the cost-savings benefits to homeowners, efficiency upgrades also have health and safety benefits. A U.S. Department of Energy report on the Weatherization Assistance Program found that home improvements focused on energy efficiency can improve indoor air quality, which reduces respiratory illness and sick days, and reduce thermal stress caused by exposure to extreme indoor thermal conditions (temperature, humidity, drafts).¹⁰ A report from E4TheFuture, entitled “Occupant Health Benefits of Residential Energy Efficiency,”¹¹ which reviews existing research on the link between resident health benefits and energy efficiency upgrades, also found that residential energy efficiency upgrades can produce significant improvements in asthma symptoms and help improve overall physical and mental health.

It is critical that Congress continue to support and expand the Weatherization Assistance Program. I was the lead author of a report¹² in 2017, published by the Home Performance Coalition, that offered recommendations for improvements to the program, opportunities for streamlining, and ways to encourage the use of private sector contractors. Some of these ideas are included in the ***Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act (HR 2041)*** which would reauthorize and make updates to the Weatherization Assistance Program. This bill has passed out of Committee this year and awaits a floor vote. I urge Congress to act on this important legislation.

Smart Energy-Efficient Buildings are a Pathway to a Clean, Affordable, Resilient Grid

When we talk about clean energy and decarbonizing the electric grid, buildings and energy efficiency must be part of that conversation. When we discuss grid resilience and stability concerns, building efficiency must be a part of the conversation, because it is buildings that are being asked not only to generate power (through renewables) but to reduce their energy consumption at certain times of the day (through demand response).

There is a growing need for policymakers to look at buildings as an integral part of the grid that not only use energy but can also generate power, store energy, and shift demand from times of high demand and cost to times when wind and solar power are abundant and energy is cheapest. Thanks to advances in technology, our nation’s buildings—and the residential sector in particular—can be enabled to play an important role in managing energy demand to support grid efficiency, reliability, and resilience and achieve significant carbon reductions.

The U.S. Department of Energy (DOE) Building Technologies Office (BTO) has been doing a lot of work in the area of “Grid-interactive Efficient Buildings” (GEBs). I am the lead author of a new report released today by the National Association of State Energy Officials (NASEO) entitled “Residential Grid-Interactive Efficient Building Technology and Policy: Harnessing the Power of Homes for a Clean, Affordable, Resilient Grid of the Future,” that describes how homes with energy efficiency measures, combined with smart technologies, and small-scale storage and generation resources can support grid needs and achieve carbon reductions while

⁷ <https://www.building-performance.org/sites/default/files/0819-EE-high-performing-homes-blueprint-v8.pdf>.

⁸ <https://e4thefuture.org/wp-content/uploads/2016/11/Occupant-Health-Benefits-Residential-EE.pdf>.

⁹ <https://www.eia.gov/todayinenergy/detail.php?id=37072>.

¹⁰ https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNLTm-2014_345.pdf.

¹¹ <https://e4thefuture.org/occupant-health-benefits-of-residential-energy-efficiency/>.

¹² <https://www.building-performance.org/sites/default/files/Weatherization%20%26%20HP%20Recommendations%20Report2.pdf>.

consumers benefit from utility bill savings, increased comfort, and amenity.¹³ GEB technologies (e.g. smart thermostats, efficient connected appliances, battery and thermal storage, and home energy management systems) make homes smart, connected, efficient and flexible, allowing them to reduce or shift energy use to take advantage of variable renewable energy and support a cleaner grid, while helping American families lower their utility bills and increase comfort and convenience.

Importantly, GEBs can provide energy savings and demand flexibility as a cost-effective clean energy solution that reduces carbon emissions. Smart grid-interactive technologies provide two-way communication between a home and the grid and offer new tools to target load shedding and shifting more precisely and continuously, exactly when and where it is needed, while maintaining occupant comfort and needs. For example, a smart water heater is able to receive a signal when there is overproduction of renewable energy and respond by adjusting its heating cycle to use that clean power and then store the hot water for use later in the day. With intelligent controls smart water heaters ensure that residents always have access to hot water, while maximizing the use of carbon-free generation by responding dynamically to grid conditions. The building efficiency sector is undergoing rapid change and is increasingly a source of innovation and new technology, with more sophisticated solutions for home energy management. As the sensors, controls, software, and machine learning that comprise home energy management systems advance and integrate with more technologies, these platforms can support the interconnection of solar, storage, and flexible end uses in the home to coordinate load management strategies for grid and user benefit.

Energy efficiency measures are the foundation of a smart, grid-interactive efficient home. They reduce the baseline load of a home, lowering overall electricity use. Conventional energy efficiency measures include building envelope improvements and replacement of existing equipment and systems (e.g., appliances, lighting, HVAC, boilers) with higher-efficiency models. All of these measures provide a foundation for other solutions' effectiveness: minimizing the load size that requires shifting, enabling homes to hold a comfortable temperature for longer periods of time, and ensuring distributed generation and storage are appropriately sized. Smart technologies help advance energy efficiency in buildings, driving additional savings and connecting efficiency measures with new opportunities to provide load flexibility. Smart thermostats, for example, offer monitoring, control, and optimization of HVAC systems to take advantage of energy saving opportunities (e.g., via learned schedules and low energy "away" modes) and can also be used for demand response. On the hottest days of the year, smart thermostats can respond by raising the set-point slightly to save energy and ease strain on the grid, when paired with other efficiency measures like a tight, well-insulated building envelope and dynamic efficient window shading keep the home cool and comfortable—all with little to no effort from the homeowner.

Deploying these solutions in an integrated way can cost-effectively reduce peak demand, address capacity constraints, and provide other grid services—deferring transmission and distribution upgrades and reducing the need for new power plants. A recent study by Rocky Mountain Institute¹⁴ found that Clean Energy Portfolios of wind, solar, storage, energy efficiency, and demand flexibility are now cost-competitive with new natural gas plants, while providing the same grid reliability services currently serviced by natural gas.¹⁵ In order to integrate these clean energy resources and maximize carbon reductions across the power system, the grid needs "intelligence." Smart grid technologies in the buildings sector like smart meters, sensors and controls, and software solutions provide enhanced monitoring, detection, and control capabilities. These technologies are an important and cost-effective way to increase the reliability and efficiency of the grid and maximize the use of renewable energy, by providing increased visibility into grid conditions and allowing utilities to better manage increasingly complex energy systems.

We need to break down the silos between energy efficiency, renewables, and distributed energy resources such as electric vehicles and battery storage. Advancing energy efficiency and smart energy management technologies will help homes and buildings save energy and use energy more flexibly to minimize our carbon footprint. Plans for interoperability, incentives, and maximizing data use is critical for tapping this great energy resource. With policy and program innovation that brings all of these pieces together to optimize energy usage we can reduce the need for new

¹³The report, released today, is attached to this testimony.

¹⁴<https://rmi.org/insight/clean-energy-portfolios-pipelines-and-plants>.

¹⁵The study also found that energy efficiency and demand flexibility resources that GEBs can provide—are the least-cost route to meeting energy, capacity, and flexibility needs.

power plants, deliver more reliable energy services at lower costs, all while making homes healthier, more comfortable places to live.

As noted in the Residential Grid-Interactive Efficient Building Technology and Policy report, the Building Performance Association also encourages federal investment in the following areas to advance innovation with residential GEBs, supporting both decarbonization in the buildings sector and a cleaner, more resilient grid:

- **Grid modernization.** Investment in full deployment of smart meters (AMI) across the entire residential sector would create an enabling infrastructure for grid-interactive energy optimization. Smart meters provide two-way communication between a home and utility and provide much more granular energy usage information, creating new opportunities for targeted energy efficiency and demand response and supporting the integration of customer-sited resources like rooftop solar and battery storage, enabling a broad range of GEB solutions.
- **Residential GEB demonstration and deployment.** To build on research on grid-interactive efficient building solutions, funding should focus on demonstration and deployment to (1) evaluate energy optimization strategies integrating energy efficiency and smart technology in real homes and (2) assess the potential of different retrofit measures to increase energy efficiency, grid interactivity, and demand flexibility in existing homes.
- **Advance workforce education.** Curriculum development and resources to train home performance contractors on integrating smart technology within home performance retrofits to further advance residential energy efficiency and demand flexibility.
- **Research to quantify the value of residential GEBs and their benefits.** New methods and tools for valuing the hard-to-quantify benefits residential GEBs provide, including energy resiliency and non-energy benefits like convenience and safety.
- **Development and promotion of standards for interoperability.** Standard communications protocols and interoperability are key to ensuring that different technologies can work together effectively, and integrated solutions are cost-effective and future-proofed.

Residential Sector is Key to Carbon Reductions

The residential buildings sector remains a largely untapped resource for carbon reduction goals. Residential buildings consume more electricity than any other sector¹⁶ and are the largest contributor to peak demand,¹⁷ which makes this sector especially important from a carbon emissions reduction standpoint. I authored a report in 2016, published by the Home Performance Coalition, which outlines how residential energy efficiency can play an important role as a proven, low-cost, and accessible way to help meet carbon emission reduction goals.¹⁸ The residential buildings sector is often overlooked by policymakers because of its diversity and complication: over 70% of our nation's housing stock was built before 1990, with almost 40% older than 1970,¹⁹ and the characteristics of homes vary considerably by the year they were built, meaning they need individualized attention. Retrofitting and providing certifications to allow for the valuation of these homes could achieve significant energy and carbon savings. Each house is unique and the barriers that exist in terms of financing, homeowner education and engagement, and proper valuation of efficiency characteristics of residential buildings all make it a difficult sector to tackle from a policy perspective. The following pieces of legislation and policy proposals represent a multi-pronged policy approach to reducing carbon emissions in the residential building stock:

Other Legislative and Policy Proposals to Incentivize Residential Energy Efficiency:

- **Home Owner Managing Energy Savings (HOMES) Act of 2019 (116th—HR 2043, Rep. Welch).** Would establish a grant program for rebates to make residential energy efficiency upgrades with a network of rebate aggregators, quality assurance, and pilot on pay for performance. Earlier iterations of the HOMES Act from previous Congresses have been bipartisan with Rep. McKinley (R-WV).

¹⁶ https://www.eia.gov/electricity/annual/html/epa_01_02.html.

¹⁷ https://www.energy.gov/sites/prod/files/2019/04/f61/bto-geb_overview-4.15.19.pdf.

¹⁸ https://www.building-performance.org/sites/default/files/A%20Policymaker%E2%80%99s%20Guide%20to%20Incorporating%20Existing%20Homes%20into%20Carbon%20Reduction%20Strategies%20and%20Clean%20Power%20Plan%20Compliance_0.pdf.

¹⁹ <https://www.eia.gov/consumption/residential/data/2015/hc/php/hc2.3.php>.

- **Access to Consumer Energy Information Act or the E-Access Act (116th—discussion draft, Rep. Welch) (114th—HR 1980/S 1044, Rep. Welch (D-VT), Rep. Cartwright (D-PA) / Sen. Markey):** Would allow DOE to facilitate customers' access to their own electricity data, adds consumer access to energy use and price data to State energy conservation plans, and provides for establishment of voluntary guidelines with access to third parties according to a protocol established by the Secretary.

- **Residential Energy Efficiency Valuation Act "REEVA":** A short term grant program to states to provide incentives based on measured energy savings from energy efficiency upgrades of residential buildings. Payments are to contractors/aggregators based on performance. The contractor/aggregator is to utilize financing to provide market-based incentives for their customers. Language available from the Building Performance Association.

- **Sensible Accounting to Value Energy (SAVE) Act (114th—HR 614/113th—S 1106, Rep. Murphy, Rep. Jolly/Sen. Bennet, Sen. Isakson):** HUD to develop and issue guidelines to all federal mortgage agencies to implement enhanced loan eligibility based on energy cost savings due to efficiency upgrades. Supported by the NAHB and many others. Included in the Energy Savings and Industrial Competitiveness Act (HR 3962, S2137).

- **Tax credit.** We recommend support for tax incentives for homeowners that invest in sound residential energy efficiency home upgrades; tax incentives like a forward-looking, expanded 25C tax credit. The 25C tax credit is the only energy efficiency tax credit provided to consumers, everyday homeowners who struggle to pay their utility bills. Residential tax incentives are critical to reducing the upfront cost of energy efficiency improvements, thereby allowing more Americans access to the efficiency market, reducing monthly utility bills, increasing the health and safety of homes, and reducing carbon emissions. We support a forward-looking extension of a tax credit for residential energy efficiency upgrades and recommend improving the 25C credit by updating goals and transitioning the credit into permanent performance-based instead of prescriptive incentive.

- **Energy Efficiency Resource Standard (EERS).** Direct electric and natural gas utilities to achieve increasing levels of energy savings through cost-effective customer energy efficiency programs.²⁰ States could administer the program, and limited credit trading would be allowed. While traditional EERS models set resource-specific savings targets, a national standard could be designed more flexibly with an overarching GHG emissions reduction goal, which would allow for beneficial electrification where clean electricity replaces direct fossil fuel use to reduce emissions.²¹

Energy Efficiency in Commercial Buildings

Some of the policy proposals above also will help to advance energy efficiency in the commercial buildings sector including support for workforce development (H.R. 1315), Access to utility data, implementing a federal EERS. Support for the retrofit of existing commercial buildings is important because it is estimated that over half of the buildings that will be in use in 2050 are already built.²²

Key to advancing commercial energy efficiency is a forward-looking, permanent extension of the 179D Energy Efficient Buildings tax deduction which will help support building owners and investors in retrofitting existing buildings, as well as in constructing new above-code buildings. Importantly this deduction has included performance criteria, incentivizes whole building efficiency, and requires verification. Congress should consider making the 179D tax deduction permanent in order to incentivize more and broader energy efficiency improvements in commercial buildings and reduce carbon emissions from this sector.

Federal Investment in Energy Efficiency Provides Significant Returns

With the "power of the purse" in the hands of Congress, it would be remiss for me to fail to mention the important role this body has to advance energy efficiency research, development, and deployment in the appropriations process. Dollar for dol-

²⁰ According to ACEEE analysis, a federal EERS of 20% electricity and 12% natural gas savings by 2030 would save utility customers nearly \$150 billion on their energy bills and would achieve CO₂ emissions reductions equivalent to taking nearly 50 million cars off the road. <https://aceee.org/policy-brief/energy-efficiency-resource-standard-eers>.

²¹ ACEEE recently published "Next-Generation Energy Efficiency Resource Standards" which looks at new EERS approaches that can help meet aggressive climate goals, along with delivering cost, grid and equity benefits. <https://aceee.org/sites/default/files/publications/researchreports/u1905.pdf>.

²² <https://buildingefficiencyinitiative.org/articles/why-focus-existing-buildings>.

lar, federal investments in energy efficiency create more jobs than investment in the utility sector or fossil-fuels,²³ and federal investments in DOE programs that support energy efficiency—like the Building Technologies Office, Weatherization Assistance Program, and State Energy Program—lead to job creation and economic growth.

The following programs at the Department of Energy deserve the support of the American taxpayer as these programs are proven to provide a significant return on investment. When funded they will continue to provide energy cost relief to households, support American-based industry and American jobs, ameliorate issues with the aging electrical grid, and support national security goals.

- **Building Technologies Office (BTO)**, which develops critical technologies, tools, and solutions that help U.S. consumers and businesses achieve peak efficiency performance in new and existing homes and buildings across all sectors of our economy. Programs like Home Performance with Energy Star, which advances contractor engagement in high efficiency equipment installations, and Home Energy Score, which helps ensure that energy efficiency is valued in real estate transactions—are just two examples of crucial residential programs within BTO. The Residential Building Integration program within BTO has the capacity to fundamentally transform the performance of homes and greatly improve the energy efficiency in the 115 million existing residential buildings throughout this country. We recommend funding be focused on facilitating later-stage research, demonstration, and widespread deployment of technology solutions in new and existing homes, with an emphasis on whole-house energy efficiency retrofits (including outreach, engagement and training to private sector contractors) and continuing efforts to advance smart home technology. BTO's programs can significantly improve the energy efficiency in the residential sector through its partnerships with the thousands of small businesses in this sector, the construction trades, equipment, smart grid technology and systems suppliers, integrators and state and local governments. We encourage the direct engagement with residential contractors and businesses, which are crucial to the success of buildings programs.

- **State Energy Program (SEP)**, which provides funding and technical assistance to states, territories, and the District of Columbia to enhance energy security, advance state-led energy initiatives, and maximize the benefits of decreasing energy waste. Over the past 30 years, SEP has proven to be the critical link in helping states improve efficiency in hospitals and schools, establish business incubators and job training programs, and establish relationships with energy service companies and small businesses to implement cost-effective energy efficiency programs across their state. The Oak Ridge National Laboratory found that every dollar invested in SEP by the federal government yields over \$10 leveraged for energy-related economic development and realizes \$7.22 in energy cost savings for U.S. citizens and businesses—a tremendous economic value. SEP provides extraordinary value and flexibility, which is why governors across the country strongly support continued funding. It is important to note that SEP defers to the governors all decisions on allocating resources provided by DOE to meet their states' priorities such as energy emergency planning and response and energy related economic development.

- **Weatherization Assistance Program (WAP)**, which helps low-income and rural families, seniors, and individuals with disabilities make lasting energy efficiency improvements to their homes. WAP has a proven track record of creating new jobs and contributing to the economy through the program's large supply chain of vendors, suppliers, and manufacturers. Since 1976, WAP has helped make more than 7 million homes more efficient, saving the average recipient about \$4,200 over the lifetime of their home. A peer-reviewed study from the Oak Ridge National Laboratory found that the program is cost-effective at even conservative levels of evaluation. Each dollar that goes toward weatherization assistance yields at least \$2.30 in benefits, and by some estimates as much as \$4.10 to the home and society. The President's FY20 budget request, which zeroes out funding for the WAP program, would be a devastating blow to America's low- and moderate-income citizens: making those who are already vulnerable, more vulnerable, and those who are already poor, poorer.

Aside from the very important programs noted above, we recommend Congress do everything in its power to support the later-stage research and development, field validation, deployment, demonstration, consumer education, and technical assistance activities performed within the Office of Energy Efficiency and Renewable En-

²³ ACEEE. N.d. Energy Efficiency and Economic Opportunity. Retrieved from <http://aceee.org/files/pdf/fact-sheet/ee-economic-opportunity.pdf>.

ergy (EERE). While the Administration continues to place an emphasis on early-stage research activities within EERE, if the results of that early-stage research are not then integrated and pushed out into the market through demonstration and deployment activities, these innovative energy technologies, practices, and information cannot be fully utilized by American consumers and companies to reduce carbon emissions. This is particularly the case with complex systems and structures such as America's homes and buildings. We urge Congress to support—and hold the Administration accountable to advancing—a comprehensive and real-world strategy that includes medium- and later-stage research, deployment, and demonstration activities that are designed to utilize the most effective means to increase buildings' energy efficiency in order to reduce carbon emissions.

Leading By Example: Energy Efficiency in Federal Buildings

There are also important opportunities to simultaneously save American taxpayer money and reduce carbon emissions by improving the energy performance of federal buildings. Energy Savings Performance Contracts (ESPCs) are an innovative and effective model for public-private partnerships to improve building energy efficiency. ESPCs allow federal agencies to procure energy savings and facility improvements with no up-front capital costs or special appropriations from Congress and provide savings guarantees, reducing government risk. Studies by the Oak Ridge National Laboratory show that actual cost savings exceed guaranteed savings for many ESPC projects allowing significant cost savings to accrue to the government.²⁴ In the short term, Congress should enable more of these successful public-private partnerships through the following pieces of legislation and policy proposals:

Legislation:

- **Federal Energy and Water Management Performance Act of 2019 (S. 1857, Sen. Murkowski, Sen. Manchin):** Would reauthorize the Federal Energy Management Program (FEMP) at \$36 million and improve federal energy and water requirements.
- **Energy Savings and Industrial Competitiveness Act of 2019 (S. 2137, Sen. Portman, Sen. Shaheen; H.R. 3962, Rep. Welch, Rep. McKinley):** Would reauthorize the Federal Energy Management Program (FEMP) at \$36 million and improve federal energy and water requirements. It extends energy use reduction goals and would expand the scope of existing energy standards for new federal buildings to include major renovations.
- **Energy Savings through Public-Private Partnerships Act of 2019, (S. 1706, Sen. Gardner, Sen. Coons; H.R. 3079, Rep. Welch):** Would encourage the increased use of ESPCs in federal facilities by addressing barriers and increasing the use of energy efficiency and distributed generation.

Federal Appropriations:

Congress should ensure adequate funding for the following programs to continue to improve the performance and cost savings for federal buildings:

- **Federal Energy Management Program (FEMP).** In addition to reauthorizing this important program (S. 1857), Congress should ensure continued adequate funding for FEMP including carveouts for the Assisting Federal Facilities with Energy Conservation Technologies (AFFECT) program which provides grants to federal agencies to support the use of ESPCs, to achieve energy savings and implement other important climate-related measures like resiliency that might not generate utility bill savings.
- **U.S. General Services Administration (GSA) Office of Federal High-Performance Buildings.** Through ESPCs, construction and leasing policies, and other public private partnership models GSA has saved millions of dollars. GSA has reported, for example, that sustainable building standards helped GSA avoid more than \$250 million in energy and water costs from 2008 to 2014.²⁵ These programs save taxpayers money while reducing energy-related carbon emissions and should continue to be funded by Congress to ensure continued progress.

Conclusion

In conclusion, Madam Chair and esteemed members of the committee, I ask you to consider the buildings you live and work in as a part of the solution to the climate crisis. The built environment is one of the largest consumers of energy and thus emitters of greenhouse gas emissions. We need to break down the silos be-

²⁴ <https://info.ornl.gov/sites/publications/Files/Pub41816.pdf>.

²⁵ https://app_gsagov_prod_rdcgwajp7wr.s3.amazonaws.com/GSA_FY_2015_SSPP_Final.docx.

tween energy efficiency, renewables, and distributed energy resources such as electric vehicles and battery storage. With policy and program innovation that brings all of these pieces together to optimize energy usage we can reduce the need for new power plants, deliver more reliable energy services at lower costs, all while making homes healthier, more comfortable places to live.

Ms. CASTOR. Thank you very much. And, without objection, we will make sure that the National Association of State Energy Officials report issued today is included in the record.

[The information follows:]

**Submission for the Record
Representative Kathy Castor
Select Committee on the Climate Crisis
October 17, 2019**

ATTACHMENT: *Residential Grid-Interactive Efficient Building Technology and Policy: Harnessing the Power of Homes for a Clean, Affordable, Resilient Grid of the Future*. National Association of State Energy Officials, October 2019.

This report is retained in the committee files and available at: <https://naseo.org/data/sites/1/documents/publications/AnnDyl-NASEO-GEB-Report.pdf>.

Ms. SAUL RINALDI. Thank you.

Ms. CASTOR. Mr. Rutland, you are now recognized for 5 minutes.

STATEMENT OF JAMES RUTLAND

Mr. RUTLAND. Thank you, Chairwoman Castor, Ranking Member Graves, members of the committee. I am pleased to appear before you today on behalf of the National Association of Home Builders. I would like to share our views regarding resiliency and energy within residential buildings.

My name is Jimmy Rutland. I am a third-generation home builder from Montgomery, Alabama. I am the president of Lowder New Homes, which focuses on building quality and energy-efficient homes.

I also serve on the State of Alabama's Energy and Residential Codes Board, where I work with others involved in the residential and commercial construction industries to adopt and amend energy and building codes for the entire State.

NAHB has been a longtime leader in the drive to make homes more energy-efficient and has repeatedly demonstrated a commitment to sound Federal disaster and flood plain management policies and cost-effective, market-driven resiliency solutions that maintain housing affordability while balancing the needs of growing communities.

Housing affordability is currently a real concern. It is at a 10-year low for the single-family market. Almost a third of the Nation's households pay more than 30 percent of their income for housing. NAHB estimates that if the median U.S. new home price goes up by just \$1,000, more than 127,000 households would be priced out of the housing market nationwide. Recognizing this crisis, Congress must factor in housing affordability when looking at solutions to build a cleaner and stronger economy.

Similarly, there are 130 million homes in the U.S. that were built before 2010 and are much less energy-efficient and resilient than today's homes. Therefore, in addition to housing affordability,

any efforts to address the performance of homes must prioritize the inefficiencies of existing homes over new homes.

Through the myriad of proposals from legislators and stakeholders, many have suggested that mandates and more stringent building codes or the immediate adoption of the latest published code is the answer to improving residential resiliency and energy efficiency. This is unnecessary and unwise.

Codes are nearing a point of diminishing returns in terms of the cost-benefit ratio, so further increasing their stringency may not make economic sense. To put it simply, mandates fail to consider the needs or desires of consumers, like the flexibility needed for realistic, widespread application, and add unnecessary cost to home construction.

Model building codes are designed to establish minimum requirements for public health and safety for commercial and residential structures. Homes constructed following these requirements are built to withstand damage from disasters and provide substantial resiliency for many catastrophic events. Because modern codes are already efficient and resilient, any changes must be carefully evaluated.

Further, State and local jurisdictions are already taking the lead in ensuring their codes are adequate. To do so, they evaluate each new edition of the model codes and add, remove, or revise provisions so that the codes better fit their local construction practices, geography, risk, and market conditions. This could mean adding a hurricane clip to roofs that are in areas prone to hurricanes or elevating homes in areas prone to flooding.

Recognizing these different conditions, it is essential to States, like my home State of Alabama, are able to adopt of the codes that are best suited for them while other States are able to do the same. Any Federal intervention into this process will be extremely problematic and undermine the outcome.

Instead of mandates, Congress should support voluntary programs and incentives, both of which are proven ways to drive consumer behavior. For example, Alabama has established a grant program and makes tax credits up to \$3,000 available for retrofitting homes to make them more resistant to disasters.

On the national front, tax incentive programs such as 45L and 25C have permeated the market and assisted many families and building owners to invest in energy-efficient homes. These incentives are critical to helping offset the high initial cost associated with some of the high-performance features needed to upgrade homes.

Therefore, I urge you today to retain and expand the current offerings and work hand-in-hand with other stakeholders to offer additional ways to recognize the value and benefit of upgrades.

In conclusion, I urge Congress to promote voluntary and market-driven programs which promote lower total ownership cost through utility savings as well as provide the flexibility builders need to construct homes that are cost-effective, affordable, and appropriate to a home's geographic location.

Thank you for the opportunity to testify before you today. I recommend Congress seriously consider and address housing afford-

ability when exploring solutions to build a cleaner and resilient economy.

[The statement of Mr. Rutland follows:]

Testimony of James Rutland
President, Lowder New Homes
On behalf of National Association of Home Builders

Before the U.S. House of Representatives, Select Committee on the Climate Crisis
Solving the Climate Crisis: Cleaner, Stronger Buildings

October 17, 2019

Introduction

Chairwoman Castor, Ranking Member Graves, I am pleased to appear before you today on behalf of the National Association of Home Builders (NAHB) to share our views regarding resiliency and energy use within residential buildings. My name is Jimmy Rutland and I am a third-generation home builder and developer from Montgomery, Alabama. I am the former President of the Greater Montgomery Home Builders Association and serve on the board of directors of NAHB. In addition to my service with the local, state and national home builders associations, I serve on the State of Alabama Energy and Residential Codes Board. In this capacity, I work with various industries and regulators involved in Alabama's residential and commercial construction industry to adopt and amend energy and building codes for the entire state.

NAHB represents more than 140,000 members who are involved in land development and building single-family and multifamily housing, remodeling and other aspects of residential and light commercial construction. NAHB's members construct approximately 80 percent of all new housing built in the United States each year.

NAHB's mission is to enhance the climate for housing and the building industry, including providing and expanding opportunities for all people to have access to safe, decent and affordable homes. Due to the wide range of activities they conduct on a regular basis to house the nation's residents, our members are often required to comply with various regulatory and incentive-based programs to address issues related to climate change and resilience.

NAHB is leading the way to improve resiliency and the performance of new and existing homes. As a longtime leader in the drive to make homes more energy efficient, NAHB has also repeatedly demonstrated a commitment to sound federal disaster and floodplain management policies and cost-effective, market-driven solutions that maintain housing affordability while balancing the needs of growing communities with the need for reasonable protection of life and property.

As stakeholders in both the public and private sectors wrestle with finding the right balance of regulations and programs to protect homes and their occupants from severe weather events and hazards, some argue that more should be done. But most additional efforts come at costs that not only curtail homeownership and significantly hinder housing affordability, but also can severely impact state and local economies. This is because these policies can greatly influence how existing structures and cities are reengineered, rebuilt and/or remodeled and impact how and where new homes and communities are built. Depending on how they are developed and implemented, they can also be inflexible and overly protective, fail to target areas of highest risk, reduce availability of buildable land, tax limited resources, and have significant cost implications that can have a detrimental impact on housing affordability in many areas of the country.

To address these questions regarding the role clean energy and resiliency plays in the housing market and to identify the challenges the industry faces in doing so, this testimony highlights the following points:

- Maintaining housing affordability must be the cornerstone to any efforts to create cleaner and stronger homes. Any efforts to improve or increase the efficiency or resiliency of the U.S. housing stock should focus on cost-effective, market-driven solutions.
- Homes built following modern building codes are resilient. Improving the performance of the 130 million homes built before 2010 that are much less energy efficient and resilient than today's new homes is a much more effective

way to achieve energy savings and improve resiliency than targeting new homes.

- State and local governments must retain authority over land use and their code adoption processes so they can continue to direct community development and implement the codes that best fit their jurisdictions.
- Climate change mitigation programs that recognize and promote voluntary-above code compliance have a proven track record and demonstrate that mandates are not necessary.
- Incentives play an important role in providing homeowners a cost-effective way to invest in energy efficiency and resiliency. Mandates, which fail to consider the needs or desires of consumers, lack the flexibility needed for realistic, widespread application, and add unnecessary costs to home construction and retrofits, are an unwise approach to improving efficiency and home performance.

Status of the Nation's Housing Stock

The American housing stock continues to age, especially as residential construction continues its modest rebound after the Great Recession. Because recent production has fallen short of even the levels needed to accommodate the number of net new households, there is increasing pressure to keep existing homes in service longer—homes that may not perform as well or be as resilient as newer homes.

One hundred and thirty million homes out of the nation's housing stock of 137 million were built before 2010, and therefore, most were not subject to the modern building codes that are now in effect. Equally problematic, the latest Census statistics show the number of homes built before 1970 that are taken out of commission is only about six out of every 1,000 being retired per year.

These low rates of replacement mean that the built environment in the U.S. will change slowly and continue to be dominated by structures that are at least several decades old. Indeed, optimistic estimates suggest that if 1.2 million homes were built every year, after 20 years only 16 percent of the conventional housing stock would consist of new homes built between now and then. In comparison, 68 percent would still consist of homes that were built before 1990.

Older homes are less resilient and energy efficient than new homes. They were not built to the stringent requirements contained in modern codes, use (and lose) more energy, and are more susceptible to damage from natural disasters. Many of FEMA's post-disaster investigations support this conclusion. For example, FEMA's Mitigation Assessment Team Report regarding Hurricane Sandy reads, "Many of the low-rise and residential buildings in coastal areas [that had observable damage] were of older construction that pre-dates the NFIP." Similarly, the Insurance Institute for Business and Home Safety stated in its preliminary findings report for Hurricanes Harvey and Irma that, "[t]otal destruction from wind occurred to mobile homes, as well as older site built conventional homes," and "[n]ewer homes generally performed better than older buildings."

Clearly, these statistics and studies demonstrate that improvements in construction practices and building codes have made significant strides in improving the efficiency and resiliency of new construction and that further gains will be difficult and costly. As policymakers seek to improve efficiency and mitigate the effects of future natural disasters, they need to create opportunities and incentives to facilitate upgrades and improvements to the older homes, structures and infrastructure that are less resilient to natural disasters.

These structures make up the majority of the housing stock and will for the foreseeable future. They were built when there were no national model codes or constructed following codes that are now outdated, and thus provide a wealth of opportunities for improvement. Because they also represent the biggest energy users and are the least resilient, programs and policies that focus on the existing housing stock would reap the most benefits.

Housing Affordability

According to a nationwide survey conducted for NAHB in August 2019, four out of five American households believe the nation is suffering a housing affordability crisis and at least 75 percent report this is a problem at the state and local level as well. Other NAHB research shows that housing affordability in the single-family market is near a 10-year low. Only 61.4 percent of new and existing homes sold in the first quarter of 2019 were affordable to families earning the U.S. median income of \$75,500, and if the median U.S. new home price goes up by \$1,000, more than 127,000 households would be priced out of the housing market nationwide.

As a result, owning or renting a suitable home is increasingly out of financial reach for many households. In fact, almost a third of the nation's households are

cost burdened and pay more than 30 percent of their income for housing. At the same time, net new households are being formed faster than new single-family and multifamily homes are coming on line to accommodate them, so there is both a surge in need and not nearly enough supply.

And finally, making things worse, NAHB estimates that nearly 25 percent of the final cost of a single-family home and more than 30 percent of the cost of a multifamily home is due to government regulations at all levels of government—regulations such as building codes, energy efficiency mandates and zoning requirements. This is further exacerbating the supply/demand curve and making the housing market even more challenging.

Clearly, the nation is experiencing a regulatory and housing affordability crisis. President Trump recognized this earlier this year when he issued an Executive Order establishing a White House Council on Eliminating Regulatory Barriers to Affordable Housing through which he directed federal agencies and others to address, reduce and remove the multitude of overly burdensome regulatory barriers that artificially raise the cost of housing development and help to cause the lack of housing supply.

Despite these real challenges, many continue to suggest that home builders should make their homes more resilient and/or efficient in an effort to respond to and stem the impacts of climate change, meet carbon emissions limits or further environmental goals, among others. Unfortunately, many of the suggestions made to date will only exacerbate the current housing crisis.

Many people cannot afford to purchase a home, much less one that exceeds current building requirements. In Louisiana, after a new code was adopted in 2017, builders saw an increase in construction costs of about 8 percent. Compliance with many code changes and conducting certain building retrofit activities can be even costlier. For example, building costs can increase between \$4,800 and \$14,000 due to the changes from the 2006 to the 2009 code and the national average cost for a typical residential 6-kilowatt photovoltaic system, a basic requirement for a net zero home, is close to \$18,000. Obviously, those costs are passed along to the consumer and can have a significant impact on the pool of eligible buyers.

Additionally, recent research has found that taking steps toward achieving near-zero carbon consumption will increase a renter or homeowner's monthly costs from \$55 to \$311. Most potential home buyers and those who are renovating or upgrading their existing homes do not have the financial resources to cover such exuberant costs.

At the end of the day, stricter construction standards and mitigation comes with a price tag. Regardless of the level of benefit, the benefit must be obvious to the homeowner in the form of reasonable paybacks in energy, insurance premiums, or other savings, and some entity must provide the upfront funding required to conduct the construction or mitigation activities or they will not occur.

This is where the challenge lies for most consumers and homeowners. Just because more stringent codes or pre-disaster mitigation may provide a benefit doesn't mean it can or will be implemented. While the increased funding from the Disaster Recovery Reform Act of 2018 (DRRA) can help, because most of these sources have been consistently oversubscribed and target the highest risk structures, it is unlikely they will be able to fully serve the array of mitigation needs associated with existing housing. New sources, avenues and incentives must be found to make upgrades and overall housing more affordable.

Options to Improve Resiliency and Energy

There have been a number of legislative proposals, regulatory suggestions and strategy recommendations about ways to make our buildings cleaner and more resilient. Most have focused on increasing mandates and creating funding streams or other incentives. Few have centered on facilitating or recognizing voluntary efforts. NAHB strongly believes that incentives and voluntary, market-based programs are the only ways to meet these goals in a cost-effective manner. Further, given the significant improvements that can be gained from improving the existing building stock, NAHB strongly encourages Congress to focus on the highest risk areas and improving the older homes, structures and infrastructure that are less energy efficient and less resilient to natural disasters.

- *Federal Building Code Mandates Problematic*

Many have suggested that more stringent building codes or meeting mandatory energy requirements, such as net-zero, are the only answers to improving residential resiliency and energy efficiency. NAHB strongly disagrees, as both options are problematic, unnecessary and adversely affect housing affordability. Further, states traditionally have, and continue to take the lead on these issues, so federal intervention is not necessary.

- Modern Codes are Resilient

Building codes are designed to establish minimum requirements for public health and safety for commercial and residential structures. Although they have existed in various forms for decades, building codes in the United States achieved a milestone in 2000 when the three regional code organizations were consolidated into the International Code Council (ICC) and their codes were combined to create the first set of “I-Codes,” which were published in 2000.

Although there are other building codes available, the I-Codes are the most widely used model building codes, with some form of the International Building Code (IBC) adopted in all 50 states and versions of the International Residential Code (IRC) adopted in 49 states. The I-Codes are modified through a formal public consensus process every three years. This has resulted in the publication of a new edition in 2003, 2006, 2009, 2012, 2015 and 2018. Work has commenced on the 2021 version of the code and final votes will take place in the fall of 2019.

When the I-Codes were created, a number of major improvements were immediately made to the traditional building code requirements within the residential building code to address issues observed after Hurricane Andrew in 1992 and the California earthquakes of 1989 and 1994. Although additional improvements have been made since the I-Codes’ debut in 2000, the number of changes incorporated into the newer editions of the IRC that dramatically impact structural reliability and occupant life safety within residential structures have greatly diminished. In other words, the modern building codes (e.g., post-2000) have proven to be resilient and the need for triannual updates is not necessary for improved resilience.

Despite this, many believe that homes built following the “latest published edition” of the building code equate to more resilient homes, but that is not necessarily the case when compared to those built to previous editions of the IRC. Homes built to modern building codes—defined as any edition of the IRC—have been shown to be resilient. Evidence from FEMA and others demonstrate the IRC, throughout its history, has been very effective in preventing the destruction of homes due to various storms and earthquakes and significantly reducing damage to wall and roof coverings. Further, because many of today’s new homes are built with additional sustainable and high-performance building features, they are even more durable and resilient.

The successful performance of the IRC is also an indication of the “maturing” of building codes as they have gone through the iterative process of refinement since 2000. While tweaking the code to reflect technological advances will continue, it is clear that major changes aren’t as necessary as they used to be. Similarly, because the codes are nearing a point of diminishing returns in terms of the cost/benefit ratio, additional updates may not be cost effective. Homes can be built to withstand any disaster, but homes cannot yet consistently be built to withstand any disaster *and* be affordable. New homes built to modern codes are efficient. New homes built to modern codes are safe. New homes built to modern codes are resilient. There is no need to require adherence to the latest published edition of the code—especially if that is interpreted to mean the most recent version.

- Use of Latest Published Codes Problematic

A number of recent proposals, like those enacted in the DRRRA, are targeted at making buildings more resilient through various avenues, such as providing additional resources for the implementation of building codes post disaster, allowing certain funds to be used for code adoption and enforcement, and requiring repair and rebuilding of federally-assisted facilities to follow certain building codes. Many of these efforts are predicated on requiring the use of “latest published editions” of certain codes or standards. This is unnecessary and creates a number of challenges.

First, homes designed and constructed to the national model building codes are built to withstand damage from disasters and already provide substantial resiliency for many high-seismic, high-wind, heavy snow, wild-fire and flooding events while maintaining housing affordability. Because modern codes already are resilient, increasing the stringency is not necessary.

Second, it is not clear that this definition recognizes and accommodates the different risks, building technologies and landforms that occur across the country or specifically allows the model codes to be amended. State and local governments play a key role in the building code adoption process and

determining the value of and need for each model code requirement. This is done through a thorough consideration of the code's applicability within the jurisdiction, along with costs, technology, and resources, among other factors.

Because many states and local governments don't fit the mold of the national averages reflected in the model codes, they frequently find the need to amend the model codes prior to adoption. They do so by adding, removing, or revising provisions so that the codes better fit the construction practices and techniques, geography and risks, and economic and market conditions within the region. If they were unable to make these vital changes, state and local governments would be stuck trying to fit the square peg of national codes into the round hole that represents local conditions. Equally problematic, doing so would impose numerous unnecessary requirements on builders—requirements that translate into higher costs for buyers.

Third, each state and local government follows its own code adoption, implementation, and enforcement processes and has limited dedicated resources, which may not be conducive to adopting the latest published codes within expected timeframes. Evaluating and adopting a new building code is a time consuming and costly undertaking—a multi-step process that oftentimes requires state legislative, as well as administrative action.

Recognizing the level of effort required to update the codes, coupled with resource constraints and the controversial changes made to the codes in the past, many state and local governments have elected to follow a six-year or longer cycle for updating their building codes instead of a three-year cycle. In this way, they are able to maintain building safety without compromising their ability to oversee, administer and enforce the requirements or keep up with emerging technology.

Given these realities, mandating the adoption of the “latest published editions” creates an unintended disadvantage for many states and localities that, under other measures, would be considered fairly up to date in maintaining their codes (e.g., following a standard and predictable process and timeline).

- States are Already Taking the Lead

For decades, state and local governments have been responsible for evaluating each new edition of the model consensus-based building codes and determining which provisions are applicable within their borders. Some states make few changes to the model codes, others hand-pick the provisions and/or amend certain requirements, and others use the model code as a baseline to create their own state-specific code.

Under this rubric, Nevada is free to identify the risks it faces and adopt the codes that are best suited to its locale, geography and economic conditions, while North Carolina is able to do the same. In fact, the model codes are intended to be tailored and amendments are made to nearly every code that is adopted at the state or local level, whether it applies to only the administrative requirements or major rewrite of the entire document.

For example, North Carolina adopted its 2018 building codes based on the 2015 I-Codes on January 1 of this year with 38 pages of amendments. Similarly, Nevada adopts the building codes at the local level, but collaborates statewide on the amending process and had 14 pages of amendments on the residential code alone. State and local governments take their building code adoption and enforcement responsibilities seriously, as demonstrated by the time and effort spent on tweaking and tailoring the codes to get them right. Federal intervention into this process is neither prudent nor necessary. Any federal intrusion into this process could have a dramatic impact on each state's ability to implement the codes that best fit their jurisdiction. Likewise, federal mandates that impose building code requirements across the board will have similar unacceptable results. One reason the codes work is because they can be tailored to local conditions, market forces, and consumer wants and needs. A blanket mandate ignores these factors; a federal mandate is not needed.

- *Federal Energy Code Mandates Problematic*

Like structural building codes, more stringent federal building energy codes needlessly raise housing costs and fail to reduce energy usage in a cost-effective manner. Therefore, they are unnecessary.

- New Homes Are Efficient

New construction is more energy-efficient than existing construction because of better insulation, energy efficient appliances and HVAC equipment, among other improvements. For example, single-family detached

homes built in 2000–2009 on average used about 100.1 Btu per square foot of heated area per year, in contrast to 120.6 Btu for homes built in 1970–1979 and 135.4 Btu for homes built before 1950. Although the size of new homes has increased, the total energy used on heating and cooling has not, especially when newer homes are compared to homes built before 1950. With the growing interest in voluntary efforts to further reduce energy usage in new construction, overall consumption is likely to continue to decrease.

Despite these gains over time, new homes are still being targeted for increased energy efficiency. This makes little sense because savings will be minimal and doing so will create a host of new problems. The energy codes are nearing a point of diminishing returns in terms of the cost/benefit ratio, meaning that most updates will probably not be cost effective. Further, if policies are adopted that apply more stringent energy conservation requirements to new homes, the cost of these homes will significantly increase. This may encourage people to remain in older, less energy-efficient homes, which would result in higher energy usage, higher greenhouse gas emissions, and lower standards of living, among other impacts—all of which are contrary to the intended goals.

Energy efficiency policies must not inadvertently penalize new construction. Instead of relying on new homes to provide desired use reductions at a cost-prohibitive pace, Congress should focus on increasing the energy efficiency of the existing housing stock because this is where the real energy savings will occur.

- Net Zero is Impractical

Even more problematic than more stringent energy mandates would be any requirement for homes to meet net zero or near zero emissions or energy usage. The current demand for net or near zero energy homes represents a sliver of the housing market. Designed and built to produce as much energy as they consume, net zero homes require careful planning, which increases upfront design and engineering costs. Net zero design also creates further challenges because it uses passive techniques, such as orienting the house to take advantage of the sun for heating and cooling, which requires treating the home as a system instead of discrete elements. This requires additional thought and consideration because changing one aspect of the design may affect another part of the house and additional modifications may be required.

Equally challenging is that to achieve net zero, additional systems must be incorporated, such as solar photovoltaics (PV), solar hot water and special controls for heat pumps to maintain needed comfort levels. Other aspects typically include highly-efficient windows, lighting and appliances. While individually some of these installations may be workable from a cost standpoint, because achieving net zero energy generally requires the installation of most of them, the total costs can be prohibitive. In addition, some of the required elements do not work well in certain geographic regions, so requiring their installation and use would be nonsensical. As a result, mandating net zero or near net zero is extremely difficult, costly and impractical in most if not all of the country.

While NAHB has long been an advocate for energy efficiency codes that are cost-effective and affordable for home buyers throughout the nation, the energy codes are growing increasingly stringent, increasingly unworkable and marginally cost-effective, at best. Mandating adherence to overly burdensome requirements—particularly for new construction—adversely impacts housing affordability, disadvantages new construction, and may not yield the intended results.

NAHB strongly discourages Congress from including mandates, such as building codes or meeting a net zero standard as solutions toward a clean economy. Building codes have little to offer in the form of emissions reductions and can impose significant costs on new home construction, supporting industries, and, ultimately, consumers. Likewise, any other federal initiatives that would impact where or how homes are built would be equally problematic.

State and local governments maintain primary authority over local land use and building practices and no federal policy should change that. In addition to maintaining their self-interests, these entities have the knowledge of local conditions, market and housing needs, risks and opportunities. Rather than impeding this proven system, Congress should support voluntary programs, retrofitting existing buildings, education and other policies aimed at encouraging

consumers to improve the performance of their homes and use energy more wisely.

- *Voluntary Programs Promote High Performance*

NAHB supports climate change mitigation programs that recognize and promote voluntary-above code compliance for energy efficiency and resilience in lieu of mandates because they provide choices, have been proven to produce results, show value to consumers and are cost-effective. In other words, they are driven by the market. NAHB continues to lead the industry in developing and providing solutions to facilitate and promote the use of voluntary means to update the housing stock.

- Respond to Market Demand

Because one size never fits most, it is important that builders, home buyers and homeowners have choices when it comes to finding strategies to reduce energy usage or increase the resiliency of their homes. As such, one reason NAHB strongly opposes federal mandates is because they fail to take into account the needs or desires of consumers and others, and typically lack the flexibility needed for realistic, widespread application. Flexibility allows builders to choose the specific efficiency component(s), program or green certification that best suits their needs and the desires of the home buyers based on their ability to afford and willingness to pay. In other words, having options versus requirements allows the market to function as intended.

As a result, voluntary, above-code programs such as ENERGY STAR for homes, DOE's Better Buildings program, the ICC700 National Green Building Standard, Leadership in Energy & Environmental Design (LEED) Resilient Design Pilot credits, RELi 2.0 pilot, FORTIFIED Home and the U.S. Resiliency Council (USRC) rating all have widespread participation.

Numerous similar initiatives have also been successful and many homeowners voluntarily take steps to improve their home's performance on their own. The popularity of these programs has led to proven track records in reducing energy usage and/or improving home resiliency. For example, over 190,000 units have been certified to the ICC 700 National Green Building Standard to date; more than 98,000 ENERGY STAR certified single-family homes and multifamily units were built in 2018 alone, for a total of nearly 2 million homes since 1995; and 10,700 homes have the FORTIFIED designation.

In addition to increasing resiliency and energy efficiency in residential structures, these programs provide value to consumers through decreased energy bills, insurance discounts, peace of mind and other benefits. The many choices also allow stakeholders to pick and choose the specific elements that fit their needs and budgets, which make voluntary alternatives inherently cost-effective. Consumers are taking notice. NAHB's recent What Home Buyers Really Want survey found that energy-saving features, such as ENERGY STAR appliances, windows and whole house certification are among the most-wanted home features. Clearly, voluntary, above-code federal programs that allow for competition and choice in the market are in demand and thriving. The broad participation in these programs demonstrate that mandates are unnecessary and Congress should not upset this established market.

- Provide Cost-Effective Options

NAHB continues to lead the way to improve energy efficiency and resiliency in the residential sector for new and existing homes through two specific efforts—the ICC 700 National Green Building Standard and the Retrofit Tech Notes.

In 2008, seeing the value of providing our members and others with a measurable and recognized way to build sustainable homes, NAHB launched the development of a green building standard for residential buildings, now known as the ICC 700 National Green Building Standard (NGBS). The NGBS is an affordable yet rigorous standard that applies to all types of residential buildings, from single-family homes to multifamily buildings of all sizes, retrofits and land development. It focuses on energy efficiency, water conservation, resource conservation, indoor environmental quality, site design and homeowner education and is the basis of a national certification program administered by the Home Innovation Research Labs.

This rigorous certification requires buildings to improve in every category to achieve a higher certification level. The NGBS is also the first and only residential green building standard approved by the American National

Standards Institute (ANSI), which guarantees that the NGBS was developed using a true consensus process.

The NGBS continues to evolve and is updated on a continuous basis to quickly respond to new solutions and innovations in design, materials, technologies, commissioning, building operation strategies, market preferences, financial transactions, etc. The NGBS is directly tied to the national building codes published by ICC to ensure compatibility and seamless implementation by all stakeholders, including developers, designers, jurisdictions and building operators. The upcoming 2020 edition of the NGBS is expected to be released in early 2020. The NGBS has proven to be a useful and relied-upon voluntary option for green building and increasing energy efficiency and resiliency in the residential sector.

Although the NGBS can be used for retrofits, many households do not have the interest or means to conduct the larger scale renovation projects to which the NGBS may apply. Recognizing this challenge, NAHB, in concert with FEMA, the International Code Council, and the Insurance Institute for Business & Home Safety, is developing a series of Tech Notes that describe different types of retrofit techniques that can be used to increase the resiliency of existing buildings.

Importantly, these will focus on strategies that require minimal costs (preferably less than \$1,000 for a typical home) but have a significant impact on reducing damage.

The first six topics include sealed roof decks, attachment of roof coverings, flashing and sealing of roof penetrations, use of hurricane shutters, use of impact resistant doors and methods of preventing ice dams. It is hoped that these new resources will help homeowners understand their options, recognize that certain mitigation options can be cost effective, and compel them to take action. The first set of Tech Notes is scheduled to be completed by early 2020.

NAHB continues to demonstrate its commitment to increase the performance of homes through the development of these resources. We strongly urge Congress to recognize and promote voluntary, market-driven, and viable green building, high performance and resiliency initiatives. Unlike mandates, these programs can promote lower total ownership costs through utility savings as well as provide the flexibility builders need to construct homes that are recognized as being cost-effective, affordable and appropriate to a home's geographic location.

- *Incentives are Crucial to Success*

Incentive programs that offset the increased costs for above-code and mitigation activities are an important tool to reduce the barriers that many energy efficiency and resiliency opportunities pose and encourage more homeowners to invest in home modernization. For example, due to the high initial costs associated with purchasing and/or installing certain energy efficient features, many homeowners are unable to finance desired or necessary upgrades and, without assistance, would likely forego the improvements. Incentives that are available at the federal and state levels, as well as those that could be offered through the real estate valuation and transaction processes, can address this issue, produce results and have proven to be attractive alternatives to mandates.

- *Federal Incentives*

Congress has taken a number of steps to alleviate the challenges associated with funding retrofits and energy efficiency upgrades. The most prominent are federal funding for pre-disaster mitigation and tax incentives.

The DRRRA includes a number of actions related to improving the ability of existing structures to withstand catastrophes, including the creation of the National Public Infrastructure Pre-Disaster Mitigation Program. States and tribal governments that have received a major disaster declaration in the past seven years will be eligible to competitively apply for these grants, which estimates suggest could range from \$800 million to \$1 billion annually. NAHB asserts that increasing the resiliency of the existing housing stock would be a prudent use of this funding stream.

Tax incentives are also a proven way to realize results and, in fact, are the most effective at advancing energy efficiency improvements. Sections 25C for qualified improvements in existing homes (building components), 45L for new homes and 179D for commercial buildings have permeated the market and assisted many families and building owners to invest in efficiency. Not only does this reduce energy consumption, NAHB estimates that for every \$100,000 spent on remodeling, 1.11 full-time equivalent jobs are created. The remodeling activity generated by the 25C tax credit in 2009 was associated with over 278,000 full-time jobs. Unfortunately, be-

cause these tax incentives keep expiring and being retroactively renewed, the positive impact of these incentives has decreased since 2011. Continuing and expanding programs like these, which have demonstrable results, will compel more homeowners to take positive actions.

- State Incentives

States can also play a role in enticing positive behavior. One alternative that has been used in several states is providing insurance discounts to homeowners who conduct specific activities. In Texas, the state's hurricane insurance pool, the Texas Windstorm Insurance Association, offers premium discounts of 19 percent to 33 percent for building code compliance. In Rhode Island, insurers are required to waive the hurricane deductible for insured homeowners who voluntarily implement mitigation measures that are specified in the insurance regulation. In Alabama, tax credits of up to \$3,000 are available for retrofitting a taxpayer's legal residence to make it more resistant to hurricanes, tornadoes, other catastrophic windstorm events, or rising floodwaters.

In addition, the Alabama State Legislature established the Strengthen Alabama Homes Act in 2011 to provide grants to qualified homeowners to retrofit their homes to reduce property damage caused by hurricanes or other catastrophic windstorm events. Currently, the response to the program has been so overwhelming that the program administrator has temporarily stopped taking new grant applications.

Clearly, these state programs have proven to be popular, as they provide value through loss reduction, yet enable and facilitate broader participation through reduced costs. The recognition and expansion of programs like these is one way to engage participation while offsetting the hefty costs associated with upgrades.

- Other Incentives

There are a number of other opportunities to facilitate, incentivize, and offset the costs of voluntary above-code construction and/or pre-disaster mitigation that could be achieved through public-private partnerships and other collaboration. These options include modifications to property valuation and financing protocols; loans, grants and other funding programs; and insurance premium reductions within the National Flood Insurance Program (NFIP), among others.

Under current practice, in most instances, mortgage companies, appraisers and real estate professionals do not consider the costs or benefits associated with various resiliency or energy efficiency upgrades. This creates a disincentive to take proactive steps to reduce a home's exposure, as those expenditures are not necessarily considered to add value. If the improvements are not included in the appraisal or appraised value of the structure, not only is the buyer uninformed about the home's qualities, his or her willingness to pay more can be significantly diminished.

In an effort to spur private investment in efficiency and resiliency, the value and benefit of above code practices and mitigation measures should be incorporated into standard real estate lending practices and real estate listings. By recognizing and valuating the upgrades, appraisers can consistently give weight to these improvements, lenders may reconsider qualifying loan ratios, realtors can promote their benefits, homeowners would get assurances that the investments they have made will retain value and be recognized in resale and homes would be more likely to get the upgrades needed to improve their performance.

Similar to the valuation process and state insurance discounts, recognizing improved resiliency can also be done by tweaking the NFIP. Currently, all improvements to fortify a home against flood hazards do not result in flood insurance premium discounts. For example, in its "Reducing Flood Risk to Residential Buildings That Cannot Be Elevated" document, FEMA outlines several alternative actions that can be taken in lieu of elevation. Of the measures discussed, however, only 50 percent of them are eligible for flood insurance premium reductions.

This limitation clearly registered with homeowners because FEMA's Office of Flood Insurance Advocate, in its 2017 Annual Report, identified customer frustration with the inability to obtain reduced premiums after conducting certain mitigation activities as a problem. More confounding is the fact that some of the projects identified in the report were undertaken through a qualified FEMA Hazard Mitigation Assistance grant. Clearly, changes to the NFIP that recognize, allow and credit homeowners who take

any of the suggested steps (and others) could go a long way toward improving resiliency.

Incentives are a proven way to drive efficiency and improve home performance while preserving housing affordability. Congress is urged to retain and expand the current offerings and work collaboratively with state and local governments and the finance, insurance and real estate industries to offer additional ways to recognize and offset the increased costs associated with many energy efficiency and resiliency designs, techniques and construction practices.

Conclusion

NAHB is committed to working as a partner with all levels of government to encourage energy efficiency and resilience. However, housing affordability cannot be jeopardized in the process. NAHB urges Congress to focus on solutions that are market driven, such as above code voluntary programs and other incentives, and to focus on increasing the energy efficiency and resiliency of the existing housing stock. Any federal mandates or further push to require the adoption of more stringent building codes is unnecessary, may not achieve the intended results and will prevent healthy competition in the marketplace. NAHB looks forward to working with the committee to find reasonable ways to increase community resilience and move the nation to a clean energy economy.

Ms. CASTOR. Thank you very much.

Dr. Shahyd, you are recognized for 5 minutes.

STATEMENT OF KHALIL SHAHYD

Dr. SHAHYD. Thank you, Chair Castor, Ranking Member Graves, and distinguished members of the select committee. Thank you for holding this hearing and for the opportunity to testify.

My name Khalil Shahyd. I am a senior policy advocate with the Natural Resources Defense Council, which is part of Energy Efficiency for All, or EEFA. We are a national partnership working to bring awareness to and increase energy-efficiency services in affordable multifamily housing. Affordable housing is generally defined as spending less than 30 percent of household income on housing.

America is being confronted today with two existential crises, and how we respond will determine the type of Nation we are for generations to come. They are the climate crisis and the increasing cost of housing. And these two issues are absolutely linked, creating extreme burdens for households and families across this country. These include renters, female-headed households, the elderly, African-Americans, and other communities of color.

Often, low-income and vulnerable households have very few housing options. They are left to rely on low-quality housing due to residential segregation, long-term neighborhood disinvestment, and deferred maintenance to the housing stock. These homes tend to waste energy so that low-income families pay more per square foot for energy than higher-income residents.

The result is that nearly one-third of households in the U.S. struggle to pay energy bills. And, in fact, one in five households have been forced to choose between buying food, medicine, or other necessities over paying an energy bill.

As if this were not enough, Americans are increasingly facing the prospects of dealing with major weather disasters such as hurricanes, flooding, wildfire, and other climate-related emergencies that place vulnerable housing stock at risk of destruction. And that leads to displacement and destabilization of families and communities.

To avert the worst impacts of climate change, our policies must ensure both the reduction of emissions that cause climate change and that people can live in safe, affordable housing.

With decisive leadership, Congress can address the dual crises of affordable housing and climate change while helping to produce hundreds of thousands of new clean jobs and alleviate the negative health impacts of indoor and outdoor air pollution.

NRDC's report, "America's Clean Energy Frontier," shows that we can reduce carbon emissions by at least 80 percent by 2050, with fully half coming from energy efficiency. This means that energy efficiency is absolutely critical to achieving U.S. emissions-reduction goals and doing so in an affordable manner.

Consider that residential energy efficiency is the largest single measure that can reduce climate pollution in the U.S. Along with cutting pollution and reducing energy bills, efficiency has considerable health and safety benefits, including improved indoor air quality, which reduces the likelihood of asthma.

And we have a report coming soon that shows that retrofitting America's affordable multifamily housing can create hundreds of thousands of local jobs that can't be outsourced. Already, energy efficiency accounts for more than 2.2 million jobs nationally. That is 10 times more than oil and gas drilling and 30 times more than coal mining.

There are two major programs that fund energy efficiency and affordable housing at the Federal level, and both need more resources from Congress. There are also several pending pieces of legislation that could help, but, in the interest of time, let me focus for a minute on the Department of Energy's Weatherization Assistance Program.

Every year, the program's efficiency improvements help reduce energy costs for thousands of low-income families, cutting America's climate pollution by 2 million metric tons. In total, residential energy-efficiency improvements can account for carbon reductions as high as 550 million metric tons every year by 2050.

Unfortunately, there are many barriers to increasing energy efficiency in the Nation's affordable housing, but Congress can help. Despite the considerable need for efficiency improvements in low-income housing, many programs that facilitate retrofits are sorely underfunded. Across the country, only about 35,000 homes can enroll in the Weatherization Assistance Program on a yearly basis, and the maximum per-unit expenditure is only about \$6,000. That is not enough.

There is not a State in the country where there isn't a waiting list for services that is not extremely long, sometimes years, for the Weatherization Assistance Program. For example, at the current rate, it would take Ohio almost 150 years to weatherize all currently eligible homes.

The cost of regular maintenance and upgrades for multifamily housing are among the most significant barriers to preserving affordable, quality homes for low-income households. Without attention, the properties deteriorate. Federal action is needed to incentivize investments in hard-to-reach sectors of the housing markets. Without it, there will be greater inequity and greater costs to families who are least able to afford it.

We have a housing affordability crisis in America. Millions of affordable rental homes have already been lost, demolished because housing providers could not afford the cost of maintaining those buildings. Much of the remaining affordable rental homes are aging and in need of repair. The escalating climate crisis will only worsen this situation.

Energy efficiency can help bridge the growing gap between renter incomes and rising housing costs. And retrofitting existing housing can preserve and expand the affordable housing stock for low-income tenants. Energy efficiency can be a win for everyone, but Congress needs to act. And we hope this committee can help.

Thank you.

[The statement of Dr. Shahyd follows:]

Testimony of Khalil Shahyd

**Senior Policy Advocate, Health People/Thriving Communities Program,
Natural Resources Defense Council**

**Before the U.S. House of Representatives, Select Committee on the Climate
Crisis**

Solving the Climate Crisis: Cleaner, Stronger Buildings

October 17, 2019

Chair Castor, Ranking Member Graves, and distinguished members of the Committee; thank you for holding this hearing and for the opportunity to testify today on the critically important topic of “solving the climate crisis: cleaner, stronger buildings”.

My name is Khalil Shahyd, I am a Senior Policy Advocate with the Natural Resources Defense Council (NRDC). NRDC is an international, non-profit environmental organization representing more than three million members and online activists. Since 1970, our environmental experts have worked to protect the world’s natural resources, improve public health, and ensure a safe and sustainable environment for all.

NRDC’s top institutional priorities include advocacy to avert the worst consequences of climate change, creating a healthy environment and clean jobs by scaling up clean energy and increasing investments in energy efficiency.

NRDC has a long history of engagement on federal and state energy efficiency standards as a key policy to lower energy bills, improve indoor air quality and reduce greenhouse gas and other forms of pollution. Since 2014, we’ve worked with the *Energy Efficiency for All* (EEFA) coalition partnering with leaders and advocates across the nation to ensure that utility rate-payer-funded energy efficiency programs respond to the needs, potential and benefits of increased energy efficiency investments in the affordable multi-family housing sector.

EEFA unites people from diverse sectors, including housing, health, energy efficiency, environmental, and community advocacy organizations, that have not typically worked together in the past to collectively make multifamily affordable homes energy and water efficient. Our national includes the National Housing Trust, Elevate Energy, Natural Resources Defense Council and the Energy Foundation as well as nearly 50 state and community-based organizations.

What began as a project involving eight state-level partnerships has now grown to twelve states and an expanded network of leaders and practitioners in the Network for Energy, Water, and Health in Affordable Buildings (NEWHAB). NEWHAB is a platform for coalition members and diverse sector leaders to convene, learn from one another, and develop collective solutions to increase access to healthy and affordable homes.

Together, our coalition partners work to ensure that utility, state, local, and federal entities provide equitable investment to improve the efficiency of affordable multifamily homes; advance proven best practices in efficiency program design and implementation to help meet the needs of affordable housing building owners and residents; and advocate for policy solutions to ensure that non-toxic, healthy building materials are used in all home improvements. EEFA’s advocacy has led to nearly \$500 million in new confirmed and expected funding for efficiency upgrades and

19 new or improved energy efficiency programs that specifically serve affordable multifamily housing. More than 100,000 affordable apartments have received upgrades via these programs, benefitting an estimated 200,000+ low-income renters.

Congressional action to address climate change can deliver positive benefits for the environment and people, with targeted policies to ensure safe, healthy and energy efficient affordable housing. Benefits including:

- Preserving affordable housing
- Lowering household energy cost
- Improving indoor air quality and health outcomes
- Creating jobs with career opportunities for workers

Why energy efficiency?

Many households in the United States are currently experiencing a dual crisis related to the affordability and quality of residential housing. Nearly two-thirds of renters nationwide say they can't afford to buy a home, as home prices are rising at twice the rate of wage growth while more than 11 million Americans (roughly the population of New York City and Chicago combined) spend more than half their paycheck on rent.¹

The legacy of housing discrimination, redlining and disinvestment also exacerbate the housing burden for low-income families, which often face few options but to rely on inadequate or lower quality housing to secure their families. Many low-income and vulnerable households have few residential options but to rely on low-quality housing due to residential segregation, long-term neighborhood disinvestment and deferred maintenance of the housing stock. These homes tend to be energy inefficient, impacting the stability of many families due to high utility bills and recurring illnesses from inadequate indoor air quality. Struggling families sometimes spend more than 20 percent of their incomes on electricity and heat—far more than the national average of 2.7 percent and nearly one-third of households in the United States have struggled to pay their energy bills, while about one in five households had to choose between purchasing food, medicine or other necessities to pay an energy bill.²

Poor ventilation can cause homes to be drafty in winter and allow in moisture in summer that leads to mold and illness. Poor construction and inefficient appliances leave families unable to safely maintain comfortable temperatures, leaving them further vulnerable to illness or potentially deadly accidents. In fact, 79 percent of fatal home heating fires are started by space heaters or stoves used when home heating systems are inadequate or malfunctioning.³

In addition, rising energy costs place an additional burden on families that have little flexibility in their household budgets to meet their needs. According to the U.S. Energy Information Administration (EIA), retail residential electricity rates (the amount one pays per kilowatt-hour, or *c/kWh*) have risen across the nation at a rate of about four percent on average over the last 10 years—faster even than the rise in average rent cost. Climate change will likely exacerbate these trends, as average temperatures rise and unpredictable weather gives rise to greater extremes of both hot and cold. Because of these and other factors, the use of energy at home imposes costs and consequences that vary significantly based on where one lives.

Rural Energy Burden

These burdens are particularly acute for rural households. Across the nation over a quarter of all rural low-income households devote more than 10 percent of their income to energy expenses.⁴ That's a significant expense, and for a household it often means deciding between keeping heat or lights on versus paying rent, buying food or paying for medicines or school supplies. Such high energy burdens increase the likelihood that these households will see their utility services shut off at some point. Once shut off, additional fees increase the cost of reestablishing service, and inability to pay can lead to arrears that damage credit ratings, making reopening services or even qualifying for better housing difficult or impossible.

Due to the lower densities of the population over wider areas, the cost of delivering energy and energy efficiency services to rural households is on average higher than for their urban counterparts. Rural communities are more likely to be serviced by smaller rural coops or publicly owned utilities that may lack the capacity or re-

¹ <https://www.curbed.com/2019/5/15/18617763/affordable-housing-policy-rent-real-estate-apartment>.

² <https://www.eia.gov/todayinenergy/detail.php?id=37072>.

³ <https://www.nfpa.org/News-and-Research/Data-research-and-tools/US-Fire-Problem/Heating-equipment>.

⁴ <https://www.energyefficiencyforall.org/resources/the-high-cost-of-energy-in-rural-america-household-energy-burdens-and/>.

sources to invest in comprehensive energy efficiency programs. Consequently, rural energy costs are vastly higher than the national averages and higher than in metro areas.

Rural families are caught in a vise, since they are also more likely to be impoverished while facing higher costs. Approximately 43 percent of households in rural areas have incomes below 200 percent of the federal poverty level, increasing vulnerability to high energy burdens. Low incomes, high energy use, non-ownership status, and inefficient housing stock are some of the key drivers of high energy burdens, which can place significant financial stress on families and other households.

Rural households are also much more likely to live in manufactured housing than their urban counterparts. More popularly known as mobile homes—which are built in a factory, transported to a site on a flatbed truck, and installed on-site—manufactured housing tends to be less energy efficient and more costly to repair than traditional homes. About 20 percent of all rural households live in manufactured homes, making provision of energy efficiency services costlier and less likely to happen.

Urban Energy Burdens Highest for Low-Income Renters and Households of Color

Similarly, low-income households in large metros pay 7.2 percent of household income on utilities—more than twice as much as the median household and three times as much as higher income households who often have the luxury to live in more modern and energy efficient homes.⁵

Affordability is a particularly acute challenge for renters in multifamily buildings, where close to 50 percent of our nation's low-income renters—nearly 10 million people, live.⁶ Almost half of these residences were built 50 years ago. Energy cost and energy related maintenance cost in multifamily housing, including public housing are usually the highest recurring expenditure to maintain affordable, quality homes. In fact, low-income households—in affordable multifamily buildings—spend, on average, 7.2 percent of their income on utility bills, which amounts to about \$1,700 annually out of a median household income of \$25,000. That is more than triple the 2.3 percent spent for electricity, heating and cooling by higher-income households. Increasing energy efficiency in these homes could cut electricity use as much as 32 percent.⁷

When viewed by race/ethnicity, communities of color are more burdened by energy cost than white families. Poverty and discrimination in rental and housing markets drive low-income households and people of color into older, less efficient buildings leading to higher energy costs. As a result, African-American households experienced a median energy burden 64 percent greater than white households, and Latino households had a median burden 24 percent greater than white households.

Meanwhile, Memphis had the highest energy burden for low-income households, with residents spending, on average, 13.2 percent of their income for energy. The median annual income for low-income residents of Memphis is \$19,157, meaning that a family would be paying a whopping \$200 a month (\$2,400 a year) for energy to keep the lights on and their homes comfortable.

In fact, in 17 of the nation's largest cities, a fourth of low-income households experienced an energy burden greater than 14 percent.

⁵ <https://www.energyefficiencyforall.org/resources/lifting-the-high-energy-burden-in-americas-largest-cities-how-energy/>.

⁶ http://www.jchs.harvard.edu/sites/jchs.harvard.edu/files/jchs_americas_rental_housing_2013_1_0.pdf.

⁷ <https://www.energyefficiencyforall.org/resources/potential-for-energy-savings-in-affordable-multifamily-housing/>.

TABLE ES1. Median income, utility bill, energy burden, and unit size for households based on income type, building type, building ownership, and household race for groups across all metro areas

	Household type	Median annual income	Median size of unit (square feet)	Median annual utility spending	Median annual utility costs per square foot	Median energy burden ¹
Income type	Low-income ² (≤80% AMI) ³	\$24,998	1,200	\$1,692	\$1.41	7.2%
	Non-low-income	\$90,000	1,800	\$2,112	\$1.17	2.3%
	Low-income multifamily (≤80% AMI)	\$21,996	800	\$1,032	\$1.29	5.0%
	Non-low-income multifamily	\$71,982	950	\$1,104	\$1.16	1.5%
Building ownership	Renters	\$34,972	1,000	\$1,404	\$1.40	4.0%
	Owners	\$68,000	1,850	\$2,172	\$1.17	3.3%
Head of household race	White	\$58,000	1,600	\$1,956	\$1.22	3.3%
	African-American	\$34,494	1,290	\$1,920	\$1.49	5.4%
	Latino	\$39,994	1,200	\$1,704	\$1.42	4.1%
All households	N/A	\$53,988	1,573	\$1,932	\$1.23	3.5%

¹ Energy burden is the percentage of household income that is spent on energy bills. To calculate median energy burden, we calculated energy burden for all households and then took the median. This value differs from the median energy burden that is calculated using median annual utility spending and income.

² Low-income includes both single- and multifamily households. ³ Area median income (AMI) is the median dollar amount that divides the population into two equal parts.

Source: American Housing Survey (Census Bureau 2011 and 2013a).



Low income households and affordable housing owners face a multitude of barriers when making efficiency investments including: “split incentives” and the need for upfront financing to pay for upgrades. Where renters pay energy bills but owners make investments in durable equipment in the building, neither party can fully capture the benefit of an investment in energy efficiency leading to the split incentive. Since these tenants are more likely to move, they have less incentive to spend their own money on efficiency since they will not enjoy the benefits of long-lived investments. Low income households, including most renters, have little surplus in their budget to pay for the upfront cost of energy efficiency upgrades.

Thankfully there are solutions to these huge burdens. Reducing the cost of energy through increased efficiency and regular maintenance that can improve residential energy performance by reducing energy consumption can help to preserve the long-term affordability of homes.

Federal Programs Falling Short of the Need

Federal support for energy efficiency through programs such as the U.S. Department of Energy’s Weatherization Assistance Program (WAP) have played an important role establishing the techniques and technologies used by energy efficiency professionals across the home performance sector.⁸ The creation of WAP has led to the establishment of workforce training centers, best practices and the deployment of adoption of more advanced energy audits and diagnostic equipment to assess home energy performance.⁹ However, despite the considerable and persistent need for energy efficiency improvements in low income housing, many programs that facilitate retrofits are sorely underfunded. Across the country, only about 35,000 homes can enroll in WAP on a yearly basis with a maximum per unit expenditure of just over \$6,000. Not enough to achieve the type of savings through whole building retrofits that will be required. At the current rate of service provision, it would take the State of Ohio roughly 150 years to weatherize all the homes currently eligible for the Department of Energy’s Weatherization Assistance Program.¹⁰

⁸ <https://www.energy.gov/eere/wipo/weatherization-assistance-program-history>.

⁹ *ibid.*

¹⁰ Dave Rinebolt, Executive Director and Counsel at Ohio Partners for Affordable Energy; “comments during a panel discussion on the Multiple Benefits of Federal Energy programs”.

Benefits of Action

Preserving Affordability of Housing

The cost of regular maintenance and upgrades for multifamily housing are the most significant barriers to preserving affordable, quality residential housing for low-income families. As negligence and neglect inflate the cost of repairs, federal action will be required to incentivize investments in hard to reach sectors of the housing market. Failure to act will ultimately result in greater inequity and greater costs to local and state budgets. According to a recent report by the Green and Healthy Homes Initiative; “Investments that address social inequities in housing, energy and health are necessary to produce greater affordability, housing stability, energy security, resiliency, health equity and social justice for all Americans”.¹¹

Without needed support for reinvestment in and preservation of existing affordable housing, we run the risk of exacerbating the affordable housing crisis. Millions of affordable rental homes have already been demolished because housing providers could not afford the cost of maintaining the buildings. Much of the nation’s remaining affordable rental homes are in buildings that are aging and in need of repair. Climate change, and climate induced disasters from hurricanes, flooding or fires risk further damage to homes critical for enabling access to affordable housing to America’s low-income families.

Improving the energy and water efficiency of buildings is an essential strategy to preserve existing affordable rentals. Efficiency upgrades can result in significant financial savings to the property by lowering operating expenses that can be reinvested in property improvements. The saved financial resources for building owners can be used to replenish reserves that are set aside for future building repair needs, and/or free up capital to offset potential rent increases. There are several ways that efficiency upgrades can help to preserve affordable housing by improving the financial stability of the property;

1. Utility bills can comprise up to a fifth of operating expenses in multifamily affordable homes and often are the largest controllable, variable expense.
2. Replacing older building equipment with new, more efficient equipment can result in lower maintenance costs.
3. Savings from efficiency upgrades improve the cash flow of the property, which can then be used to leverage additional debt financing that can be reinvested to make other capital improvements to the building.

Lowering Energy Cost for Renters

Energy efficiency investments provide a critical cross sector opportunity to stimulate multiple household and societal benefits. First, weatherizing a home for low-income families offers numerous benefits. Weatherization saves an average of \$283 per year for families living at or below 200 percent of the federal poverty level—which is just over \$12,000 for a single person household and \$25,000 for a four-person household. Households residing in rural manufactured homes would see savings of \$458 per year or more than one-quarter of their energy bill and a full 1.5 percent of their household income. Rural renting, low-income, elderly, and non-white families would all save over \$100 per year if they had the same utility costs per square foot as the metropolitan median household.

Investing in energy efficiency is the most cost-effective path to reducing the demand for energy, thus reducing the amount families need to spend on energy services. If we were just able to bring the low income and low-income multifamily housing stock up to the efficiency of the median household in our largest cities, we would eliminate at least 35 percent of the excess energy burden these families face. The average family could save as much as \$300 annually on utility bills in addition to improvements in health, comfort and safety.

Health Benefits of Energy Efficiency

Direct energy savings benefits to households from efficiency are just one potential benefit from efficiency upgrades. Improving the energy efficiency of homes when coupled with actions addressing social determinants of health and prioritizing the use of healthy building materials can provide a number of “non-energy” health benefits to households.

Energy efficiency measures can improve indoor air quality by reducing criteria air pollutants such as carbon monoxide, lead, ground-level ozone, nitrogen dioxide, par-

¹¹ https://assets.ctfassets.net/ntcn17ss1ow9/2CMLkZBwL3n37tfwNfqWS/e5dc2cfc9d74f6a39b5149f922707583/AchievingHealth_SocialEquity_final-lo_0.pdf.

ticulate matter, and sulfur dioxide.¹² Persistent exposure to these pollutants can increase the likelihood of cardiovascular disorders, respiratory illness and risk of carbon monoxide poisoning. In addition, outdoor particulate matter (PM) can enter a home through cracks and gaps in the doorways or walls but also through open windows and HVAC systems.

In Washington State, the Department of Commerce, who operates the state's weatherization program, incorporates asthma and Chronic Obstructive Pulmonary Disease (COPD) among the outcomes administrators would use to measure program achievements. The Weatherization Plus Health program, partnering with local public health organizations to assist in recruitment and assessment served more than 500 families across the state of Washington and is expanding to provide services to more households.¹³

Residential Energy Efficiency Creates Jobs

In addition to the health and cost saving benefits of investing in energy efficiency, there are job¹⁴ and economic development¹⁵ benefits that provide opportunities for families. For every dollar invested in energy efficiency for low income families, two dollars are put back into the economy through energy savings and increased income from job creation. In fact, energy efficiency is a labor-intensive industry that already accounts for more than 2.2 million jobs across the nation. Ten times more than oil and gas drilling, and thirty times more than coal mining.

These include direct jobs for contractors hired to implement efficiency measures in the home, indirect "supply-chain" jobs generated from the purchase and provision of the materials required to complete the projects, and the final boost in economic activity from the increased combined expenditure of job related income for contractors and energy cost savings for families who receive the services.

A soon to be released report by EEFA on the job potential in retrofitting affordable multifamily housing found that more than 700,000 jobs can be created by deploying energy efficiency upgrades in eleven states with active EEFA coalitions.

Environment and Climate Benefits of Energy Efficiency

Finally, boosting energy efficiency also means we avoid the cost of building out expensive energy infrastructure like power plants and transmission lines, reducing the nation's energy-related utility costs.

Further, everyone's health improves when we reduce the amount of hazardous mercury, sulfur dioxide and particulate matter spewing out of power plant smokestacks and furnaces.

NRDC's 2018 analysis and report, *America's Clean Energy Frontier: The Pathway to a Safer Climate Future*, shows that the U.S. economy can reduce carbon emissions by at least 80 percent by 2050, with fully half of those savings coming from energy efficiency. This means that maintaining and accelerating energy efficiency improvements is absolutely critical to achieving U.S. emissions reduction goals and doing so in an affordable manner. Aggressive deployment of energy efficiency technologies and system-wide energy efficiency services will be needed across all economic sectors, to slash our energy demand by 40 percent.

The residential sector has a key role to play in meeting those goals. Residential energy efficiency is the largest single measure source of potential carbon reduction in the nation.¹⁶ Every year improvements undertaken through WAP alone cuts America's climate pollution by two million metric tons.¹⁷ In total, **residential efficiency can account for as much as 550 million metric tons of CO₂ equivalent emissions reductions annually by 2050** (equal to the combined electric power emissions of California, Texas, New York, Florida, Illinois, and Virginia in 2016).¹⁸

We need Congressional leadership to realize these benefits

To avert the worst impacts of climate change, our policy must ensure both the reduction of emissions that cause climate change and also support people's capacity to adapt and thrive in a post carbon world. In order to act on climate change while also addressing the threat of rising inequality, we must accelerate action on all fronts and in particular create a more supportive policy environment for affordable

¹² <https://www.epa.gov/criteria-air-pollutants>.

¹³ <https://www.commerce.wa.gov/growing-the-economy/energy/weatherization-and-energy-efficiency/matchmaker/weatherization-plus-health-wxh/>.

¹⁴ <http://aceee.org/files/pdf/fact-sheet/ee-job-creation.pdf>.

¹⁵ <https://www.iea.org/newsroom/news/2014/september/energy-efficiency-a-key>.

¹⁶ <https://www.nrdc.org/resources/americas-clean-energy-frontier-pathway-safer-climate-future>.

¹⁷ <https://energy.gov/eere/articles/celebrating-40-years-america-s-weatherization-assistance-program>.

¹⁸ <https://www.nrdc.org/resources/americas-clean-energy-frontier-pathway-safer-climate-future>.

housing and accelerate residential energy efficiency. We need Congressional action to lead our nation in its response to climate change and to realize the enormous benefits of these investments. Through decisive action, Congressional leaders can address the dual crisis of affordable housing and climate change, while producing hundreds of thousands of clean jobs and alleviating the negative health impacts of indoor and outdoor air pollution.

Addressing these core policy areas will enable affordable housing and low-income families to be engaged as partners in actions that contribute to meaningful emissions reductions by reducing household energy use and demand. Key policies congress should support toward these outcomes are;

Preserving Affordable Housing

- Expand the National Housing Trust Fund from \$367m now to \$3.5 billion/year. Affordable housing is in short supply across the country, and this is one of the newer sources of funding to improve it. The support can be used to reduce energy use and increase resiliency of housing, depending on state allocation plan requirements. But the need vastly outstrips the funding currently available.
- Support and utilize S. 1703 the Affordable Housing Credit Improvement Act (AHCIA)¹⁹ and S. 1288 the Clean Energy for America Act²⁰ to enable Low Income Housing Tax Credit (LIHTC) properties to take advantage of tax incentives available for energy efficiency investments.²¹ The LIHTC is the largest and most successful tool for creating and preserving affordable housing. The Clean Energy for America Act amends the Internal Revenue Code of 1986 to provide tax incentives for increased efficiency investments in retrofitting existing and new residential and commercial buildings.
- Support H.R. 4307, the Build More Housing Near Transit Act.²² The legislation would require major transit projects using Federal Transit Administration (FTA) New Starts capital investment grant funding to incorporate an evaluation of housing development near transit station areas as a part of the application process.

Lowering Household Energy Cost

- Support reauthorization of S. 983, the Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act.²³ This bill reauthorizes the DOE WAP, creates a new innovation fund for special projects.
- Support S. 185 the Investing in State Energy Act.²⁴ This bill would require that the Department of Energy (DOE) distribute funding appropriated for WAP and SEP by Congress to implementing agencies within 60 days.²⁵

Improving Indoor Air Quality and Health

- Support H.R. 3590, the Environmental Justice and Civil Rights Restoration and Enforcement Act.²⁶ This bill reinforces that Federal agencies are to comply and be held accountable to the Title VI Civil Rights Act and that disparities and outcomes shown to have disparate impact must be address through Environmental Justice actions.²⁷ This bill gives communities the legal tools to hold Federal agencies including the Environmental Protection Agency (EPA) accountable to unequal burdens.
- Support H.R. 3923, the Environmental Justice Act.²⁸ Requires Federal agencies to address environmental justice, to require consideration of cumulative impacts in certain permitting decisions, and for other purposes.

¹⁹ https://www.novoco.com/sites/default/files/atoms/files/sb_1703_ahcia_060419.pdf.

²⁰ <https://www.congress.gov/bill/116th-congress/senate-bill/1288/text>.

²¹ <https://www.novoco.com/notes-from-novogradac/using-energy-efficient-practices-preserve-affordable-homes>.

²² <https://www.congress.gov/bill/116th-congress/house-bill/4307/text>.

²³ <https://www.congress.gov/bill/116th-congress/senate-bill/983/cosponsors>.

²⁴ <https://www.congress.gov/bill/116th-congress/senate-bill/185/text>.

²⁵ <https://www.nrdc.org/experts/deron-lovaas/congress-must-pass-investing-state-energy-act>.

²⁶ <https://www.congress.gov/bill/115th-congress/house-bill/3590/text>.

²⁷ https://www.americanbar.org/groups/environment_energy-resources/publications/trends/2011_12/march_april/environmental_justice_title_vi_civil_rights_act/.

²⁸ <https://www.congress.gov/bill/116th-congress/house-bill/3923/text>.

Creation Jobs with Career Opportunities for Workers

- Support H.R. 4061, the Blue Collar and Green Collar Jobs Development Act.²⁹ Directs the Secretary of Energy to establish and carry out a comprehensive, nationwide, energy-related industries jobs program.
- Support H.R. 4148, the Green Jobs and Opportunity Act.³⁰ Requires the Secretary of Labor, in consultation with the Secretary of Energy and Secretary of Education, to submit a report on current and future trends and shortages in the clean energy technology industry to achieve a clean energy economy, and to provide grants to establish and enhance training programs for any occupation or field of work for which a shortage is identified.

Ms. CASTOR. Thank you very much.

Mr. Wright, you are recognized for 5 minutes.

STATEMENT OF ROY WRIGHT

Mr. WRIGHT. Good morning, Chair Castor, Mr. Graves, and members of the committee. I am Roy Wright. After years of leading FEMA's work on flood insurance and disaster resilience, today I have the honor of leading the Insurance Institute for Business and Home Safety.

We know that severe weather disrupts lives, displaces families, and drives financial loss. The forces of Mother Nature will not be constrained, yet much of the damage that is caused by these severe weather events is avoidable. The catastrophic disasters of 2017 and 2018 make this plain. These experiences focused the public's attention and should drive climate adaptation.

IBHS knows that putting proven building science solutions in place now will reduce disaster losses in the future. Given its important societal and economic benefits, adaptation is a public health objective, a humanitarian obligation, and a sound fiscal strategy. It touches both fiscal economics and environmental justice.

First, how do we prevent avoidable losses, preventing the avoidable portion of the damages that disasters ravage on homes and communities? Simply, we need to narrow the path of damage. For example, the zone of the strongest winds for a Cat 4 hurricane will cause destruction, there is no question about it. Yet the damages that can occur at 120-miles, 110-, 100-miles-an-hour wind can be significantly reduced.

To that end, we spend a lot of time talking about roofs, that most basic level of need. When the roof fails because of severe weather, it kickstarts a cascade of failures. When the roof fails, we see damages in homes, we see disruptions in businesses, it breaks up families, it derails careers, it destroys the financial security of a family.

All too often, these policy discussions miss the most vulnerable populations in our Nation—the disabled, elderly, low-income, and other disadvantaged people who are less likely to prepare for disasters, evacuate safely, avoid the physical and psychological trauma. Frankly, they are less likely to recover quickly and fully.

Those who live in rental units are dependent on landlords and public housing agencies for structural loss prevention. This places an even higher priority on adaptation measures that prevent avoidable damage to the places where they live and work.

Understanding this, Habitat for Humanity created the Habitat Strong program, which is built to our FORTIFIED Home standard.

²⁹ <https://www.congress.gov/bill/116th-congress/house-bill/4061/text>.

³⁰ <https://www.congress.gov/bill/116th-congress/house-bill/4148/text>.

We are particularly proud of the performance of the five Habitat Strong homes that were affected by Hurricane Michael. They stood strong against those fierce winds of that Cat 5 in 2018. The only reported damage to these single-family, 1,200-square-foot homes was a single piece of lost siding.

At the State and local level, it clearly begins with the building code, but today I want to focus on the Federal side. Last year, Congress enacted two pieces of legislation that will reduce the severity of disasters and the amount of taxpayer funds directed towards recovery.

Chief among them is the Disaster Recovery Reform Act. Though its implementation has been too slow by FEMA, the DRRRA will deliver the largest investment by the Federal Government to buy down the risk of natural disasters prior to the devastation occurring.

That is important, yet insufficient. Resilience and adaptation cannot be funded by the government alone. That is neither feasible nor responsible. Any practical agenda requires an emphasis on individual Americans leaning in and taking action, making their own investments.

Congress needs to move forward with a homeowners disaster resilience tax credit for making improvements on their own that buy down the risk of future disasters. This holds potential across every State in the Union, whether your principal risk is wildfire, hurricane, high wind, earthquake, flooding, or severe winter weather.

And where States are doing the right thing and funding their own grants, Congress needs to eliminate the tax penalties associated with implementing those catastrophic loss resilience programs. Alabama, North Carolina, and California would immediately benefit, and this could incent other States to lean in with their own resources.

Americans are not powerless against severe weather and changes to the climate. It is possible to reduce the damage inflicted today and in the future. We know it is practical, affordable, and just makes plain good sense.

I appreciate the opportunity to share these thoughts with you today, and I look forward to the questions from the committee.

[The statement of Mr. Wright follows:]

Testimony of Roy Wright
President and CEO, Insurance Institute for Business and Home Safety
Before the U.S. House of Representatives, Select Committee on the Climate Crisis
Solving the Climate Crisis: Cleaner, Stronger Buildings

October 17, 2019

Members of the Select Committee, thank you for the opportunity to speak with you today about the importance of the built environment as we think about ways to adapt to the adverse effects of future climate conditions. My name is Roy Wright, and I am President & CEO of the Insurance Institute for Business & Home Safety (IBHS). IBHS is a 501(c)(3) organization, enabled by the property insurance industry's investment, to fund building safety research that leads to real-world solutions for home and business owners, helping to create more resilient communities.

Severe weather disrupts lives, displaces families, and drives financial loss. IBHS delivers top-tier science and translates it into action so we can prevent avoidable

suffering, strengthen our homes and businesses, inform the insurance industry, and support thriving communities.

The forces of Mother Nature will not be constrained, yet much of the damage caused by severe weather is avoidable. If the devastating hurricanes, wildfires, and other disasters of 2017 made the case for resilience, those of 2018 underscored the urgency of IBHS' mission and the importance of these questions to the Nation.

The perils we study at IBHS are part of the natural world in which we live, but social and economic disasters occur when these perils meet human populations that live or work in harm's way. In order to break the cycle of destruction, it is essential to address all aspects of the building performance chain: where you build, how you design and construct, and how well you maintain and repair. As a building science institute, IBHS focuses on the ways that weather behaves, what makes homes and businesses vulnerable, and how our buildings can be better protected. We exist to help ensure that the places where people live, learn, work, worship, and gather are safe, stable and as strong as the best science can equip them to be.

The Importance of Adaptation

The goal of climate change adaptation is to take actions *today* to reduce losses *tomorrow*. Recognizing that we can't predict specific weather events next month, much less over the next several decades, IBHS knows that putting proven building science solutions in place now will reduce disaster losses in the future. Given its important societal and economic benefits, adaptation is a sound fiscal strategy, public health objective, and humanitarian obligation. It touches both fiscal economics and economic justice.

Moreover, the same actions that protect buildings also protect the environment, by reducing the massive amounts of post-disaster debris that can overwhelm landfills and lessening the release of carbon dioxide and other greenhouse gases generated when buildings burn.

Adaptation: From Research to Action

In order to prioritize our efforts on the initiatives that best advance our mission, IBHS thinks about adaptation through three lenses: Lead with the Roof; Solve with Research on Vulnerability and Loss; and Prevent Avoidable Damage.

1. Lead with the Roof

When you think about a home, "having a roof over your head" is the most basic level of need. Yet this protection can be threatened by severe weather. When roofs fail, they can kick-start a cascade of failures such as water infiltration, projectile damage, and destruction of rooftop equipment, resulting in as much as 70–90 percent of insured residential losses from some disasters. As startling as these insurance statistics may be, they fail to capture the broader human consequences resulting from roof failures—damaged homes and businesses that disrupt daily life, break up families, derail careers, and destroy financial security.

To end this path of destruction and dislocation, IBHS's highest priority is to understand what makes roof systems vulnerable and how roofing materials, their supply chain, and installation methods can be improved to reduce roof-related damage. Our studies show one easy way to achieve this is by applying tape over the roof deck's joints before the underlayment is applied (this is called a "sealed roof deck"). The process costs only several hundred dollars for a typical roofing installation but can save tens of thousands of dollars in the event the roof cover is blown off during a high or prolonged wind event. The sealed roof deck is the most cost-effective and accessible component of the FORTIFIED Home building standard developed by IBHS to provide design and construction specifications for home- and business owners who wish to improve their resilience beyond the mandatory levels outlined in state and local building codes. IBHS also believes that standard model building codes would be improved by incorporating a cost-effective sealed roof deck requirement. Similarly, wildfire codes should reflect best practices to resist ignition through the roof system.

From a communications perspective, it is important to educate home and business owners to pay more attention to their roof and to understand how to extend its life and reduce the likelihood of storm-related damage. IBHS knows that small investments today can prevent large losses in the future—but we have to find ways to get people to pay attention and take action.

2. Solve with Research

The core perils studied at the IBHS Research Center are wind, wind-driven rain, hail, and wildfire, all relevant to today's hearing because they could become more frequent and destructive with a changing climate. The design of our Research Center—with 105 fans capable of generating wind speeds approximating the gusts of

a Category 3 Hurricane—provides unique capabilities to replicate real world weather conditions. We also have made significant, long-term investments in equipment that allows us to create the ember showers that are the leading cause of home ignitions from destructive wildfires. And, we have developed a unique capability to replicate the density, hardness, and kinetic energy of natural hailstones in order to assess the durability and damageability of asphalt shingles and other products. IBHS’ best-in-class science fills knowledge gaps to achieve significant social and economic benefits across all regions and demographics of America.

IBHS brings the ability—through experimental testing, field research, and analytics—to understand the pathology behind the damage caused by our core perils and identify where building protection strategies can have a real-world impact. To reduce damage, we need to understand it. In this regard, observing damaged homes and businesses—whether during post-event field investigations or through other external data sources such as aerial imagery—helps IBHS to identify vulnerabilities and design experimental testing to more fully understand the sequence of events that leads to damage. Results captured in the lab are coupled with data gathered in the field to understand and demonstrate what makes buildings vulnerable, cost-effective ways to prevent damage, and how to reduce loss when damage cannot be fully avoided.

In choosing specific research projects, we are driven by our mission of translating our research into action. That means that we choose science that can shape building codes and standards, evolve our FORTIFIED program, influence building professionals and products, improve consumer choices, and advance sound public policy solutions. At a fundamental level, consumers deserve to have confidence that the time and financial investments they make in resilience will live up to their reasonable expectations. Our research demonstrates that home and business resilience is available at a range of price points, and that poor choices or inaction can result in damage or destruction when severe weather strikes. Over the longer term, understanding the importance of resilience as part of climate change adaptation will amplify our research for future generations.

3. Prevent Avoidable Damage: Public Policy Levers

At IBHS, we call this “narrowing the path of damage.” For example, in a Cat 4 hurricane, the zone of the strongest winds will cause destruction, yet the damage caused by bands of 100, 110, or even 120 mph winds can be significantly reduced. Similarly, the strongest areas of EF3, EF4, and EF5 tornadoes will see destruction, yet damage in the outer bands with winds equal to EF0, EF1, and EF2 can be reduced by building better.

Building codes are an important part of this focus. Historically, codes focus on life safety, but through proper application, they also can reduce the disruption natural hazards have on our lives. Yet, adoption and enforcement are not uniform across the country, or even in some of our most hazard-prone states.

Last year, Congress enacted two pieces of legislation to advance that recognize the need for long-term investments to reduce the severity of disasters and the amount of taxpayer funds directed toward recovery:

- The Bipartisan Budget Act of 2018 included new cost-share incentives for states to invest in resilience. Prior to the new law being passed, the Stafford Act generally provided a 75% federal share for state assistance and reimbursement. The new mitigation provision amends the Stafford Act to provide an increased federal share (up to 10 percent more) to states and territories that undertake eligible mitigation actions, such as: adopting current building codes, developing an approved mitigation plan, investing in insurance, participating in the Community Rating System, and/or providing financial incentives for mitigation projects like tax breaks or credits. The increased federal cost-share incentive will be implemented using a sliding scale.
- The Disaster Recovery Reform Act (DRRA) of 2018 creates several new mitigation policies, such as:

- Allowing states and local governments to use FEMA Pre-Disaster Mitigation (PDM) grants to facilitate the adoption and enforcement of building codes.
- Incentivizing states and local governments to adopt the latest model code.
- Authorizing the President to set aside six percent of the total amount of disaster recovery grants awarded from the Disaster Relief Fund, for deposit into FEMA’s PDM fund. The new funds represent a *fundamental shift* in the way the federal government prepares communities for future storm events.

As important as these federal measures are, they will not advance adaptation unless states understand how these funds can be applied to make homes, businesses, and communities less vulnerable to the severe weather scenarios that play out at the IBHS Research Center. It is critical to connect the dots between these new federal grant opportunities and bricks and mortar state programs that can strengthen

the built environment for the future. We have partnered with the BuildStrong Coalition to provide technical assistance in making these connections.

The DRRR, once fully implemented, will deliver the largest investment by the Federal government to buy down the risk of natural disasters now and in the future. While the advancement, enactment, implementation, and oversight of the DRRR are ably handled by the House Committee on Transportation and Infrastructure, this Select Committee can highlight the importance of projects to strengthen home and businesses and protect communities from climate change.

While DRRR represents a new era in disaster mitigation policy at the federal level, there are additional steps Congress can take to assist homeowners and small businessowners with disaster preparedness. One idea is to remove the tax penalty for individuals and businesses that benefit from state-based catastrophe-loss mitigation programs. H.R. 2053 the “Catastrophe-Loss-Mitigation Incentive and Tax Parity Act of 2019” would eliminate tax liability for amounts received as part of certain state-funded grant programs. Several states sponsor these types of successful mitigation programs, including the California Bolt + Brace program for strengthening buildings located in earthquake prone areas, and the Strengthen Alabama Homes program, which provides grants funds to upgrade to a FORTIFIED Roof. On the individual side, bipartisan legislation pending in both the House and Senate, known as the SHELTER Act, would provide up to a 25% tax credit for eligible expenses paid by individuals and businesses for purchases that help reduce potential damage from hurricanes, flooding, and other forms of natural disaster. These types of proposals empower and reward states and individuals who take action into their own hands—ultimately contributing to overall community resilience.

4. Vulnerable Populations

In making these investments, it is critical to protect our nation’s most vulnerable populations. According to sociological research, disabled, elderly, low income, and other disadvantaged people are less likely to prepare for disasters, evacuate safely, avoid physical or psychological trauma, or recover quickly and fully. This reality places an even higher priority on adaptation measures that prevent avoidable damage to the places they live and work.

Despite media images of lavish beachfront mansions, low income residents account for a meaningful percentage of the population in many coastal communities and other areas that face climate risk, often in the most vulnerable housing. Those who live in rental units are dependent on landlords or public housing agencies for structural loss prevention measures. And, low-income homeowners are more likely to take a “do-it-yourself” approach to maintenance or rely on neighborhood handymen to keep costs down. These local contractors may be unlicensed, undertake work without obtaining building permits, and be unaware of science-based loss prevention measures.

This is one of the reasons IBHS supports strong and up-to-date building codes. These codes are regulatory requirements that establish the minimum acceptable construction standards necessary to protect people and property from natural hazards, interior fires, and other causes of loss. They are particularly important for low-income homeowners and tenants, who may lack the clout to require a builder or landlord to take loss prevention into account. Building codes also provide consistency in building standards and trigger processes, such as public inspections, that help ensure that the structural elements of a building are up to current standards. It is critical to make sure that strong building codes not only are enacted but also enforced.

One place where the congruence of policy initiatives, strengthened building codes, and grassroots education has led to large-scale homeowner action is in south Alabama, where more than 12,000 homes have received a FORTIFIED designation. The progress in mitigation began in the wake of Hurricanes Ivan and Katrina (which hit the Gulf Coast in 2004 and 2005 respectively) and has surged with several key innovations. The State of Alabama enacted legislation which provided benefits to homeowners who built or retrofitted their homes to the FORTIFIED standard and later expanded the applicability of those benefits. The state’s coastal communities understand their particular risk and regularly update their building codes—many have even adopted an additional “coastal supplement” which brings their code up to the FORTIFIED level. Public/private partnerships paired with a grassroots educational campaign helped to educate homeowners, legislators, and builders on the importance of resilient construction.

In 2016, the State launched Strengthen Alabama Homes, a State-funded program that provides grants to help homeowners retrofit their roofs to the FORTIFIED standard. So far, over 1,600 homeowners have received the grant, and over 3,000 more are on the waiting list. The attention generated by the grant program, coupled

with grassroots education and stronger codes created an environment in which mitigating your home against hurricanes is becoming common practice, and the real estate market has taken note. A collaborative study led by the University of Alabama shows homes with a FORTIFIED designation are, on average, valued 7% higher than homes without the FORTIFIED proof of resilience. This shows innovative building science standards and techniques can not only provide protection but can also add value.

Interestingly, the first significant step in Alabama's path to resilience was taken by a local Habitat for Humanity affiliate. The organization built one of the state's first FORTIFIED homes and worked closely with another nonprofit, Smart Home America, to promote the idea that that resilience wasn't only smart; it was affordable too. This helped to dispel the common misconception that mitigation and resilient construction are cost prohibitive to working families.

As we consider mitigating buildings against severe weather caused by shifting climate risks, it is important to note that we are also protecting homeowners from a costly disruption of their daily lives. Understanding this, Habitat for Humanity, at the national level, created the Habitat Strong program, which mirrors the FORTIFIED Home standards. They have partnered with several IBHS member companies and universities to help homeowners achieve these stronger protections and have seen some of their homes tested by severe weather. We are particularly proud of the performance of the five Habitat Strong homes in Panama City, Florida, which stood strong against the fierce winds of Hurricane Michael in 2018—the only reported damage to any of the homes being a single piece of loose siding.

Other national nonprofits such, as Team Rubicon and SBP, see the importance of protecting the homes and financial stability of low to moderate income homeowners and are also incorporating FORTIFIED's protections into their building designs. Another group, My Strong Home, is an innovative benefit corporation which provides lending solutions to help coastal residents become more resilient. They require homes to meet the FORTIFIED standard to ensure the company's investment is protected, and in turn provide homeowners with construction, financing, and insurance options that are designed with affordability and long-term protection in mind.

While a FORTIFIED home offers great protection, we, at IBHS recognize not all coastal residents can upgrade their homes to this level, in the near term. So, we designed a user-friendly "hurricane ready" guide, which details different actions homeowners can take, at a variety of price points. On the high end, impact resistant doors and windows add a level of protection and eliminate the need for a homeowner to install hurricane shutters before each storm. More modestly, as I said earlier, a few hundred dollars can provide a sealed roof deck, which can prevent very costly damage caused by water-intrusion. The guide also includes tasks as simple as cleaning gutters or securing outdoor furniture, which both can help residents reduce the risk of damage in an easy and accessible manner. One of the most successful hurricane-preparedness campaigns IBHS ever launched showed people how to potentially save their home without spending a penny. It simply encouraged people to shut their interior doors during a hurricane. This one simple task could save a home by isolating pressure if the building envelope were breached (the message went viral before Hurricane Irma in 2017). So, as you can see there are a variety of stages of resilience that together can help homeowners be better protected today and adapt to climate change. IBHS is committed to studying and promoting each of these, in an effort to help homeowners and communities across the country to better weather the storm.

In closing, I would like to thank you for the recognizing the importance of climate adaptation and the critical role IBHS research plays to help strengthen the built environment. Americans are not powerless against severe weather—it is possible to reduce the damage inflicted today and in the future. We know it is practical, affordable, and just plain good sense to construct and retrofit buildings to be strong enough to defend against these threats. I appreciate the opportunity to share some of our ideas with you today.

Ms. CASTOR. Terrific.

Well, I want to thank all of our witnesses for your compelling testimony. The entire committee has been looking forward to getting into this subject, and I appreciate your direct and concrete policy recommendations.

Let me start with Ms. Landreneau.

You mentioned that in the 2009 Recovery Act it provided strong incentives for local jurisdictions and States to adopt the most recent model energy codes for buildings. Could you expand on the type and value of incentives given? Did they work? I think everyone would rather create incentives than adopt mandates.

You also mentioned that Congress could use tax incentives to encourage States and cities to adopt building codes focused on performance. Can you explain how you would structure these type of incentives?

Ms. LANDRENEAU. Thank you.

So, yes, on the 2009 Recovery Act, the incentives required the States to develop a plan to implement the 2009 energy code. They had to have it in place by 2017, so there was not an expectation that it would be adopted overnight.

They basically provided training, workbooks, code books, a lot of resources, but the States had to show up and meet them halfway. They had to put a lot of their own effort and investment into the program as well.

There was an application process, and about 24 States were selected in that process. And \$3.1 billion, I believe, was used to fund that effort. And I do believe it is the reason that 88 percent of the country is now at least on the 2009 energy code. So it was highly successful.

The Federal Government can certainly lead by example in terms of outcome-based requirements and performance requirements by sending a market signal with its own funding—that is, whether it is procuring its own buildings or offering tax incentives to have either high-performance metrics, energy use intensities, or even zero-carbon/zero-energy expectations for things like the low-income tax credit, low-income housing tax credit, or historic preservation tax credit, or other incentives that already exist.

Ms. CASTOR. And you mentioned that States and cities are using transparency and benchmarking. I actually saw the sustainability officer for the city of Orlando pulled up his laptop and showed me how they are benchmarking buildings across their community and helping, partnering with them to lower their AC bills and become more energy-efficient.

So these policies often rely on national tools maintained by the feds, though. I know we passed some laws—I authored one—about benchmarking in Federal buildings. We have a lot of real estate under control of the Federal Government.

Could you describe the Federal resources that are being used in partnership with cities and States and how these tools are helping them to enact building performance standards?

Ms. LANDRENEAU. Absolutely.

Energy Star Portfolio Manager is being used by dozens of cities around the country for the benchmarking and transparency legislation. That is backed by data collected in the Commercial Building Energy Consumption Survey.

There are tools such as EnergyPlus, a modeling tool created by the Department of Energy, that help owners make decisions about investment in energy performance improvements.

The Building Technologies Office helps identify new technologies and programs that would help improve building performance.

There is also a building code assistance program that helps States with implementing new building codes.

So there are countless programs across the Department of Energy and other agencies that help cities with benchmarking and transparency as well as the private sector with implementation.

Ms. CASTOR. Well, it is not business as usual anymore; it is about carbon reduction. And in order to avoid the worst impacts of the climate crisis, we have to act with urgency.

So, Ms. Saul Rinaldi, what tools do you recommend to us that would have the biggest bang for the buck and help us reduce carbon pollution?

Ms. SAUL RINALDI. One of the key things we need to see is really strong investment. The upfront costs for energy efficiency are very staggering for some households. So the HOMES Act, which Mr. Welch has been working on with Mr. McKinley, has at different times had \$6 billion focused on supporting homeowners updating their homes. This would provide rebates to homeowners.

We are talking really—it does need a lot of resources so that we can advance a lot of energy savings. I mean, the fact of the matter is that energy prices are often so low in some parts of the country that the technology cost really creates a bigger upgrade than really will pay for itself. It will pay for itself if you include all of the carbon savings and the environmental impact, but a homeowner—asking them to do all of this for all of us is a bit much.

So that is why we say, you know, look at the HOMES Act to provide rebates. Look to 25C tax credit, which—increase that so that homeowners—it is the only tax credit on the books that is for actual homeowners that they can take to upgrade their homes. Also 179D, that tax deduction for commercial buildings and commercial building owners to update their buildings. I mean, these are some of the key issues that we need.

Another thing is building codes. Strong building codes address some of the landlord-tenant issues because the buildings are built correctly in the first place. That, of course, is a State issue, so just supporting that at the Federal level, usually through appropriations to the Building Technologies Office to support the technology that is needed.

Ms. CASTOR. Terrific.

Mr. Carter, you are recognized for 5 minutes.

Mr. CARTER. Well, thank you, Madam Chair. I appreciate it.

And I appreciate all of you being here.

Just a quick question. Anybody know what the number-one forestry State in the Nation is?

Mr. RUTLAND. Georgia.

Mr. CARTER. That would be Georgia. That is correct. Good answer.

And in the First Congressional District that I have the honor and privilege of representing, we have a very competitive timber market. And it is something that we are very proud of and something that we certainly work hard toward making sure that we have sustainable forests and making sure that it is a robust and vibrant system.

And, of course, we know how advantageous it is in the fight against climate change. I mean, timber draws carbon out of the at-

mosphere. It is very important. Not only that, but it helps with clean water. A vibrant forest helps with clean water. It helps with wildlife habitat and all these different things.

In fact, in the State of Georgia, the annual value of the ecosystem services provided by private forests alone is valued to be over \$37 billion. So obviously it is a big part of our economy.

And we know that throughout the United States that the annual amount of carbon that is stored by forest products is over 70 million tons. So this is extremely important.

And I wanted to ask you, Mr. RUTLAND—you are from our neighboring State of Alabama, and I am sure you would live in Georgia if you could, but you are in our neighboring State of Alabama, and you are in this business. And I have worked very closely with the home builders and have for quite a while. Wood products, you use them extensively of in your business, I am sure, in your industry. How closely is your industry tied to a robust, working forest?

Mr. RUTLAND. Well, first, while I got your question right about Georgia, I do want to say “War Eagle” in your neighboring State, so—

Mr. CARTER. We are off to an inauspicious start here.

Mr. RUTLAND. I apologize for that, sir.

As far as our—the timber industry is very tied, obviously, to the home-building industry. We rely on good-quality timber. And we thank you for the timber that you grow in Georgia and the timber that is grown in Alabama as well. And it is a big part of the workforce in both of our States. It is a very important product.

Mr. CARTER. Are there advantages to building with wood products?

Mr. RUTLAND. Absolutely. It is certainly very flexible, very easy to use. There are a lot of things that you can do with lumber, I would agree.

Mr. CARTER. Any other type of building materials that impact climate change as much as wood does, as much as lumber does?

Mr. RUTLAND. I am not sure I can answer that question.

Mr. CARTER. The answer is, no, there is not.

Mr. RUTLAND. Sure.

Mr. CARTER. You talked about energy efficiency quite extensively in your testimony. And energy-efficiency advantages, are they tied directly to wood products?

Mr. RUTLAND. I would believe so, yes, sir.

Mr. CARTER. Absolutely. You are aware that the natural thermal resistance and the embodied energy that makes this easier to insulate these homes to higher standards—which, of course, is important as well.

There is also—and, Mr. Wright, I will go to you for this. There is also—in commercial buildings, we have been using a new green building trend that is called mass timber. I don’t know if you are familiar with that or not.

Mr. WRIGHT. I am.

Mr. CARTER. Good. We have two buildings in the State of Georgia that are commercial buildings that have been built that are very notable, one at Georgia Tech, and then there is another one in Atlanta that is the largest-square-foot wood-built building in the United States.

What are some of the advantages that commercial buildings could have in using wood as a building material?

Mr. WRIGHT. So, while we don't make specific calls on which products go down that, I do think that, as you look at the tall wood approach, you look collectively, by which you have the engineers and architects going, what are the best products for that structure? And when you do that, how does that service the functional needs of that building, as well as the kind of work you would do to make sure that it is energy-efficient? Which, in so many ways, yes, affects carbon and also affects the cost of operation.

Mr. CARTER. And I get that, and I understand that. And, certainly, in the private sector it is a business decision, but we have to all agree that it has an impact on climate change, as well, and on our environment.

Mr. WRIGHT. Most assuredly, the products and materials that are used on each one of those structures has an impact, and when you are collectively looking at it, you have to make the best choice.

Mr. CARTER. Should the impact on the environment enter into a business decision like that?

Mr. WRIGHT. I think, for many companies, they look collectively in terms of their own cost and how it serves into the broader needs of the communities they live in.

Mr. CARTER. And that is very important, and I appreciate that approach, because we are never going to solve this problem without the buy-in from the private sector. So that is why this is so important.

And thank you, Madam Chair, and I yield back.

Ms. CASTOR. Ms. Bonamici, you are recognized for 5 minutes.

Ms. BONAMICI. Thank you very much.

Thank you to our witnesses. This has been a great discussion today.

I am from Oregon. The Oregon Department of Energy has identified 43 percent of the total energy used in my home State is from buildings, about 23 percent residential, 19 percent commercial.

We know that both residential and commercial buildings are notoriously challenging to decarbonize. I think we have heard a lot of great ideas today about doing that, and we have a responsibility to help with that.

In 2017, Oregon's Governor Brown signed an executive order that developed clear requirements for newly constructed buildings to become more energy-efficient by 2023. It created a pathway for building codes to reach Zero Energy Ready standards by 2032.

And I wanted to follow up on my colleague from Georgia, who is just walking out the door. I wanted to follow up and invite him out to see—in the district I am honored to represent, the First Tech Federal Credit Union has the country's largest cross-laminated timber structure. About 650 people work in that building.

A lot of our companies are turning to mass timber as an alternative to steel and concrete. And we know that cross-laminated timber, especially when harvested using sustainable forest practices, can sequester and store massive amounts of carbon dioxide.

So we are going to get in touch. We are going to work on this.

Mr. CARTER. Thank you.

Ms. BONAMICI. And we know these State and regional commitments are important, but Federal efforts are critical, as well, to be complementary.

Dr. Shahyd, thank you so much for identifying and especially focusing on the impact on low-income families. Hillsboro, Oregon, is also home to the largest certified multifamily Passive House building in North America, with 57 units of affordable housing built to Passive House standards, where they saved about 90 percent on their heating and up to 70 percent on their overall energy use. And it was built into how they planned the building. And, of course, it cost a bit more at the outset, but the savings are recouped pretty rapidly.

So, Dr. Shahyd, in your testimony, you noted that for every dollar invested in energy efficiency for low-income families, \$2 are put back into the economy through energy savings and increased income from job creation. And you also acknowledge that the Department of Energy's Weatherization Assistance Program can't meet current demand.

How can Congress better incentivize and support those innovative residential weatherization and energy-efficiency practices, especially for low-income families?

Dr. SHAHYD. Yes. Thank you for your question.

There are a number of bills on the table now. One is the reauthorization of the Weatherization Assistance Program, which is sitting there, which also includes a new innovation fund, which, actually, for the first time, allows local contractors, working with DOE program offices, to actually create new incentive programs, to create new approaches to actually dealing with some of those hard-to-reach sectors in the market. And we didn't have that before.

I think one of my colleagues actually mentioned the Blue Collar to Green Collar Jobs Act, which is from Congressman Rush of Illinois, which is really the first time—because, usually, when we think about green jobs, I think the image that comes to most people's minds is someone on a rooftop installing a solar panel. But energy efficiency, real construction jobs are really the overwhelming majority of what green jobs are—

Ms. BONAMICI. Absolutely.

Dr. SHAHYD [continuing]. Actually going to look like.

Ms. BONAMICI. Terrific. I want to get another question in.

To Ms. Rinaldi, in the Pacific Northwest, Bonneville Power Administration and Portland General Electric conducted a 3-year smart water heater pilot program to find ways to better manage clean energy production and grid loads. So there are 277 water heaters that were equipped with a communication port. So it allowed the utilities to use the water heater as a battery, and by sending load-shifting requests directly to the water heater, they can heat the water at a time of day or night when the energy costs are lower instead of on demand when the costs are higher.

So, in your testimony, you discuss these kinds of technologies and the value of smart-grid-interactive efficient homes. So what are the current barriers to the demonstration and deployment of these grid-interactive efficient buildings, and what investments can help support them?

Ms. SAUL RINALDI. Thank you, and thank you for the question. And since I only have 35 seconds, I do talk about this in the report, so I do have some of those answers.

But the electrification, which is something that is being discussed quite frequently now, it is really an interesting policy mix with the idea of grid-interactive buildings, because then our buildings can become like power plants. Like, that is exactly what was happening in Oregon in that system. We also are looking to do other opportunities for heat pumps.

But I would say that one thing the Federal Government can do is provide access to utility data. One thing which is very difficult is for contractors and providers to actually get access to the utility data from the homeowner in a secure and private way—and that is possible—so that they can, kind of, create those better systems and those better connections between the grid and the homes and be able to model the home and its energy use better.

So that would be my quick answer.

Ms. BONAMICI. Thank you. My time has expired.

Ms. CASTOR. Mr. Griffith, you are recognized for 5 minutes.

Mr. GRIFFITH. Thank you, Madam Chair. This is a great panel, so let me see what I can get done in my 5 minutes.

Mr. Wright, I do appreciate what you said about making sure we build things with the right materials and try to get it right. I had the opportunity, as a part of my committee work with Energy and Commerce, to go to the Virgin Islands and to Puerto Rico after the hurricanes, and it was fascinating.

In the Virgin Islands, only 10 of their telephone poles survived the storm and didn't need to be replaced. Those were the only 10 on the island that were composite material telephone poles, as opposed to your standard wood, which Mr. Carter might not like to hear, but there are great advantages to different things in different places. So I thought that was important.

Dr. Shahyd, you talked about one of our challenges—and it is a challenge—affordable housing and energy bills and how do we balance the two out.

And that brings me to you, Mr. Rutland. So, in your testimony, you said that the median new home price increases by \$1,000—if it increases by \$1,000, it displaces about 127,000 households from the market.

Now, this is particularly troubling in a region like mine, in an area like mine. I represent central Appalachia and those portions of Virginia where our household income is less than the national average and even less than the Virginia average as a whole.

So what do we do to try to make sure that we have some homeowner-friendly approaches that will ensure families aren't getting priced out of the market?

And I would say to Ms. Rinaldi, one of the problems I have in my district, although it may work for the vast majority of the middle class, is that rebates and tax credits don't work if you don't have the money in the first place to get the rebate back from or you don't have enough income that the tax credit does you a whole lot of good.

But, Mr. Rutland, what do you think we can do in that regard?

Mr. RUTLAND. Sure. Well, thank you.

We are in a housing affordability crisis. I see it every day. We build entry-level homes, and we build luxury homes.

We find that the majority of the public are very interested in energy-efficient homes and resilient homes. The problem comes when they start pricing it, when we start showing them what it costs to do some of the things that they have seen on TV, they have heard friends talk about, they have seen in forums like this.

And so we price it and we offer them those options and show them. And many, many times, that is the first thing that they cut. They would rather see the granite countertops or the hardwood flooring.

Mr. GRIFFITH. Do you have any data that tells us where that breakpoint is on the price and how long they are willing to look at a repayment? So, if they spend \$1,000 now, how long are they willing to get the payback on that? Is there a number out there that tells us when we reach that tipping point?

Mr. RUTLAND. We have found as a company that typically our homeowners live in their homes no more than 7 years. So if they can get that paid back in 5, then they are willing to pay for it, but if it is 10 or longer, they are not.

Mr. GRIFFITH. All right.

Let me switch gears. Earlier this year, we had a report that we have 3 billion fewer birds than we had in 1970. The Guardian reported in a report also—the report on the birds was a couple of weeks ago; the Guardian report was from April of this year—that buildings are killing up to a billion birds a year in the U.S. Some numbers are less than that, but that is what we are looking at.

So when we go in to retrofit these buildings for energy costs—and I guess I will go to you, Ms. Landreneau—did I get it correct?—and just say—and I noticed in some of your pictures in your report, a lot of those buildings had glass. Glass increases the energy costs if it doesn't have protective film or if it doesn't have a solar energy use to it. And we can add, for little or no cost—if you are putting the film on for energy reasons, you can put in bird-safe building technology.

Is that a part of you all's plans as well?

Ms. LANDRENEAU. There is bird-safe technology, some of which is not even visible to humans—

Mr. GRIFFITH. That is right.

Ms. LANDRENEAU [continuing]. But birds can see it. And, absolutely, that can be integrated with film that is being applied to existing buildings.

Mr. GRIFFITH. And so we can not only work on the energy efficiency in a building but we can also keep them from being death-traps for the birds that migrate through the United States. Isn't that true?

Ms. LANDRENEAU. Absolutely. And it is a fantastic proposal.

Mr. GRIFFITH. And do you know what some of those features that LEED encourages to meet these ends? Do you know some of those?

Ms. LANDRENEAU. There is a pilot credit for bird-safe design. And the District of Columbia's Green Construction Code, which just went out for its second round of public comment and should be adopted by the end of the year, has this also as an elective.

Mr. GRIFFITH. And so, as we are looking at energy-efficient legislation, we should also protect the birds, wouldn't you agree?

Ms. LANDRENEAU. Absolutely. Absolutely.

Mr. GRIFFITH. Anybody disagree?

Thank you very much. No disagreement.

I yield back.

Ms. CASTOR. Well, thank you.

In fact, the Audubon Society has a new tool on their website I recommend to everyone. Of course, they issued a recent report that said the climate crisis is causing an unfortunate and stunning impact to the loss of bird species.

And I recommend the tool on their website that demonstrates the loss of bird species across the globe. You can localize it for your own community and analyze the difference between inaction here in the United States on climate or actual, bold climate action. And there is a significant, significant difference.

At this time, I will recognize Mr. Huffman for 5 minutes.

Mr. HUFFMAN. Thank you. Thank you, Madam Chair.

That was a really interesting line of questioning. I didn't realize we were going to be trying to solve multiple problems together, but I thought that was a really thoughtful point from Mr. Griffith. I appreciate it.

Ms. Landreneau, I would like to ask you about something many of the communities in my district are considering, and that is, as they look at their own local ordinances and policies, they are thinking about the fact that we have this climate problem, and most people would agree that the first thing you do when you are in a hole is stop digging, so they are considering local ordinances to prohibit new fossil-dependent construction.

Would you agree that that is a pretty good idea? And how feasible is it at this point? Do we have to have fossil-dependent buildings, going forward? Is it possible to be cost-effective and also have no new fossil construction?

Ms. LANDRENEAU. There are just a couple of jurisdictions that have banned fossil fuels in new construction, so gas or coal or heating oil-powered equipment.

There are some effective programs at the, sort of, State level in certain regions that are helping with replacement of equipment in buildings, going to electrification in existing buildings or with new construction.

But it is absolutely possible to ban natural gas in new construction. And it is essential, if we want to get to carbon-neutral buildings, that we do go to electrification that also makes buildings more resilient and more flexible with the grid.

Mr. HUFFMAN. So there is no reason why we need to continue building fossil-dependent structures at this point.

Ms. LANDRENEAU. That is correct. There is no reason.

Mr. HUFFMAN. So let's talk about something in your testimony that really jumped out at me. Half the country is operating on antiquated building codes, where certainly we are building a lot of new fossil-dependent structures but probably also a lot of really inefficient structures as well.

What can we do about that? What are your thoughts about a Federal policy that might address that?

And I guess the related question I had is: If we can't incentivize States to modernize and evolve on this, is this something that perhaps the insurance industry could step in and, you know, sort of, go around them in a way that forces those changes?

Ms. LANDRENEAU. I mean, I certainly think replicating the 2009 program that incentivizes States to adopt the latest energy code would be a great model to follow. The 2021 code will be published next year, and just jumping on that and saying, you know, adopt the latest code.

To the Congressman and Congresswoman who have departed, the 2021 code in its entirety, including the IBC, has removed barriers to tall timber construction. So it allows for low-embodied-carbon buildings, which is also very critical to meeting our low-carbon goals.

So I would say, any kind of incentives that help jurisdictions adopt the absolute newest code as quickly as possible would be fantastic.

I can't speak for the insurance industry, but, yes, I think they could certainly go around legislation and say, we will only ensure high-performance buildings.

Mr. HUFFMAN. Maybe I will ask Mr. Wright that same question.

Mr. WRIGHT. The insurance industry is a vast industry, so I think it is hard to pigeonhole one piece on it.

What I will tell you is, companies evaluate risk. And one of the factors—I have more than 100 insurers that are members of IBHS. Building codes are essential. And they are essential because they help them understand what is the baseline of risk, and to the degree that the elements of the building code reduce the risk going forward, you would see that translate back through the balance of their product.

Mr. HUFFMAN. Okay. Thank you.

Ms. Saul Rinaldi, I want to ask you about building retrofits. And others are welcome to chime in on this, because I know we have a lot of expertise on this panel.

So the benefits of a retrofit program have been discussed. I think we all pretty much get that. But actually making it happen in any kind of a timely way is an almost overwhelming proposition when you think about it.

So I want to ask you to describe for us what a deep decarbonization building retrofit program, not a goal—goals are easy—but a program, would actually look like. And if there are some examples out there, I would love to hear about it.

Ms. SAUL RINALDI. Sure. Well, there are some deep decarbonization, meaning moving to net-zero and electrification.

Well, one thing that you need to do is have cold weather heat pumps or, if you are in a certain climate zones—because one of the issues is a climate zone when we are looking at electrification and being off of carbon and not using those hydrocarbons to heat the home. So if you are in the Northeast or in New England, we need to look at the cold weather heat pumps and making sure that those are there.

The homes have to be really well-insulated, so there need to be policies to either ensure they are there for the new home or that they are in a retrofit situation. You have tax incentives or rebate

programs to help deal with those up-front costs to get some deep energy-efficiency insulation and also to support the contractors who are putting those in.

Again, it is those training programs, making sure that they know how to install the solar panels, how to do air sealing and insulation, how to do duct sealing, how to do that in the correct way. Because sometimes it is the manner in which the building is retrofit that really gets you the most energy efficiency out of that.

And also let's not forget smart technologies. You need smart meters and smart technologies, smart thermostats to really help control the house and be able to interact with the grid so that you are able to provide that generation when it is needed and pull back when it is not.

And I also want to note the labeling programs to make sure that that homeowner is going to get the return on their investment. There are some private labeling programs, like Pearl Certification. There are public ones, like the Home Energy Score. And there is the SAVE Act, which helps people get that money back when they are doing their retrofit, of their refinancing and making sure that the energy bills are included in that, so the value of the home, so it is not just the granite countertops but it is also all the energy measures that actually add value in the resale.

Mr. HUFFMAN. Thank you.

Thank you, Madam Chair, for the extra time.

Ms. CASTOR. You bet.

And since everyone lives now with their phone attached to their bodies, it would make sense if that technology to the smart grid to control your home thermostat or your business was available to everyone.

Ranking Member Graves, you are recognized for 5 minutes.

Mr. GRAVES. Thank you, Madam Chair.

I was just looking down at my phone. I heard Congressman Carter say that Georgia was the top forestry State, and I wanted to ask him about the metric, because I was very curious about that. And I am convinced it has to do with the ratio of trees per people with funny accents, but maybe I am wrong. And I hope he hears that.

Ms. Saul Rinaldi, I want to thank you for bringing your children here today. Growing up, my parents, we would have hurricanes, I would have, like, a 140 fever, the school would be closed, and my mom would still make me go. So I appreciate you bringing your kids today.

And what your mom is doing is very important. And I am glad you all are able to be here to see her.

Mr. Wright and Mr. Rutland, you both make mention of legislation that we enacted last year in October. And I want to be clear, this was bipartisan legislation, the Disaster Recovery Reform Act.

It has important provisions in it, like, for example, trying to shift this paradigm or narrative from, let's come in after disasters and pick up all the pieces and spend an absurd amount of money—we have spent \$1.7 trillion since 1980 responding to disasters. And it tries to flip that narrative, that whole paradigm over. Let's lean forward, let's be proactive, whether it is the mandatory funding on

the Pre-Disaster Mitigation Program that ultimately was enacted in an appropriations bill but it was part of—

Mr. WRIGHT. Right.

Mr. GRAVES [continuing]. Disaster Recovery Reform Act; whether it was the incentive in lowering the cost share for disasters from 75/25 to 80/20 or perhaps even 85/15 under certain scenarios if the States or localities carried out resiliency measures ahead of time; for the first time ever, defined the term “resiliency,” “resilience,” and looking at how we rebuild, making sure that in the aftermath of a disaster we don’t rebuild the same thing the same way, which was just stupid. And you know this better than anybody. We would come and pay for the same structure over and over again.

Mr. WRIGHT. Uh-huh.

Mr. GRAVES. Can you both comment, Mr. Wright perhaps starting, on your thoughts on what that ultimately is going to do? Could you expand on your testimony?

And, Mr. Wright, you say in here, “The DRRRA, once fully implemented, will deliver the largest investment by the Federal Government to buy down the risk of natural disasters now and in the future.”

Could you talk a little bit more about that and, sort of, the repercussions and how it perhaps shifts the paradigm on proactive versus reactive?

Mr. WRIGHT. Yeah. The DRRRA—and, as you appropriately said, there are a couple provisions that ended up on different vehicles going forward in appropriations acts and the like. But it dedicates money on the front side. Because in my prior job and so many times in your district, including that no-name storm in 2016, people would give lip service to reducing risk. They would look at the impact of the disaster, they would see how it ravaged a community, and says, “We could have done something to make this better ahead of time,” and there were endless speeches about how—

Mr. GRAVES. Hindsight is 20/20.

Mr. WRIGHT. Right?

Mr. GRAVES. Yeah.

Mr. WRIGHT. And says, so put the money there on the front side.

Congress did its lifting. I think FEMA has been too slow to get it to the point of implementation. But there is a really important next step on this—

Mr. GRAVES. You always defended FEMA’s time periods when you worked there, I just want to make note. But please continue.

Mr. WRIGHT. I may have a bit more liberty to share my personal opinion today than I may have in the past, for sure.

Mr. GRAVES. I am sorry. Go ahead.

Mr. WRIGHT. But I look at that and says, those grant programs are 75 percent Federal, 25 percent State or local. And one of my concerns with the implementation of that, going forward, is, are States and localities ready to start putting investments that are there? Because maybe we did all the right things and Congress put the vehicles in place and put a pot of money there, but if we haven’t looked at finding what needs to take place—and so we watched this in Alabama, where the State has a grant program that is in place. California has done this. North Carolina.

Here is the irony of it. If the State has a grant program for mitigation, it is taxable income and they get a 1099. If it is a FEMA grant program for the exact same activity—

Mr. GRAVES. Wow.

Mr. WRIGHT [continuing]. It is not taxable. You know, you are like, wait a second here. If we are trying to make this more than just the Feds have to pay all the bills, we have to take some of these other barriers out and let States innovate, let local communities drive down this point.

And at the end of it, after they got the grant, whether it was—that could accomplish energy efficiency as well as resilience, they shouldn't be rewarded with a 1099 at the end of the year.

Mr. GRAVES. That is a good point.

Mr. Rutland, do you care to add?

Mr. RUTLAND. Sure. First, just let me say I am very sympathetic to disasters in your State. My sister-in-law's home was destroyed twice in your State and was displaced. So I am very sympathetic to that.

I am also very sympathetic to something that I saw in May of last year. I went and toured Jacksonville, Alabama, when an F3 tornado went through it and destroyed a lot of Jacksonville State and a lot of homes around the area. It was amazing to me to see the homes that were constructed in the 1990s and 1980s and the 1970s that were gone. There was nothing but slab standing. The homes that had been built since 2006, when some major code revisions were done to address resiliency, those homes fared very well. The homes that were built to the 2012 code fared very, very well.

So I think our focus may ought to be on existing homes, structures that were built in the late 2000s, 1990s, and beyond—or going back.

Mr. GRAVES. Thank you.

I yield back.

Ms. CASTOR. Ms. Brownley, you are recognized for 5 minutes.

Ms. BROWNLEY. Thank you, Madam Chair, and thanks for holding this hearing.

Thanks for all of you who are here today. We appreciate it very, very much. I think this is a really important topic when we are talking about the climate crisis and where we need to get to.

The building codes just astonish me, learning about how we—the process, just in and of itself, happening every 3 years. And cities and States and counties don't have an obligation, really, to do anything once you have gone through this huge process.

And I feel like the home, for most families, is their largest asset. And you can choose to build a home or have a home that is going to cost you more and more and more over a 30-year period, or you can have a home that is going to save you money over and over and over again over 30 years. Some have equated it to it is like having an interest-only mortgage, if you are not doing anything to your home, because of the increasing costs of owning the home.

And so I guess, you know, Ms. Landreneau, you talked about the building codes in your testimony and what could be done in terms of improving those processes, and I appreciate that. So I guess, just in terms of the process, not requiring commitments necessarily—well, I guess requiring commitments is definitely part of it. But

just in terms of a process and who is involved in terms of creating those codes, do you see any changes that can be made there to improve the outcome of compliance with building codes? If that makes any sense whatsoever.

Ms. LANDRENEAU. In the code development process or—

Ms. BROWNLEY. Yeah.

Ms. LANDRENEAU [continuing]. The local process?

Ms. BROWNLEY. I mean, it seems as though, in the code development process—and correct me if I’m wrong—it is more, the folks that are involved in that, the stakeholders that are involved in that, I think many of them, perhaps, don’t have an interest in getting a really performance-based building code.

Ms. LANDRENEAU. I am on the International Energy Conservation Code for commercial buildings, so I can’t speak for all of the committees. I think the residential energy conservation code is made up a little bit differently.

Our code committee this year, I think, was comprised of many people who were interested in seeing a more progressive energy conservation code. We had folks from D.C., Department of Consumer and Regulatory Affairs, from the city of Seattle, New York. But we do have to look at cost impact and the reason for the code changes. We can’t just adopt whatever we want. We have to be very pragmatic.

You know, I do think there are architects, there are engineers, there are manufacturing associations, there are people, members of the building industry that are involved. I do think it should be a balanced committee that is looking at these issues.

However, anyone can propose an amendment. The committee votes on those. They are out for public comment. But the final vote is made by IECC members, which are primarily code officials. And should that vote be made up of a larger body so that stakeholders such as homeowners or building owners are also voting on those code outcomes? Perhaps. It is a limited voting population.

Ms. BROWNLEY. And how do we better educate the consumer just so that they understand the economic impacts, you know, of perhaps even, in terms of building a new home, building a smaller home so you can afford some of the other elements that you can put in to provide those cost savings over the period of time of ownership?

You know, I feel like we talk a lot about the environmental impacts, which are really important, but I think, at the end of the day, the consumer really understands the economic impacts better.

Ms. LANDRENEAU. Absolutely. I think more disclosure, more transparency. Buildings should be labeled with what code they are built under. Just the benchmarking policies alone have been really helpful for people to be able to look up buildings and see how they are performing. But the more transparency we can get in our built environment, I think the more the consumer will know.

Ms. BROWNLEY. And, Ms. Saul Rinaldi, if we met, across the country, the highest standards in building codes and energy efficiencies and, you know, with regards to retrofits and all the smart technology out there, if we were doing all of that, how would you quantify that contribution to the overall goal of reducing temperature by 2 degrees Celsius by 2050?

Ms. SAUL RINALDI. Well, I—

Ms. BROWNLEY. You have 10 seconds.

Ms. SAUL RINALDI. Yeah. I don't know that I can do that back-of-the-envelope calculation, but—

Ms. BROWNLEY. It would be a significant—I mean, it would—

Ms. SAUL RINALDI. It would be significant. Well, the ACEEE—

Ms. BROWNLEY. There are so many—yeah.

Ms. SAUL RINALDI. The ACEEE report said that buildings can contribute to a third of the 50 percent reduction just from energy efficiency alone. That is not including all the renewables you were talking about.

Ms. BROWNLEY. Yeah. That is pretty significant.

So thank you, Madam Chair. I yield.

Ms. CASTOR. Sure thing.

Mrs. Miller, you are recognized for 5 minutes.

Mrs. MILLER. Thank you, Chairwoman Castor.

And thank you all for being here today.

In 2016, West Virginia suffered devastating floods which destroyed homes, schools, roads, and whole communities, and it resulted in the death of 23 people.

As our communities have started to recover, we have recognized the need for rebuilding with resilience. This helps ensure, should catastrophic—and they will—weather events happen again, our infrastructure is prepared so that the storms' impacts are not quite so disastrous.

That being said, we need to focus on the solutions that prioritize choice for consumers and ensure low costs. My State, geographically, is quite different from Alabama and Louisiana. One-size-fits-all Federal regulations are not the way to accomplish our goal of not only energy efficiency but resilience. We need to engage with our States, localities, and private sector to ensure that any solutions that are implemented are tailored to our individual communities.

Mr. Rutland and Mr. Wright, how have your respective industries taken proactive steps to ensure structural adaptation and resilience for natural disaster events?

Mr. RUTLAND. Well, I couldn't agree with you more on several of your points, as far as the need to improve on the resiliency and that our States are very, very different and so one size does not fit all. So any type of Federal mandate that affects all States would just not be appropriate.

In Alabama, we have tried to adopt the code as we saw fit for the things that would help improve our homes, and, as a company, we have tried to go a step ahead. But we understand the importance of it, at the same time while balancing that housing affordability crisis that we are in and trying to make sure that we can provide housing that people can afford.

Mrs. MILLER. Okay.

Mr. WRIGHT. And I think that we look at these elements, because of the way that different kinds of weather events play out across the country, what are those, kind of, universal pieces and then how does it apply?

So, in the case of West Virginia, clearly, there is a flooding element there, and that has to do with where the water goes. And

sometimes elevating work, sometimes it doesn't, given the way that the topography of the State works.

But we look at the kind of impact that roofs have. So the convective storms—we watched this with tornadoes, probably at the lower end but still high wind, and derechos. And so, yeah, so much of it is about what was already built. That was one of the numbers earlier, in terms of the homes that were already built back in the 1960s, 1970s, 1980s, 1990s. How do we help those folks?

Well, one of the elements is, when we are recovering from these disasters, let's make sure we are putting it back in a way that we don't expect to have to pay for it again.

And, secondly—and I think this is the real opportunity in front of us—the next innovation in resilience has to be affordability. We have to find ways to address these things, whether it is around the roof, it is how the external pieces of the building come together, the envelope—how do we do that in ways that address both? Because the way that you protect your roof and you seal your roof deck and the way you deal with your openings and windows are the exact same things that drive down your energy bills and your utilization of those pieces.

Those pieces, frankly, are universal, but then they then need to be applied to the context in West Virginia, in Alabama, in California, which will all have very different experiences with it.

Mrs. MILLER. Well, I know many of our homes were built—I have a farmhouse that was built in the 1880s. A lot of the houses were built in the 1940s.

How have home builders worked to make energy efficiency and resiliency affordable for home buyers?

Mr. Rutland.

Mr. RUTLAND. Well, again, what we have tried to do is give them choices and give them a menu, if you will, of options to choose from so that they could upgrade, again, trying to stay in that affordable price range.

You know, it was mentioned earlier that you pay for it over 30 years. Most people don't stay in their home 30 years. Most people stay in their home 5 to 6 or 7 years. And so you have to make that payback attainable sooner. So you have to have solutions that make that attainable sooner.

Mrs. MILLER. In your testimony, you stated, "NAHB estimates that nearly 25 percent of the final cost of a single-family home and more than 30 percent of the cost of a multifamily home is due to government regulation at all levels of government."

Can you elaborate on that?

Mr. RUTLAND. Well, it starts with the land development. It starts with, in our State, ADEM. It starts with the regulations that we have that add cost to putting that lot, putting those streets and gutters in.

And then it starts with the unnecessary codes in so many points and regulation that restricts us from coming up with new and inventive ways—smart technology, smart thermostats, things like that—that would help us be able to offset other regulation and code.

Mrs. MILLER. Thank you.

I yield back.

Ms. CASTOR. Thank you.

Mr. Casten, you are recognized for 5 minutes.

Mr. CASTEN. Thank you, Chair Castor.

Thank you all for coming here today.

I am always struck that we have either a great opportunity or a great embarrassment and, if we are honest, probably both, that comes from the fact that so many of our trading partners use so much less energy per dollar of GDP than we do, with existing technology, with standards of living that are comparable to our own. And that means we have an enormous opportunity and, if we are honest, an enormous amount of shame that we haven't gotten there already.

As my colleagues know, I spent 20 years in the clean-energy and energy-efficiency world before I got here. And the non-nerdy way to describe that is this great joke that all my colleagues used to like to tell about an economist who walks down the street with his grandmother, and he sees a 20-dollar bill on the ground, and he keeps on walking. And his grandma says, "Aren't you going to go pick up the 20-dollar bill?" And the economist says, "No. We live in a perfect economy. If the 20-dollar bill existed, somebody would have picked it up already."

I tell you that story to start with a question for you, Ms. Rinaldi. When homeowners are making a decision about investing in thicker insulation or a more efficient light bulb or a better water heater, all the things they could do, what kind of payback do they typically require? Do they get their money back in 4 years, 3 years, 2 years? How much do they need to really see an uptick of those investments?

Ms. SAUL RINALDI. Well, I think that there is—I have generally been told by contractors that 3 years is a good—you know, for a large investment. But, obviously, the faster the payback, the better. That is the reason why I noted earlier the need for incentives, just to help reduce that payback. Because the faster the payback, the more likely they are going to take that option.

I do think there are other opportunities, which is to give them an additional value, whether it is making sure these are in the MLS systems or that they have a certification or other things that can provide visibility and transparency to the upgrades so they can brag about it. I think that is another piece.

Mr. CASTEN. So 3 years is awesome. My experience was that we used to tell our salespeople, if you can't see a way through to a 2-year payback, don't waste your time, because we don't have enough time to send salespeople out.

But let's just stay with 3 years.

Ms. SAUL RINALDI. Okay.

Mr. CASTEN. On a compounded basis, that is like a 25-percent return on your investment. We have retirees and savers and people putting aside for a rainy day who fantasize about getting 7-, 8-, 9-percent compound returns. And what you are saying is that homeowners walk away from 20-, 25-percent returns every day.

Ms. SAUL RINALDI. Yes.

Mr. CASTEN. Dr. Shahyd, talk a little bit about the split-incentive problem, if you would, between when the building owner and the person who pays the utilities are two separate people.

Mr. SHAHYD. Yep. Thank you. Yes, because I feel like much of the conversation so far has been focused on homeowners, but renters also face these burdens and are particularly vulnerable.

And so the split incentive, as you mentioned, when the building owner doesn't pay the utilities, so has no incentive to invest in the continued maintenance or, really, the upgrade of that building, and so just allows it to deteriorate. And if you are a renter, you obviously don't want to, you know, put your own money into a place that you don't own.

And so a couple of things, you know, that we have done is, one, just working with utilities to improve the incentive to the building owners, basically making it more cost-effective for them to want to invest into their home; but then also working with them to quantify what is the benefit to the building owner of actually investing in your home.

Well, one of them is that people will actually want to stay there and not just use the apartment as a way station to something better. And so, if you are an owner of the property, you want to have full occupancy, you want to have, you know, continuous occupancy of the unit, which is where you get your investment and your return back.

And so being able to quantify, you know, what that is. And we have worked with building owners across the country who have seen improvements where, you know, they have trouble renting units, to units that are now on a waiting list because so many people wanted to get in.

Another thing that you can do is, as some cities and States have, have renter ordinances where renters can actually see the energy score of the apartments that they are actually looking to rent. So they can use that as part of their decisionmaking in where they want to rent, which also makes an incentive for a building owner to say, okay, I want to have a much more energy-efficient—

Mr. CASTEN. So if I could just wrap up, with the little bit of time I have left, I am delighted with both of your answers, and I want to come back to that this is both an opportunity and some shame. Because I don't want any of us to fall for being that dumb economist anymore. And we know we have this opportunity.

We know, you know, Mr. Rutland, as you eloquently pointed out, people look at the first cost of the house. They don't look at what it is going to save them down the road.

And we have legislation that educates consumers. We have building codes. We have tax incentives. And if we are really honest, they ain't enough. Because we are not capturing that win-win that will lower CO₂ and put more money in our pockets. And until we maximally capture that win-win, none of us should sit here saying that we economically can't go after CO₂ reduction.

And so, if you all have thoughts—and I am out of time. But if you have your one—if you get to be king and you have one policy that would really make a difference and bring us up to the level that our trading partners are already at, please submit them for the record and keep us educated. Thank you.

Thank you, and I yield back.

Ms. CASTOR. Mr. Palmer, you are recognized for 5 minutes.

Mr. PALMER. And I am Mr. Palmer, not Mr. Graves. So I don't want any confusion there.

A couple of things that I want to talk about.

One, Mr. Wright, you said that the grants from the States for mitigation are taxable. Are those Federal grants that are administered by the States, or are those State-originated grants?

Mr. WRIGHT. If you are using State money appropriated by the State legislature. If it is appropriated by the Feds, it is not taxable. So you take something—like, the State of Alabama has their product—

Mr. PALMER. Okay. That is what I am looking for, because I think that is something we need to look at. I am sure it is going to be on an individual State basis how to do this.

But on another area, there is the Low Income Household Energy Assistance Program, LIHEAP. That money is administered to the States as a grant. I think in Alabama it is through ADECA, the Alabama Department of Economic and Community Affairs. And I think we need to look into that and see whether or not that money is used for mitigation. It is supposed to be assisting low-income households to pay their energy bills.

Mr. WRIGHT. Sir, very simply on this, to the degree that there is Federal money that is flowing, my understanding is none of that is taxable. It is when it is only a State—

Mr. PALMER. In the last fiscal year, we sent \$3.65 billion. \$54.2 million of that went to Alabama. Florida got \$96.8 million. Now, that is up over—right at 21 percent from 2016. So we are putting quite a bit a money out there.

Also, I want to respond to something that was in your testimony about rural households and manufactured housing. I think your number is a little bit high on the percentage of rural people who live in manufactured housing. I grew up in rural Alabama, pretty much dirt-poor. I lived in a house that my dad built. It had cardboard between the two floors. We heated it with a coal heater and cooled it with a box fan in the kitchen window. So I know a little bit about living in a low-income household.

But I also, when I was in college, worked in manufactured housing as a summer job and as a night job. And the energy efficiency from manufactured housing has tremendously improved. Now, I know Mr. Rutland might not appreciate me speaking up for manufactured housing. And manufactured housing is no longer—I think you said it is delivered on a flatbed truck. That is not exactly accurate either. It is delivered by a truck, but there are manufactured houses that are delivered on a flatbed truck that look like any other house. And you see them not only in rural areas but you will see them in suburban areas and urban areas.

So I just wanted to make that point, that the technology that is going into building these homes is substantially different from what it was years ago when you just saw one being pulled down the highway. And there is a major emphasis on energy efficiency.

And there was also a point made that rural customers pay more for electricity than suburban or urban customers. And I checked with Alabama Power, and all customers, all residential customers, pay the same rate. What you run into is a percentage of disposable income.

And I looked up a Tax Foundation report on the cap-and-trade bill that was before Congress in 2009. Had that passed, the people who are in the bottom 20 percentile of income would have paid five times as much for their energy as people in the top 20 percent.

So I just want to make some clarifications here, that the policies that we are discussing here have ramifications and a cost, and you have to take that into account.

And I know that is important to you, Mr. Rutland, when you are building a home, the affordability of the home and the ability of the purchaser of that home to maintain the household, including the energy costs.

In your testimony, you say that the NAHB estimates that nearly 25 percent of the final cost of single-family homes and more than 30 percent of the cost of multifamily homes is due to government regulations at all levels of government.

If we want people to buy newer homes and more energy-efficient homes and safer homes, you know, to be able to withstand a storm, wouldn't it make sense if there were fewer mandates and that the regulations were clearer and more concise in your ability to build an affordable home?

Mr. RUTLAND. Absolutely. I couldn't agree with you more.

Mr. PALMER. That is one of the things that we are trying to work on. It is not that we want to get rid of regulations. We want to get the regulations down so that we get rid of the obsolete and the duplications and the contradictions and work this out so that we can build safe products at an affordable cost.

The other issue is—and, Mr. Wright, listening to your testimony too—is mitigation. I ran a think tank for 25 years. Prior to that, I worked for two international engineering companies. And the codes are different in different States. When we would build a project in California, we had to take into account earthquakes. So when you are putting together your engineering plan for structures, you had to take that into account.

Mr. Rutland, if you are building a home on the coast, you are building under different regulations there. So we are not going to be talking about one size fits all.

And we also have to take into account where you build the home. If you are building on the Gulf Coast, then you are basically accepting the risk that your home might be damaged or destroyed.

So when you are building a home, you take all that into account. Is that correct?

Mr. RUTLAND. Absolutely. In my local area, there are two different soil types, so we have to build differently in just 10 miles from each other.

Mr. PALMER. Well, I think I am out of—no, I have a minute and 30 left.

Ms. CASTOR. No, you are over.

Mr. PALMER. Oh, I am? Well, I didn't see the clock.

Ms. CASTOR. Do you have one quick comment or question?

Mr. PALMER. No, I appreciate the panel. And I think we are moving in the right direction in terms of our engineering expertise to build houses that can survive storms, that are also energy-efficient.

And, with that, I will yield back.

Ms. CASTOR. Perfect.

Well, thanks to all the witnesses.

And, Mr. Palmer, you had me hearkening back to 10 years ago during the debate of the Waxman-Markey bill, which was a substantial carbon-reduction bill. When the nonpartisan Congressional Budget Office analyzed the cost to low-income families, they actually found that Waxman-Markey and tackling the climate crisis at that time would reduce the burden on hardworking families across America.

So that is our challenge moving forward, to craft policies that reduce carbon pollution, build resiliency, reduce risk, create jobs, and make sure that the burden is properly placed.

And, at this time, I would like to submit a few reports, without objection.

The first report is the “Energy Efficiency Jobs in America” report. 2.3 million Americans work in energy efficiency. This was released by E2 in September.

Next, the National Institute of Building Sciences, the NBI, New Buildings Institute report, “Implementing an Outcome-Based Compliance Path in Energy Codes: Guidance for Cities.”

Next, the American Institute of Architects, “Understanding Codes Change Proposal.”

And, finally, a letter, October 16, 2019, from PG&E.

Without objection, these are entered into the record.

[The reports follow:]

**Submissions for the Record
Representative Kathy Castor
Select Committee on the Climate Crisis
October 17, 2019**

ATTACHMENT: *Energy Efficiency Jobs in America*. E2, 2019.

This report is retained in the committee files and available at: <https://www.e2.org/wp-content/uploads/2019/09/Energy-Efficiency-Jobs-in-America-2019-Full-Report.pdf>.

ATTACHMENT: *Implementing an Outcome-Based Compliance Path in Energy Codes: Guidance for Cities*. National Institute of Building Sciences, 2017.

This report is retained in the committee files and available at: <https://cdn.ymaws.com/www.nibs.org/resource/resmgr/docs/OBP-CityLevelGuide.pdf>.

ATTACHMENT: *Understanding Code Change Proposal CE264-19: Zero Code Renewable Energy Appendix*. The American Institute of Architects, 2019.

This report is retained in the committee files and available at: http://content.aia.org/sites/default/files/2019-08/Guidance_Document_for_Building_Code_Officials_CE264-19.pdf.

[The letter follows:]

**Submission for the Record
Representative Kathy Castor
Select Committee on the Climate Crisis
October 17, 2019**

OCTOBER 16, 2019.

The Honorable Kathy Castor
Chair, House Select Committee on the Climate Crisis
U.S. House of Representatives
H2-359 Ford House Office Building
Washington, D.C. 20515

The Honorable Garret Graves
Ranking Member, House Select Committee on the Climate Crisis
U.S. House of Representatives

H2-361 Ford House Office Building
Washington, DC. 20515

Dear Chairman Castor and Ranking Member Graves:

Pacific Gas and Electric Company (PG&E) writes to thank you for scheduling an upcoming hearing entitled, "Solving the Climate Crisis: Cleaner, Stronger Buildings." In advance of this hearing, PG&E respectfully requests the opportunity to submit this letter for the hearing record.

PG&E is one of the largest combined natural gas and electric utilities in the United States. Based in San Francisco, with more than 24,000 employees, the company delivers some of the nation's cleanest energy to nearly 16 million people—or one in 20 Americans—throughout a 70,000-square-mile service area in Northern and Central California.

PG&E appreciates the time and consideration the House Select Committee on the Climate Crisis is devoting to the important matter of how to reduce the carbon footprint of our nation's buildings while improving resilience to the increasing threats of climate change.

Meeting the challenge of climate change is central to PG&E's vision of a sustainable energy future. Consistent with our vision, PG&E is significantly reducing its greenhouse gas (GHG) emissions and environmental impacts from our operations, in partnership with California and beyond. In 2018, over 80 percent of electricity delivered to PG&E customers was GHG-free.

According to the California Air Resources Board's 2019 GHG Inventory, the electric sector accounts for 15 percent of statewide GHG emissions, whereas the transportation sector accounts for 41 percent of GHG emissions and the commercial and residential building sector accounts for 12 percent of GHG emissions.

This success serves as a foundation to help decarbonize other sectors. Notably, PG&E is helping to reduce emissions in the transportation sector by investing in alternative refueling infrastructure and customer incentives to adopt electric vehicles, while PG&E's energy efficiency, demand response and distributed generation programs are helping to reduce emissions from buildings in our service area.

Energy efficiency is a core part of California's efforts to reduce greenhouse emissions and promote customer affordability, and PG&E has been a key partner in implementing many of these programs. In 1976, PG&E became the first utility in the nation to offer energy efficiency programs to our customers. Since California's institution of energy-efficiency policies and utility-directed programs began in the 1970s, the state's per capita electricity consumption has remained nearly flat, while the rest of the United States has increased by about one-third.

Today, PG&E is continuing this leadership in offering our customers various assessment tools and programs to determine how best customers can maximize energy savings, and multiple rebate and assistance programs to incentivize adoption of more efficient homes, products and behaviors. A few examples of these programs include:

- In order to reduce the financial barriers to energy efficiency, PG&E provides mostly small- and medium-sized businesses and local governments with zero-interest loans to support energy efficiency updates. In 2018, PG&E provided nearly 800 loans cumulatively worth \$37.6 million.
- PG&E operates two Energy Centers and supports a Food Service Training Center, offering energy efficiency education and training programs for building professionals, including architects, designers, engineers, contractors and technicians. In 2018, PG&E held more than 485 classes, 100 technical consultations and 170 outreach events focused on educating and training these professionals on energy-efficient design and practices.
- In 2018, PG&E provided nearly 147,000 customers a Home Energy Check-up, which provides customers personalized information on how they use energy and how they could be saving more.
- More than 200,000 residential customers and 150,000 larger commercial and industrial customers participate in various PG&E demand response programs. For example, PG&E's SmartAC program allows PG&E to send a signal to a PG&E-provided device on a customer's air conditioner, cycling the AC to use less energy. Over 112,000 customers participate in the program, which last year provided 61 MW in potential load reduction.
- PG&E is also very active at the federal and state levels to advocate for stronger building codes and appliance and product standards. Notably, PG&E supported California's goal for all newly constructed residential buildings to be zero net energy (ZNE) by 2020.

Thanks to these energy efficiency programs, in 2018 PG&E helped customers save approximately \$300 million on their energy bills and avoid the emission of more than 284,000 metric tons of carbon dioxide.

In addition to PG&E's energy efficiency and demand response programs, PG&E is also helping to reduce the carbon footprint of our buildings by providing our customers a variety of tools and resources for those who want to use solar energy and other distributed energy resources. In 2018, PG&E reached nearly 400,000 inter-connected solar systems, representing about 20 percent of all private rooftop solar in the United States. During the year, PG&E connected 77 percent of customers' private solar systems to the electric grid within three days. PG&E also offers incentive programs for low-income solar, solar thermal water heating, fuel cells, wind, battery storage and other advanced technologies.

Long-term decarbonization goals will also need to address the use of natural gas in buildings. In California, this transition has been focused on the promotion of appliance electrification (e.g., upgrading to an electric heat pump) and changes to local building codes requiring new construction to be all-electric. PG&E has recently supported efforts in Berkeley, San Luis Obispo and other California municipalities to transition away from natural gas infrastructure in new buildings. PG&E supports these local governments taking such action in cases where it is cost effective, and welcomes the opportunity to avoid investments in new gas assets that might later prove underutilized as local governments and the State of California work together to realize long-term decarbonization objectives. Beyond new construction, PG&E believes a multi-faceted approach is needed to cost-effectively achieve California's broader economy-wide long-term GHG reduction objectives, including both electrification and decarbonizing the gas system with renewable natural gas and hydrogen.

The transition of California's gas system will create various affordability, reliability and workforce challenges that will need to be addressed. In September, Gridworks issued a report entitled "California's Gas System in Transition: Equitable, Affordable, Decarbonized, and Smaller," which identifies challenges in managing a transition away from natural gas and provides a series of recommendations that policymakers should consider proactively to minimize the impacts this transition will have for customers, workers and communities. PG&E provided input to Gridworks for this report, along with IBEW Local 1245, state regulators, environmental organizations, consumer advocacy organizations and others. A copy of the report is attached to be included in the hearing record.

As we work to decarbonize the building sector, we must also invest in the resilience of our communities. Many of the communities and customers PG&E serves in California are already experiencing the consequences of climate change, including more frequent extreme weather, rising sea levels, increased drought, extreme heat and longer, more severe wildfire seasons. In response, PG&E is working to design, influence and implement policies that measurably and demonstrably increase the resilience of the company's assets and operations, and support climate resilience in the communities we serve.

At the community level, PG&E is investing \$2 million over five years through the Better Together Resilient Communities grant program to support local climate resilience initiatives. This grant program provides eligible local governments, educational institutions and non-profits \$100,000 for projects that increase community resilience to various climate risks, including heat waves and wildfires. The competitive process evaluates applications by criteria including how the project assists disadvantaged communities and provides measurable benefits.

Furthermore, PG&E is working to integrate long-term climate resilience into the company's core processes by incorporating long-term climate projections into infrastructure planning. By planning today for the projected changes in heat, precipitation, sea level rise and other conditions that will occur in California in the coming decades, PG&E can avoid increased maintenance or replacement costs and be better prepared to continue providing safe, reliable, affordable, clean energy into the future.

While PG&E is taking steps today to plan for the future, bolstering our nation's resilience in the face of increased extreme weather and a changing climate will require multiple sectors, communities and governments at all levels working together. To this end, PG&E believes there are many supportive actions the Federal Government can take to promote resilience in local communities and buildings, including:

- Encouraging public-private partnerships to design, develop, and fund resilience projects;
- Establishing voluntary resilient zoning and building codes and standards, using the LEED certification program as a model, and providing incentives for customers and communities in disaster-prone areas to adopt the standards;

- Incorporating climate resilience in future federal spending and planning decisions to maximize infrastructure lifespans;
- Funding for local climate resilience planning and implementation.

Thank you for convening the hearing and for the opportunity to submit this letter for your consideration. PG&E welcomes the opportunity to serve as a resource to you and the Select Committee as you evaluate opportunities to reduce the carbon footprint of the building sector and increase the resilience of our communities.

Sincerely,

JESSICA HOGLE,
*Vice President, Federal Affairs and Chief
 Sustainability Officer PG&E Corporation.*

Attachment: Gridworks, "California's Gas System in Transition" (Available at: https://gridworks.org/wp-content/uploads/2019/09/CA_Gas_System_in_Transition.pdf).

Ms. CASTOR. I would like to remind everyone that the Select Committee on the Climate Crisis currently has a request for proposals, a request for information out. We want your ideas on how we reduce CO₂ in the atmosphere and build more resilient communities across America.

You can find that on our website at climatecrisis.house.gov or follow us on Twitter, @climatecrisis.

Without objection, all members will have 10 business days within which to submit additional written questions for the witnesses. I ask our witnesses to please respond as promptly as you are able. [The information follows:]

**United States House of Representatives
 Select Committee on the Climate Crisis**

Hearing on October 17, 2019

"Solving the Climate Crisis: Cleaner, Stronger Buildings"

Questions for the Record

**Anica Landreneau
 Senior Principal
 Director of Sustainable Design
 HOK**

THE HONORABLE KATHY CASTOR

- 1. Why are some of your clients, like hospitals, airports, and universities, opting for electric space and water heating? What are some of the benefits they have experienced? What policies do we need to support building electrification?**

Energy efficiency and renewable energy are critical first steps to achieving a low carbon built environment. Another critical element is the **electrification of buildings**. While Renewable Portfolio Standards (RPS) are addressing the combustion of fossil fuels at the utility level, it is important to also address the consumption of fossil fuels on site at the building and central plant. This means replacing fossil fuel-based cooking, water heating, space heating and cooling equipment and co-generation equipment with electric equipment.

In many cases natural gas or coal is used in large central plant facilities serving multiple buildings, particularly at hospitals, airports, universities and other campuses or networks that serve our communities. Eliminating onsite combustion of fossil fuels can have co-benefits such as improved safety, indoor air quality and grid flexibility. When these facilities and campuses convert to all-electric systems, they are more grid flexible (energy can run both ways, depending on time of day pricing), renewable-ready and zero energy-ready. This flexibility and adaptability to alternative energy sources helps them to be more resilient, capable of safely storing energy for emergency scenarios, and better prepared for the future.

Congress can offer incentives, such as tax deductions where applicable, for the replacement of fossil fuel-based equipment in existing facilities, particularly water heaters, furnaces, boilers and space heating/cooling equipment (i.e. heat pumps), or rebates (for non-profit institutions) to buy down the cost premium for first-time installation of electric equipment. Studies indicate regional state-led incentive programs¹ have been successful to date.

Congress can also revisit a Federal law² which often precludes state action on efficiency and emissions. In 1975 Congress enacted the National Appliance Energy Conservation Act (NAECA) to set national standards for equipment like heaters, boilers and rooftop air conditioners, but this legislation also disallows states and other jurisdictions from setting more stringent local standards on these products. The International Code Council (ICC), the states, and or cities that adopt stretch energy codes, are still strictly limited in how much efficiency they can achieve in the products covered by NAECA. Innovative U.S.-based manufacturing companies could be created by demand for high performance heating and cooling equipment should more stringent state and local requirements be permitted. The performance cap or ceiling created by NAECA suppresses such innovation.

2. How could all-electric buildings save consumers money upfront and over the lifetime of the buildings? What barriers prevent developers and owners from building electric-only buildings?

When the local energy grid can support the entirety of building loads (i.e. both heat and power demands), an all-electric building can save the consumer money upfront, offsetting the cost of an electric heat pump by eliminating the costs of gas boilers and natural gas connections. In some cases, the length of connection to a natural gas line is quite long and therefore the savings by eliminating the gas connection are substantial.

In other cases, if there is insufficient capacity in the local grid to handle both power and heating needs, and if the utility forces the developer or consumer to bear the cost of adding an additional transformer, substation or other electric infrastructure, then that cost could pose a barrier to all-electric construction. Other barriers may include cultural or social preferences for cooking with natural gas. If any natural gas infrastructure is provided, even for nominal uses, then the savings for eliminating natural gas aren't realized.

Over the lifespan of the building, an all-electric system has greater capacity for grid flexibility (energy can run both ways, depending on time of day pricing), is renewable-ready and zero energy-ready, is capable of safely storing energy for grid harmonization or emergency scenarios. This can substantially lower a home or building owner's costs to operate over the lifespan of the building.

Natural gas is a finite resource that already utilizes environmentally harmful extraction methods such as fracking. As resources become scarcer the cost for this resource will rise. An all-electric building can be completely powered with renewable energy, which already outpaces coal in states like Texas³ and the "cost of renewable energy is now falling so fast that it should be a consistently cheaper source of electricity generation than traditional fossil fuels" as early as 2020 according to International Renewable Energy Agency's (IRENA) *Renewable Power Generation Costs in 2017* report. Renewable energy at utility scale already costs less to build and these savings can be passed on to consumers: "Costs for most coal plants ranged between \$33–111/MWh. Costs in 2018 for solar were between \$28–52/MWh. Wind power costs varied more widely, based on location, coming in at \$13–88/MWh, said the coal-cost report."⁴

3. In your testimony, you mentioned that several cities and states are adopting net zero energy and net zero carbon building codes and goals. You also referenced the Zero Code appendix to the 2021 model energy code currently being developed. What can the Federal government do to incentivize the adoption of net zero building codes and goals?

Congress can incentivize states and cities to be early adopters of **Zero Energy** and **Zero Carbon codes** by supporting the staff and permitting infrastructure, public education and engagement programs, annual benchmarking and reporting infrastructure and the development of shared tools and lessons learned.

¹<http://www.aceee.org/sites/default/files/publications/researchreports/a1803.pdf>.

²Federal Preemption as a Barrier to Cost Savings and High-Performance in Local Codes (NBI, 2017).

³<https://www.cnn.com/2019/07/25/us/texas-wind-energy-trnd/index.html><http://www.ercot.com/content/wcm/lists/172485/DemandandEnergy2019.xlsx>.

⁴https://energyinnovation.org/wp-content/uploads/2019/04/Coal-Cost-Crossover_Energy-Innovation_VCE_FINAL2.pdf.

There are existing models and vehicles for this kind of support. For example, the *American Recovery and Reinvestment Act (Recovery Act) of 2009* provided the State Energy Program (SEP) with \$3.1 billion of resources, requiring required states to develop a plan for achieving compliance with codes equal to or greater than the 2009 IECC and ASHRAE Standard 90.1–2007 in at least 90% of new and renovated residential and commercial buildings within eight years (by 2017). The U.S. Department of Energy provided workforce training, code manuals and other tools. While the Recovery Act SEP funding represents an unprecedented level of federal support for energy code implementation, the requirements also called for an extraordinary level of commitment and planning from participating state and local entities. This incentive program is likely a major factor leading 88% of the U.S. to *at least* be on the 2009 energy code or a later edition now. This is a model for a program that could be developed around zero energy or zero carbon codes, providing workforce training, code manuals and other tools to states and local jurisdictions willing to accelerate the adoption of these advanced building standards.

Congress can also direct federal spending through existing programs to focus on zero energy and zero carbon goals, such as the **Building Technologies Office** (BTO), the development and maintenance of free/open source energy modeling tools such as **EnergyPlus** and renewable energy sizing tools such as **PVWatts**, and most importantly, **the Building Energy Codes Program**, which can provide training and technical assistance, assess savings impacts, and administer a help desk specific to model zero energy codes.

Congress can maintain and increase Federal tax incentives for Renewable Energy technologies, including **energy storage**. As more production comes online, the ability to store energy and control how and when it flows onto the grid will be critical to maintaining our infrastructure and energy autonomy.

Congress can also link existing **Federal tax incentives** (or restore lapsed tax incentives) to Zero Energy and Zero Carbon goals. By leveraging existing financial incentives but tying them to Zero Energy or Zero Carbon, Congress not only uses its buying power to reduce carbon emissions in the built environment but also creates a replicable framework that smaller jurisdictions can emulate and normalizes the expectation of performance outcomes.

Examples of existing or recently lapsed tax incentives include:

The **Low-Income Housing Tax Credit** (LIHTC) gives incentives for the utilization of private equity in the development of affordable housing aimed at low-income Americans. LIHTC accounts for 90% of all affordable rental housing created in the United States today. Congress can incentive zero energy or zero carbon low income housing.

The **Federal Historic Preservation Tax Incentives Program** (HTC) provides a 20% Federal tax credit to property owners who undertake a substantial rehabilitation of a historic building in a business or income-producing use while maintaining its historic character. HTC is designed to not only preserve and rehabilitate historic buildings, but to also promote the economic revitalization of older communities in the nation's cities and towns, along Main Streets, and in rural areas. HTC has leveraged over \$162 billion in private investment in historic rehabilitation and generating almost 2.7 million jobs. Congress can incentivize zero energy or zero carbon historic restoration and preservation projects. In addition to the 20% Historic Preservation credit, Congress can resurrect a lapsed 10% tax credit for the restoration of non-historic buildings. This tax credit should be linked to zero energy and zero carbon renovation projects.

The tax deductions for **commercial buildings** have expired, effective December 31, 2017. The tax deduction of up to \$1.80 per square foot was previously available to owners or designers of commercial buildings or systems that saved at least 50% of the heating and cooling energy as compared to ASHRAE Standard 90.1-2007 (or 90.1-2001 for buildings or systems placed in service before January 1, 2018). Partial deductions of up to \$.60 per square foot could be taken for measures affecting any one of three building systems: the building envelope, lighting, or heating and cooling systems. Congress could reinstate a commercial building tax deduction for zero-ready, zero energy or zero carbon buildings.

The Federal Energy Policy Act of 2005 established tax credits of up to \$2,000 for builders of new energy-efficient homes. This tax credit has also expired,⁵ effective December 31, 2017. Congress could reinstate the tax credit for zero-ready, zero energy or zero carbon homes.

⁵ https://www.energystar.gov/about/federal_tax_credits/federal_tax_credit_archives/tax_credits_home_builders.

4. Can you discuss the potential scale of embodied carbon emissions in new construction? What are the emissions and climate benefits of low embodied carbon building materials, such as cross-laminated timber? How can the Federal government help incentivize the use of low carbon materials and encourage other ways to reduce embodied emissions?

Globally we must phase out fossil fuel CO₂ emissions in the built environment by 2050 in order to stay “well below 2 °C—preferably 1.5 °C—warming above pre-industrial levels”, but new research from the IPCC, the UN, and the scientific community stresses the critical importance of a 2030 milestone: if we do not achieve a 45–55% reduction in total global emissions by 2030 we will have lost the opportunity to meet the 1.5/2 °C warming threshold and climate change will become irreversible. The immediate focus for embodied carbon reductions must therefore be on the next decade.

Annually, the **embodied carbon of building structure, substructure, and enclosures are responsible for 11% of global GHG emissions** and 28% of global building sector emissions. Eliminating these emissions is key to addressing climate change and meeting Paris Climate Agreement targets.

Under a business as usual scenario, embodied carbon in buildings constructed globally between 2020 and 2050 could exceed 250 gigatons (GtCO₂). This is half of the 500 GtCO₂ global carbon budget we must stay within to stay within a 20 °C temperature rise and nearly three quarters of the 340 GtCO₂ global carbon budget we must stay within to stay within a 1.50 °C temperature rise.

Of the 173 billion square meters (1.86 trillion square feet) of new buildings we will construct between 2020 and 2050, approximately 52% of associated carbon emissions (130 GtCO₂) in that time frame will be derived from embodied carbon, and 48% of associated carbon emissions (120 GtCO₂) will be derived from operating carbon.

Looking more narrowly at the critical window between 2020 and 2030, under a business as usual scenario, approximately 72% of associated carbon emissions in that time frame will be derived from embodied carbon, and 28% of associated carbon emissions will be derived from operating carbon. This is because embodied carbon emissions are ‘front loaded’ and although they average out over the life span of a building, we are concerned with the ‘time value of carbon’ when it is particularly critical that we stay under a total 500 GtCO₂ carbon limit.

Buildings are complex systems. There is no such thing as a wholly concrete building; it requires steel reinforcement. There is no such thing as a wholly steel building; it requires concrete footings and foundations. And there is no such thing as a wholly mass timber building; it requires steel fasteners and concrete footings and foundations. We need all materials in our palette, and we need to decarbonize them all. There are ways to decarbonize concrete, by replacing cement with fly ash or blast furnace slag, or using a carbon sequestration technology such as **Carbon Cure**,⁶ or using a cement manufactured with a coal replacement product⁷ that is processed in an aerobic digester and that reduces landfill waste. There are ways to select steel products with lower embodied carbon, based on manufacturing location, methods and fuel sources. And there are an increasingly wide variety of mass timber products, such as **cross laminated timber** that are inherently a lower embodied carbon material.

Perhaps even more importantly, over one third of the solutions described in the Paris Accord are described as ‘natural climate solutions’. If the construction industry specifies significantly more timber products, it could lead to *increased land use for forestry*. Much of the cement and steel used in the U.S. is manufactured and milled overseas. But wood products actually are a robust domestic industry and have the potential to grow should the market signal increasing demand.

Historically code barriers, cost premiums and a lack of workforce familiarity or experience with mass timber construction have been barriers to increase specification. Fortunately the 2021 International Building Code (IBC) has removed barriers to 12- and 18- story tall wood buildings (exposed structure, and concealed behind fire proofing, respectively).

Congress can incentivize states and cities to adopt IBC 2021 by supporting the staff and permitting infrastructure, public education and engagement programs, and the development of shared tools and lessons learned.

There are existing models and vehicles for this kind of support. For example, the *American Recovery and Reinvestment Act (Recovery Act) of 2009* provided the State Energy Program (SEP) with \$3.1 billion of resources for workforce training, code

⁶ <https://www.carboncure.com/>.

⁷ <https://biohitech.com/renewables/>.

manuals and other tools. This could be replicated around IBC 2021 with particular emphasis on **Mass Timber** construction.

Congress can also direct federal spending through existing programs to focus on low embodied carbon goals, such as the **Building Technologies Office** (BTO), the development or expansion of free/open source embodied carbon modeling tools, and **the Building Energy Codes Program**, which could partner with industry leaders to develop a framework for an embodied carbon model code, or an integrated operating and embodied carbon code.

Congress can also link existing **Federal tax incentives** (or restore lapsed tax incentives) to low embodied carbon goals. By leveraging existing financial incentives but tying them low embodied carbon, Congress not only uses its buying power to reduce carbon emissions in the built environment but also creates a replicable framework that smaller jurisdictions can emulate and normalizes the expectation of performance outcomes.

Examples of existing or recently lapsed tax incentives include:

The **Low-Income Housing Tax Credit** (LIHTC) gives incentives for the utilization of private equity in the development of affordable housing aimed at low-income Americans. LIHTC accounts for 90% of all affordable rental housing created in the United States today. Congress can incentive the use of **Mass Timber** or other low embodied carbon materials for low income housing.

The tax deductions for **commercial buildings** have expired, effective December 31, 2017. The tax deduction of up to \$1.80 per square foot was previously available to owners or designers of commercial buildings or systems that saved at least 50% of the heating and cooling energy as compared to ASHRAE Standard 90.1-2007 (or 90.1-2001 for buildings or systems placed in service before January 1, 2018). Partial deductions of up to \$.60 per square foot could be taken for measures affecting any one of three building systems: the building envelope, lighting, or heating and cooling systems. Congress could reinstate a commercial building tax deduction for **Mass Timber** or other low embodied carbon building materials for commercial buildings.

5. In your testimony, you outlined several policies that could reduce emissions in the building sector. In your opinion, which policies would be most impactful and should be prioritized?

Policy Priority 1: address existing buildings through transparency and benchmarking

The model energy code addresses new construction and planned alterations projects that require a permit. Planned construction activity triggers the code. Buildings with no planned construction activity are not typically addressed by energy codes.

In most established U.S. cities, 80–90% of the buildings that will be consuming energy in 2050 already exist. U.S. cities only see 1–2% turnover (renovation or replacement) of building stock every year on average. And yet, in cities, buildings represent on average 50–75% of GHG emissions inventory. Buildings are the single largest opportunity to meet climate goals. Therefore, building codes alone won't address the issue of emissions in the built environment. Other complementary policy solutions, such as energy transparency and benchmarking, as well as building performance standards are required.

Energy benchmarking and transparency ordinances have been adopted by over two dozen jurisdictions across the country, making publicly and privately-owned building annual performance data available to jurisdictions and the public. These policies currently encompass nearly 92,000 properties⁸ at 11 billion square feet of floor area⁹ reported every year. Through transparency alone these cities are seeing an average of 4–13% energy improvement in their existing building stock. Just starting to use the benchmarking and reporting tools, such as EnergyStar Portfolio Manager, shining a light on building performance, and introducing a comparative metric has already inspired improved operations and maintenance as well as investment in energy efficiency.

Congress can incentivize states and cities to adopt transparency and benchmarking policies, by co-funding staff or providing resources and tools, particularly when policies are linked to a national benchmarking platform such as the U.S. Environmental Protection Agency (EPA) **EnergyStar Portfolio Manager** tool. Congress can also incentivize building owners by providing financial incentives (tax

⁸ <https://www.buildingrating.org/graphic/us-number-properties-covered-annually>.

⁹ <https://www.buildingrating.org/graphic/us-building-area-covered-annually>.

incentives or rebates) for energy audits, retro-commissioning, deep green retrofits, systems or component replacement, and building operator training programs.

Investment in Energy Efficiency is investment in local jobs and the local economy. Building improvements focused on improved energy efficiency in existing building stock cannot be shipped overseas. They are labor intensive and site-specific projects, driving the creation of local jobs in construction, renovation, installation, operations and maintenance.¹⁰ According to the 2019 *U.S. Energy and Employment Report*, Energy Efficiency produced more new jobs in the United States in 2018 than any other energy sector, and accounted for more than **2.3 million jobs** overall, as compared with about 534,000 in renewable energy and about 200,000 in coal.

Policy 2: address existing buildings through building performance standards

Once jurisdictions have established transparency and benchmarking infrastructure with its annual communication channels between building owners and a building performance oversight agency, it is easier to put a building performance standard into place. Cities may want to require building owners to take additional steps beyond just reporting performance such as improving buildings that exceed carbon intensity, energy- or water-consumption thresholds or fall below peer building EnergyStar scores.

There are a small number of jurisdictions that have already passed building performance standards, but many more are looking at similar policies to address their existing building stock. The next most likely jurisdictions to pass similar policies will be those with existing transparency and benchmarking policies already in effect.

Congress can incentivize states and cities to adopt Building Performance Standards, particularly when policies are linked to a national benchmarking platform such as the U.S. Environmental Protection Agency (EPA) **EnergyStar Portfolio Manager** tool. Support may include co-funding staff or providing resources, tools and training for jurisdictions.

Congress can continue to support the development and improvement of energy simulation tools that aid building owners in making financial investment decisions, as well as EPA EnergyStar Portfolio Manager platform, and ensure it remains relevant by maintaining funding for the **Commercial Building Energy Consumption Survey** which populates the database on the backend.

Congress can leverage the National Laboratories and the U.S. Department of Energy Building Technologies Office (BTO) to provide demonstration and field validation of advanced technologies so that American businesses may foster innovative solutions to our building energy challenges, these technologies may become shelf-ready and cost-competitive, and building owners may confidently employ these technologies in existing buildings to improve their performance.

Congress can also incentivize building owners by providing financial incentives (tax incentives or rebates) for energy audits, retro-commissioning, deep green retrofits, systems or component replacement, and building operator training programs.

Policy Priority 3: modernize code enforcement

The International Energy Conservation Code (IECC) is in use or adopted in 48 states, the District of Columbia, Puerto Rico and the U.S. Virgin Islands. The model code is updated in three-year cycles, supported by research and analysis conducted by industry stakeholders and U.S. Department of Energy (PNNL). The model building code is a powerful and far reaching tool, however many jurisdictions do not have the personnel or fiscal resources to adequately ensure compliance with energy requirements. Codes are only as good as they can be and are enforced, which is why the next policy priority focuses on enforcement.

Congress can provide resources to state and local governments in many ways. Congress can provide assistance to jurisdictions who wish to convert to an **e-plan review** process or to leverage **integrated technology solutions** that work with Building Information Modeling (BIM) design tools to facilitate virtual inspections through Augmented Reality (AR), Virtual Reality (VR) or drone site visits, all of which can streamline the permitting and inspection process and creates more efficient use of staff resources, enabling better code enforcement procedures and more consistent code updates.¹¹

¹⁰Energy Efficiency in Buildings: the key to Effective and Equitable Clean Energy Action for Cities (IMT).

¹¹Disruption, Evolution, and Change: AIA's vision for the future of design and construction (AIA, 2019).

Congress can also incentivize jurisdictions to adopt the latest codes by offering to co-fund staff or provide training for code officials using the existing U.S. Department of Energy (DOE) energy code training modules. There was a highly successful Federal program in the wake of the last recession with the **2009 American Recovery and Reinvestment Act** that provided free training and 2009 IECC code books and workbooks along with strong incentives for all jurisdictions to adopt the 2009 IECC.¹²

Policy Priority 4: incentivize outcome-based codes

Congress can incentivize states and cities to be early adopters of **outcome-based codes** by supporting the transition of staff and permitting infrastructure, public education and engagement programs, annual benchmarking and reporting infrastructure and the development of shared tools and lessons learned. Outcome-based codes establish a target energy use level or energy allowance, then require measured and reported actual energy use in relation to that target once the building is completed and occupied. At a minimum, an outcome-based energy code requires 12 consecutive months of post-occupancy performance within the allowed energy or carbon budget, typically within the first 18–36 months of use to normalize for weather and allow for commissioning. If the building doesn't meet performance requirements, the builder or owner forfeits a financial penalty.

By focusing on the outcome, code officials and communities can be assured that requirements are being met while not incurring additional enforcement burdens. Outcome-based codes mean that there would be less reliance on design documentation to obtain a permit, alleviating the pressure on a diminishing code enforcement workforce and freeing that workforce up to focus on building lifecycle performance policies such as transparency (annual benchmarking) and building performance standards. Typically, communities that are prepared for an outcome-based code already have adopted public and commercial building benchmarking policies, thus establishing an annual communication channel between building owner and building performance oversight agency.¹³

This simplification of the energy code would allow for more rapid escalation of performance expectations without the burden of retraining the entire code enforcement workforce every code cycle. It will also link escalation design expectations to more rigorous oversight of **construction quality** and **ongoing performance optimization** as an integral part of operations and maintenance activities. The National Institute of Building Sciences (NIBS) and New Building Institute (NBI) have provided energy code appendix language in the guide **Implementing an Outcome-Based Compliance Path in Energy Codes** to help jurisdictions interested in moving towards an outcome-based code.

Policy Priority 5: incentivize zero carbon buildings

The 2021 model energy code includes a **Zero Code appendix**, a platform that jurisdictions can opt into to incentivize or make mandatory for certain building types or sizes to help them meet their climate goals. As an appendix it is built into the code enforcement framework of the IECC but is voluntarily adopted by jurisdictions and could be adjusted locally to align with a step code or other local programs. The provisions contained in this appendix will become mandatory when specified as such in the jurisdiction's adopting ordinance.

The Zero Code appendix to the 2021 IECC is constructed to require that new commercial, institutional, and mid- to high-rise residential buildings install or procure enough renewable energy to achieve zero net carbon annually.¹⁴ The appendix encourages on-site renewable energy systems when feasible but also supports off-site procurement of renewable energy through a variety of methods. This appendix does not allow renewable energy to be traded off against the energy efficiency required by the 2021 IECC. Buildings are required to comply with the 2021 IECC using either the prescriptive or performance approach. When the prescriptive approach is used, the renewable energy that must be installed or procured is specified based on building type and climate zone.

Once the IECC 2021 model code is published Congress can offer incentives to state and local governments to increase speed of adoption and encourage use of the **Zero Code appendix**.¹⁵ Congress can incentivize states and cities to be early adopters of **Zero Energy** and **Zero Carbon codes** by supporting the staff and per-

¹² <http://bcapcodes.org/topics/federal-funding/>.

¹³ Implementing an Outcome-Based Compliance Path in Energy Codes (NIBS, NBI; 2017).

¹⁴ Understanding Code Change Proposal CE264-19 Zero Code Renewable Energy Appendix (AIA, 2019).

¹⁵ <https://architecture2030.org/wp-content/uploads/ZERO-Code-RE-Appendix-Fact-Sheet.pdf>.

mitting infrastructure, public education and engagement programs, annual benchmarking and reporting infrastructure and the development of shared tools and lessons learned.

Congress can also link existing **Federal tax incentives** to Zero Energy and Zero Carbon goals. By leveraging existing financial incentives but tying them to Zero Energy or Zero Carbon, Congress not only uses its buying power to reduce carbon emissions in the built environment but also creates a replicable framework that smaller jurisdictions can emulate and normalizes the expectation of performance outcomes.

Congress can maintain and increase Federal tax incentives for Renewable Energy technologies, including storage. As more production comes online, the ability to store energy and control how and when it flows onto the grid will be critical to maintaining our infrastructure and energy autonomy.

6. Recent reporting has revealed that the National Association of Home Builders has the ability to select 4 out of the 11 members of the residential code committee, based on a formal quid pro quo agreement with the International Code Council. How has this 4-vote block affected the code development process and the energy efficiency and resilience outcomes of the codes adopted? What reforms to the code development process would you recommend, if any?

The code update process typically involves a Code Development Committee (CDC) that is formed by qualified applicants representing a broad range of stakeholders. These stakeholders may include code officials, members of the building product or material manufacturing community (or representative associations), members of the architecture or engineering community, code consultants, and in the case of the residential code, home builders. The residential code is unique in this, as commercial developers and contractors are not typically engaged in the code development process. Anyone can propose code amendments, however the bulk are proposed by Code Action Committees (CACs) who have a vested interest in improving the code. Individual stakeholders who have identified unclear language, unintended barriers to good design or construction, inherent conflicts or other challenges within the code also propose amendments. There are some proposed amendments in every code cycle that attempt to ‘roll back’ the requirements or stringency of the code. It is the Code Development Committee’s role to protect the intent and integrity of the code.

While it has been evident that the residential energy code committee has had disproportionate representation by the National Association of Home Builders (NAHB), it was not evident until recently that this was a formal agreement. The agreement with the International Codes Council (ICC) was that having this significant representation or voting block on the committee would be in exchange for promoting the adoption of the i-codes, including the energy conservation code, with states and local jurisdictions.

The NAHB has leveraged this voting block to attempt to roll back much of the progress made in the residential energy code over the last couple of cycles, and other stakeholders have had to work in earnest merely to try to keep the code holding steady. For example, the update from the 2015 to 2018 residential energy conservation code only saw a nominal improvement:

- 1.97 percent energy cost savings
- 1.91 percent source energy savings
- 1.68 percent site energy savings

At the same time the commercial energy conservation code was advancing at four times the pace of the residential energy code. This is similar to the trajectory of the 2012 to 2015 energy code update and the 2018 to 2021 energy code update (in the 2021 code cycle the residential energy code improved by about 3% while the commercial energy code improved by about 12%). For three cycles in a row the commercial energy code has progressed at four times the rate of residential code because of the stranglehold NAHB has on the code development committee.

Ultimately it is the consumers who pay the price for inefficient homes, not only in energy bills but in thermal discomfort and poor indoor air quality and health impacts as well.

A better thermal envelope allows for passive survivability, or habitable human conditions with the loss of power. Increased r-values, lower u-values, and improved air tightness retain heat in the winter (when winter storms may knock out power) or prevent heat gain in the summer (when tropical storms, hurricanes or drought-driven fires may knock out power). Residents can stay in their homes without power for many more when their homes are built to more efficient standards.

Despite this quid pro quo, allowing the NAHB to maintain a significant voting block on the residential energy code development committee, thereby holding back code progress, in exchange for its support, the NAHB and its membership have *not*

worked with jurisdictions advocating for the adoption of the latest energy codes. NAHB and its membership have actively lobbied against adoption of the latest codes, decrying them as too stringent, too difficult, too much of a cost burden, despite the fact that NAHB has barely allowed the residential energy code to make any changes at all in nearly a decade.

No single organization or entity should be able to have such a large influence on the code development process. Nor should there be any quid pro quo arrangements that trade votes for influence or support. This has clearly been an ineffective arrangement with the energy code AND consumers losing on both sides of the deal.

Although the code hearings and public comment process are public, the final votes are only open to ICC members, primarily comprised of code officials. Even code development committee members cannot vote if they are not code officials. It seems that both the development committee and the final vote are lacking in representation from the most important constituencies: the people who actually must live in these homes. If not actual home buyers or home owners, then associations that represent them (REALTORS, etc.) who can advocate for that stakeholder population. Other advocates from the community may also be able to represent these concerns and issues on the committee as well as in the final vote.

THE HONORABLE GARRET GRAVES

1. Your testimony highlighted the role that buildings play in global emissions—40 percent. Could you elaborate on the role that the Department of Energy's Building Technology Office plays in finding new construction techniques that may make a difference not just for Californians, but also residents of developing nations?

The Building Technologies Office (BTO) supports the development and implementation of residential and commercial building energy codes by engaging with government and industry stakeholders, and by providing technical assistance for code development, adoption, and compliance. Through advancing building codes, we aim to improve building energy efficiency, and to help states achieve maximum savings. Through the Building Energy Codes Program, BTO:

- Assesses the savings impacts of model energy codes, calculating energy, cost and carbon savings to inform jurisdictions and the public
- Coordinates with key stakeholders to improve model energy codes, including architects, engineers, builders, code officials, and a variety of other energy professionals
- Reviews published codes to ensure increased energy savings, such as the International Energy Conservation Code (IECC) and ASHRAE 90.1
- Tracks the status of energy code adoption across the U.S. and provides technical assistance to states implementing updated codes
- Provides a variety of educational and training resources and assists states working to measure and improve code compliance
- Administers a Help Desk to assist individual code users with questions about energy codes

BTO also sponsors an Emerging Technologies (ET) Program that fosters the development of cost-effective, energy-efficient technologies and helps introduce those technologies into the marketplace. ET funds and directs applied research and development (R&D) for technologies and tools that support building energy efficiency. The BTO provides demonstration and field validation of advanced technologies so that American businesses may foster innovative solutions to our building energy challenges, these technologies may become shelf-ready and cost-competitive, and building owners may confidently employ these technologies in new and existing buildings to improve their performance.

BTO develops and maintains open source Whole-Building Energy Modeling (BEM) tools such as EnergyPlus and Open Studio. These are versatile, multipurpose tools that are used in new building and retrofit designs, code compliance, green certification, qualification for tax credits and utility incentives, and real-time building control. BEM is also used in large-scale analyses to develop building energy-efficiency codes and inform policy decisions. These energy simulation tools are vital support to aid building owners in making financial investment decisions. They provide timely feedback on first cost, energy cost savings and simple payback analysis, as well as load reduction and first cost tradeoffs for cost neutral high-performance construction.

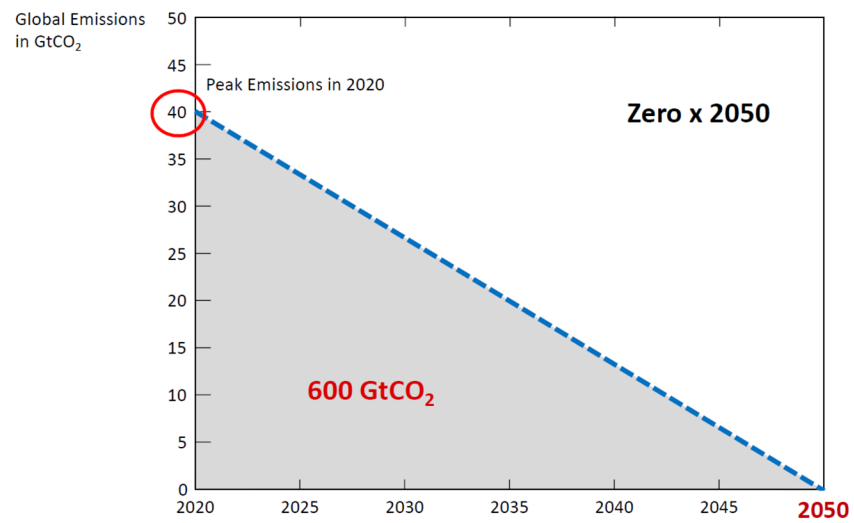
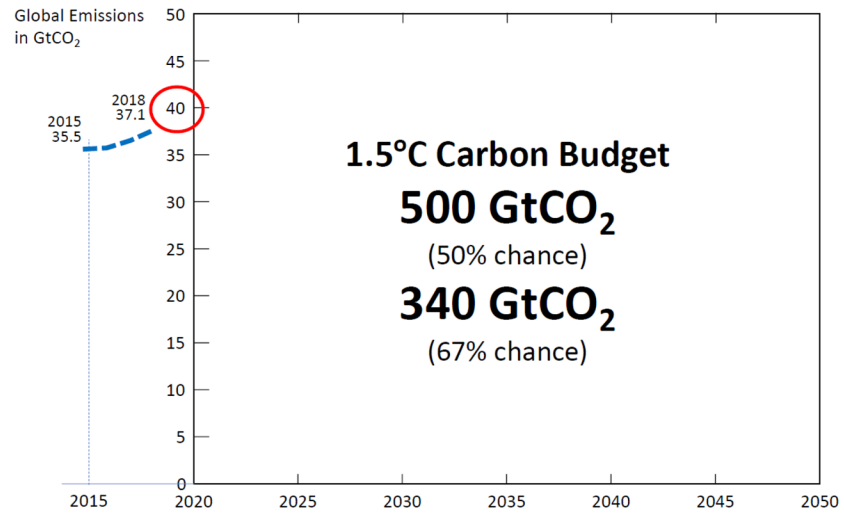
By providing model code assistance, tools and resources are made available including cost effectiveness studies, technical training and implementation guides that many developing nations would not be able to produce on their own. These tools and resources enable developing nations, many of whom are constructing billions of

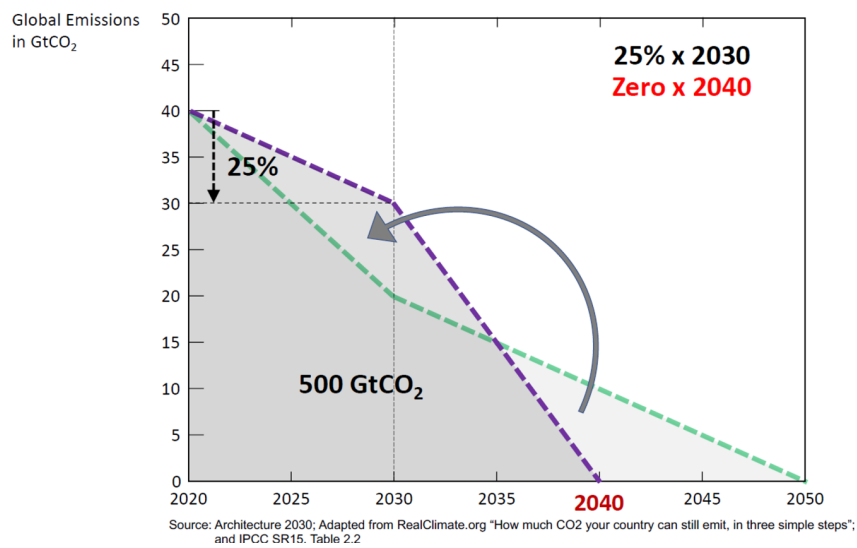
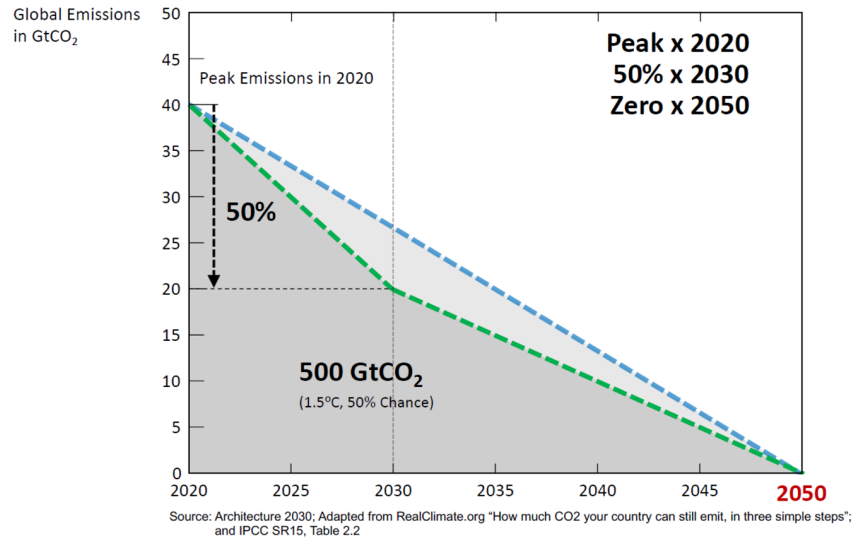
square feet of new buildings over the next few decades, to adopt and enforce a higher caliber of building and energy code. This results in safer, more resilient buildings, as well as lower global carbon emissions, which makes us all safer.

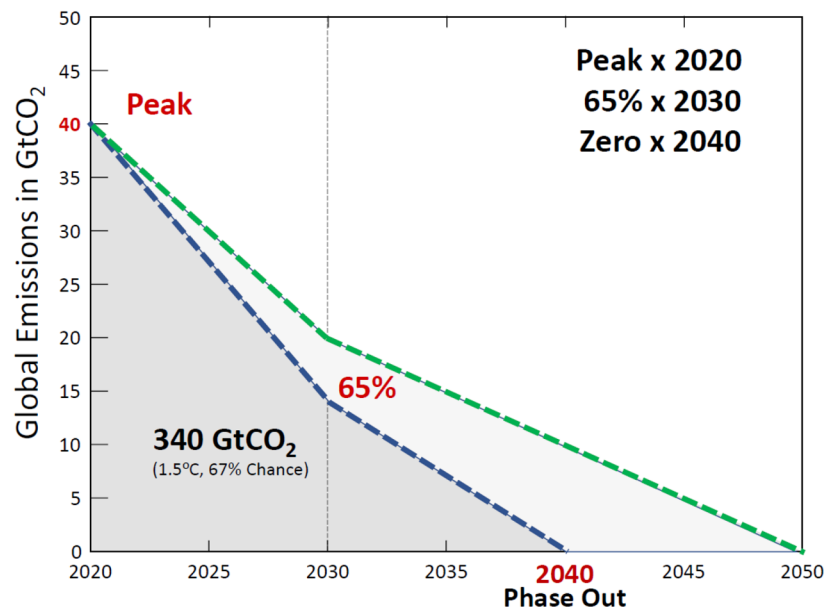
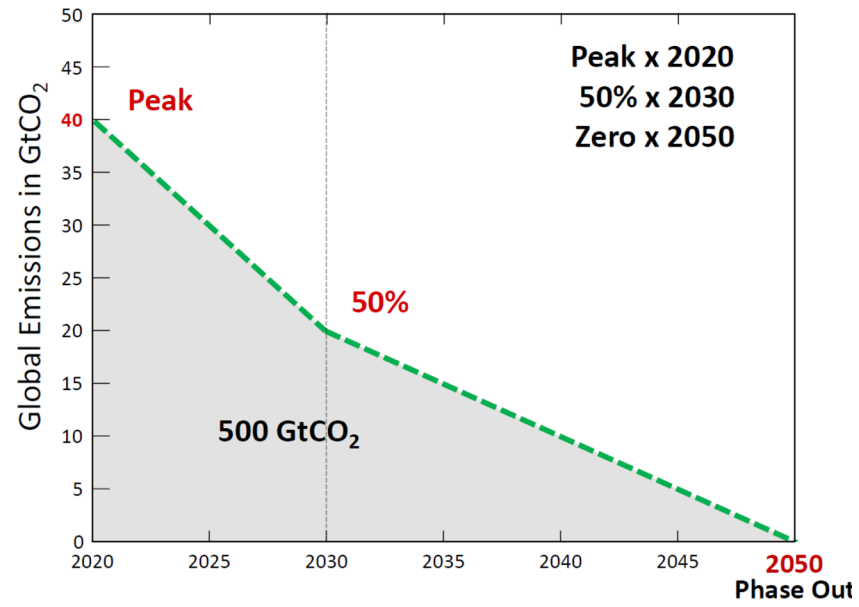
By fostering emerging technologies and proving their effectiveness, BTO is able to introduce technologies that ultimately become shelf-ready and cost-competitive, not just in the U.S. but in developing nations. By providing access to open source Whole-Building Energy Modeling (BEM) tools such as EnergyPlus and Open Studio, BTO enables designers and building owners to make construction decisions informed by first cost, energy cost savings and simple payback analysis, as well as load reduction and first cost tradeoffs for cost neutral high-performance construction. Simulation in concert with lower energy, lower carbon technologies contribute to lower carbon construction in developing nations. They result in safer, more resilient buildings, as well as lower global carbon emissions, which makes us all safer.

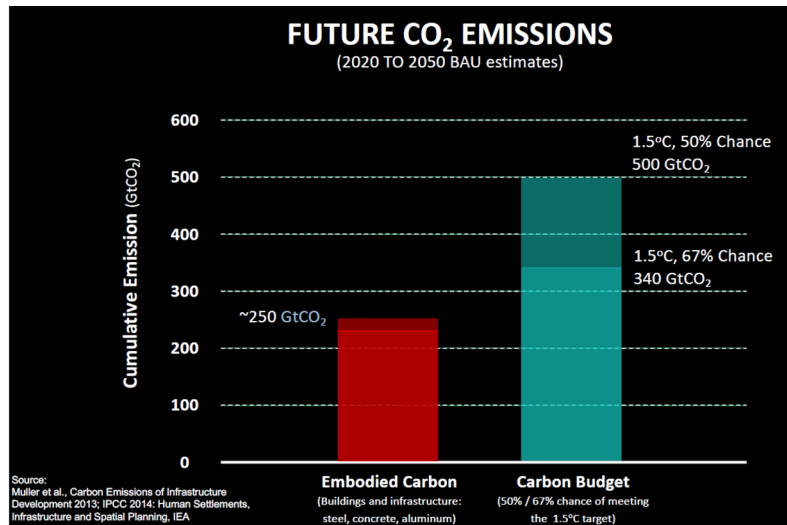
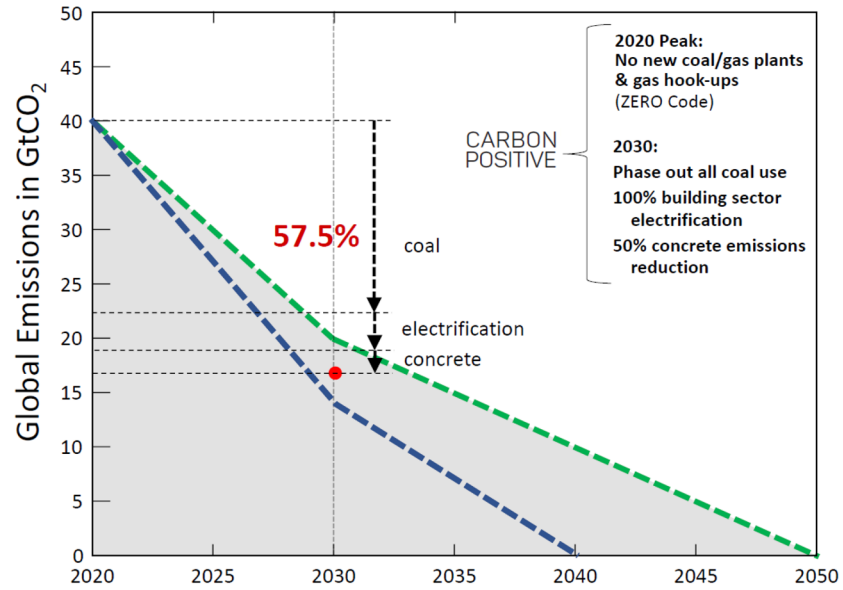
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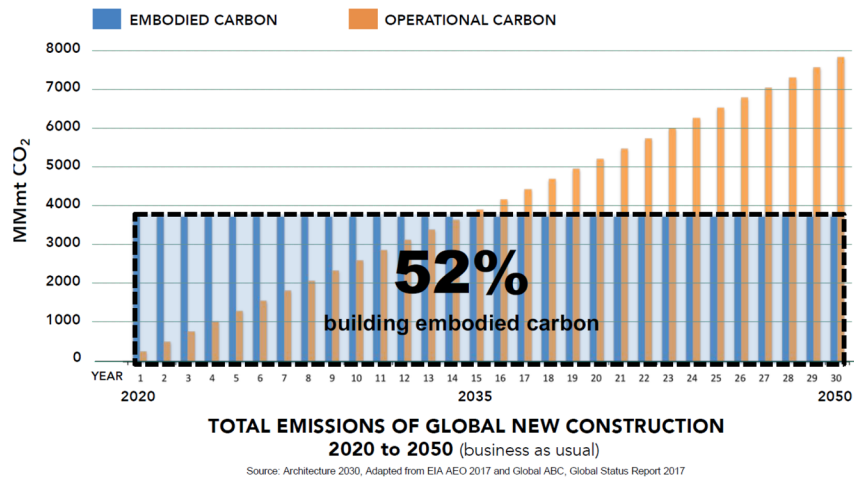
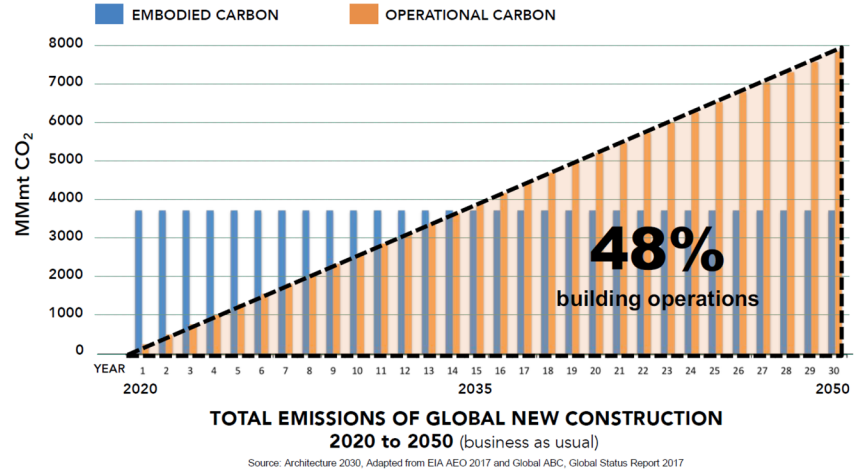
Graphs, charts, diagrams courtesy of Architecture 2030, except where noted.

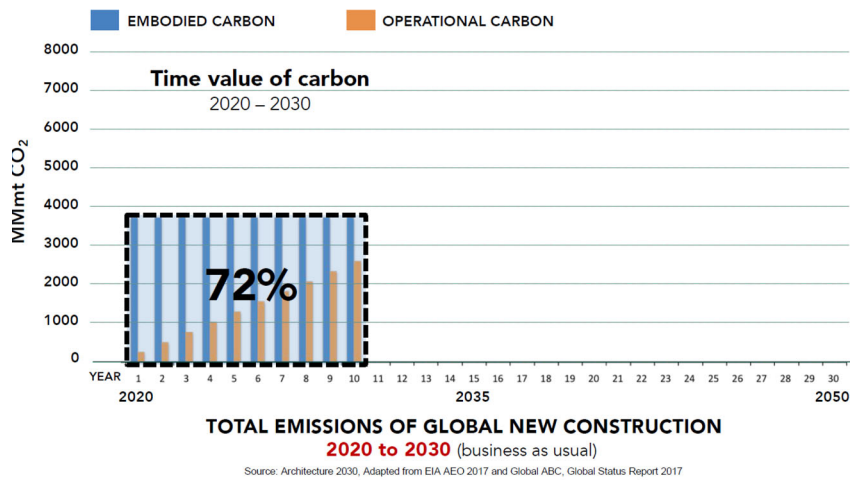
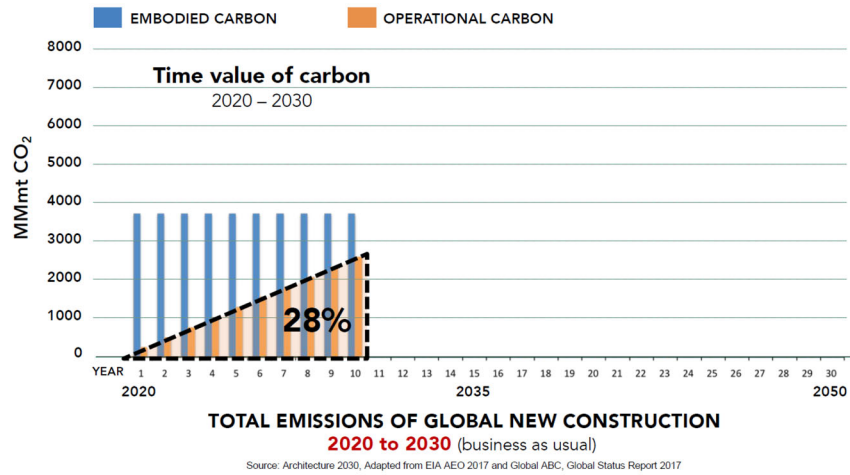








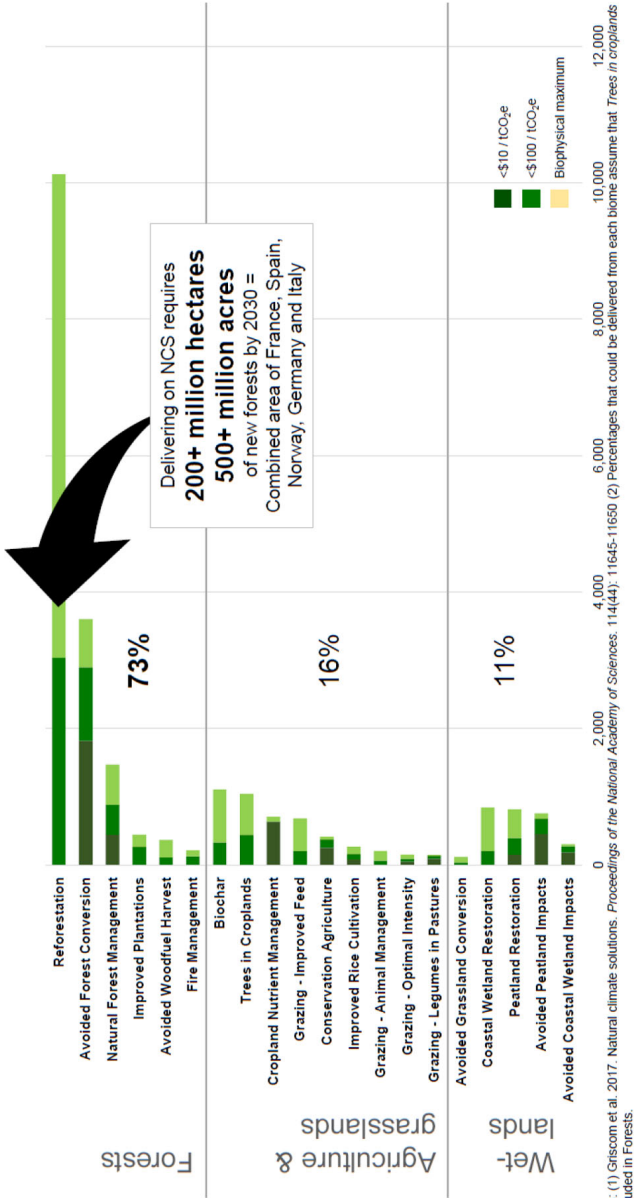




Image/graph courtesy of The Nature Conservancy

NATURAL CLIMATE SOLUTIONS

NCS can provide 37% of mitigation through 2030



Questions for the Record

Kara Saul Rinaldi

Vice President, Government Affairs, Policy, and Programs, Building Performance Association

THE HONORABLE KATHY CASTOR

1. In your testimony, you outlined several policies that could expand the use of energy efficiency in the building sector. In your opinion, which policies would be most impactful and should be prioritized?

There are five barriers to advancing energy efficiency that need to be addressed in unison for maximum impact, and the associated benefits of reduced emissions, cost savings, and improved health and safety: (1) valuing energy efficiency, (2) upfront costs, (3) accurate measuring and modeling, (4) a shortage of trained workers, and (5) equity. Congress should prioritize policies that together can address all of those challenges and make the greatest impact to increase energy efficiency in the building sector.

1. Valuing energy efficiency. Often the energy efficiency upgrades that result in the greatest energy savings cost the most—costs that most homeowners simply cannot afford without some level of certainty that they will be able to get a return on their investment. Without appropriate consideration in the appraisal, real estate, and mortgage lending processes for energy efficiency upgrades and the value and cost savings that they provide, homeowners cannot recoup the value of their energy efficiency investments at the time of sale or refinancing. Improving valuation of energy efficiency will help homeowners get a fair payback for investments that save energy and reduce emissions, and it will drive future demand for these improvements.

Sensible Accounting to Value Energy (SAVE) Act (114th—HR 614, Rep. Murphy, Rep. Jolly/113th—S 1106, Sen. Bennet, Sen. Isakson). The SAVE Act would require HUD to develop and issue guidelines to all federal mortgage agencies to implement enhanced loan eligibility based on energy cost savings due to efficiency upgrades. This would help to address this issue of valuing energy efficiency by ensuring consideration and proper valuation of energy efficiency measures in the mortgage lending process. In the 116th Congress the SAVE Act is included in the Energy Savings and Industrial Competitiveness Act (HR 3962, S 2137).

2. Upfront costs. Energy efficiency helps homeowners and building owners save money on their monthly utility bills and improve the comfort, health, safety, and resiliency of their homes—providing a significant payback on investment. However, upfront costs remain a significant barrier preventing low and moderate-income households from completing energy efficiency upgrades. Furthermore, the energy efficiency measures that can achieve the most energy savings, such as whole-home insulation and air sealing and upgrading to an efficient HVAC system, often have the highest upfront costs. Congress should support residential incentives that reduce the upfront cost of energy efficiency improvements to allow more Americans to access the efficiency market.

Home Owner Managing Energy Savings (HOMES) Act of 2019 (116th—HR 2043, Rep. Welch).¹ The HOMES Act would create a Grant Program for rebates to residential efficiency customers with a network of rebate aggregators, as well as grants for quality assurance and a pilot on pay for performance. This legislation would lower the barrier of high upfront costs for energy efficiency measures that can achieve substantial energy savings and help more middle-income Americans make efficiency upgrades to their homes. This bill is going through additional changes to include lessons from state programs.

25C tax credit. Residential tax incentives are critical to reducing the upfront cost of energy efficiency improvements. The 25C tax credit is the only residential energy efficiency tax credit provided to consumers. Congress should support a forward-looking extension of a tax credit for residential energy efficiency upgrades and improve the 25C credit by updating goals and transitioning the credit into a permanent performance-based instead of prescriptive incentive.

179D tax credit. Key to advancing commercial energy efficiency is an extension of the 179D Energy Efficient Buildings tax deduction that will help support owners and investors in retrofitting existing buildings, as well as in constructing new above-code buildings. Congress should pass a forward-looking ex-

¹ Updated version pending introduction.

tension of 179D that would provide the certainty needed for consumers, manufacturers, contractors and others to fully capitalize on the incentive. Congress should also modernize the tax credit with updates that reflect the current market of high-efficiency equipment and building technologies.

3. Accurate measuring and modeling. Energy usage information—especially granular interval data provided by smart meters—is a key tool for advancing energy savings in buildings. Smart meter data can be used to identify cost-effective energy-saving opportunities, measure the performance of specific energy efficiency measures, and drive behavior changes and efficiency investments that achieve measurable and verifiable energy savings. However, utilities control that data and, in many cases, do not readily provide access to customers or allow them to grant access to third party providers who could provide data analysis, actionable insights, and recommendations. Congress should act to encourage and support the adoption of best practices and policies to allow consumers to access and share their own electricity and natural gas data.

Access to Consumer Energy Information Act or the E-Access Act (116th—discussion draft, Rep. Welch). Would allow DOE to facilitate customers' access to their own electricity and natural gas data, adds consumer access to energy use and price data to State energy conservation plans, and provides for establishment of voluntary guidelines with access to third parties according to a protocol established by the Secretary.

4. Trained worker shortage. Across the country, jobs in energy-efficient lighting, HVAC, insulation and air sealing, and energy management technology are available, but in many markets trained professionals are in short supply. Employers in energy efficiency, especially in the construction trades, are experiencing difficulty hiring new employees due to a shortfall of workers with the necessary experience, training, and technical skills to fill these jobs, according to the 2019 U.S. Energy and Employment Report. The energy efficiency industry is comprised mainly of small businesses—a large majority have fewer than 20 employees.² Small energy efficiency businesses need resources to help train new hires and provide ongoing education to existing employees, keeping them up to date on certifications and trained in the latest technologies and health and safety practices. To prepare more American workers for quality jobs in energy efficiency and drive further growth in this industry, Congress should act to support workforce development and jobs training.

Blue Collar and Green Collar Jobs Development Act of 2019 (116th—HR 4061, Reps. Rush and Hudson). Directs DOE to prioritize education and training for energy and manufacturing jobs and would establish an energy workforce grant program. Grant program would provide assistance to businesses in the energy efficiency and renewable energy industries that are seeking to educate and train new hires and existing employees, with priority to small businesses. Similar to S 2393, Clean Energy Jobs Act (Sen. Heinrich).

5. Equity. There are a number of unique barriers preventing low-income and other vulnerable households from accessing energy efficiency improvements, when these households could stand to benefit most from the cost savings and health and safety benefits provided by energy efficiency. High upfront costs, creditworthiness requirements, and split incentives between renters and landlords to invest in energy efficiency upgrades can prevent lower-income customers from accessing energy efficiency services. Many low-income homes also face issues such as mold, leaky roofs, asbestos, and other deteriorated conditions that can prevent installation of important efficiency measures. Congress should improve low-income access to energy efficiency by supporting and expanding the Weatherization Assistance Program (WAP) which helps low-income and rural families, seniors, and individuals with disabilities make lasting energy efficiency improvements to their homes.

Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act (116th—HR 2041, Rep. Tonko, Rep. Rush, Rep. Kaptur). This legislation would reauthorize the Weatherization Assistance Program, helping low-income citizens make important improvements to increase the energy efficiency, health, and safety of their home, save money, and improve their quality of life. It would also update and strengthen the program: supporting innovation in weatherization practices through a new competitive grant and modernizing the program to incorporate the latest cost-effective technology and services—including renewables and smart energy management technologies.

² <https://e4thefuture.org/wp-content/uploads/2019/09/Energy-Efficiency-Jobs-in-America-2019.pdf>.

Congress should prioritize these five pillars to create a holistic approach that addresses key barriers to advancing energy efficiency. Each of the above policies is needed to ensure that the others can have the greatest impact and, enacted together, they would create a robust and mutually reinforcing strategy to significantly expand the use of energy efficiency in the building sector.

2. Why is it important to focus on retrofitting existing buildings as opposed to just focusing on increased efficiency of new construction?

Simply put, we cannot reach the emissions reductions needed from the building sector to achieve net zero emissions by 2050 without addressing existing buildings. Estimates suggest that roughly half of the buildings that will be in use in 2050 have already been built³ and, already, much of America's building stock is aging and inefficient. Therefore, retrofitting the existing building stock is key to decarbonizing the building sector. Approximately half of all commercial buildings in the U.S. were constructed before 1980. In the residential sector, over 70% of our nation's housing stock was built before 1990, with almost 40% older than 1970.⁴ These older buildings waste energy, costing more to heat and cool and making them an outsized contributor to greenhouse gas emissions. To reduce the carbon footprint of our buildings—which are currently responsible for 31% of all U.S. greenhouse gas emissions⁵—we must focus on the sizable opportunities to increase efficiency in existing buildings.

Focusing on retrofitting existing homes is also key to ensuring that American families across the country are part of and benefit from the transition to a decarbonized economy. The occupants of the vast majority of homes in the U.S. experience comfort problems, health issues, and/or high utility bills.⁶ Energy efficiency retrofits can address these problems, and improve the health, wellbeing, and financial security of Americans, while simultaneously reducing carbon emissions and increasing the resiliency of homes in the face of climate change. Numerous studies have illustrated the health and safety benefits of energy efficiency retrofits, including significant improvements in asthma symptoms, reduced thermal stress, and improved overall physical and mental health.^{7,8} Energy efficiency also improves a home's resilience, which is increasingly important in the face of climate change, and the increasingly frequent and devastating storms, extreme weather, and wildfires that will accompany it. Efficiency measures that improve the durability of homes and minimize residents' exposure to wind, moisture and temperature extremes are critical to keeping people safe through a storm or power outage. Focusing on existing buildings is also an equity issue, as many families cannot afford to buy new homes being built to the latest energy codes.

With the cost savings, non-energy benefits to households, and societal benefits including reduced emissions and economic growth, energy efficiency retrofits are a win-win and an essential strategy for addressing the climate crisis. According to the U.S. Department of Energy, every \$1 invested in weatherization generates \$4.50 in energy and non-energy benefits to the home and community and supports local employment.⁹ Furthermore, the National Renewable Energy Laboratory (NREL) estimates that cost-effective measures could reduce total residential electric energy use in single-family homes by 21.9%; use of gas, propane and other bulk fuels by 24%, and total carbon emissions in the single family housing stock by 24%.¹⁰ Focusing on retrofitting existing buildings will improve the lives of Americans, while creating jobs and helping us reach our climate goals.

3. How can the Federal government encourage public-private partnerships to reduce emissions from Federal buildings?

There is significant opportunity to reduce carbon emissions and simultaneously save American taxpayer money by improving the energy performance of federal buildings. Energy Savings Performance Contracts (ESPCs) are an innovative and

³ <https://aceee.org/blog/2019/05/deep-retrofits-financing-needs-play>.

⁴ <https://www.eia.gov/consumption/residential/data/2015/hc/php/hc2.3.php>.

⁵ Total combined emissions from the residential and commercial sectors with electricity-related emissions distributed. <https://www.epa.gov/sites/production/files/2019-04/documents/us-ghg-inventory-2019-main-text.pdf>.

⁶ <https://www.building-performance.org/sites/default/files/0819-EE-high-performing-homes-blueprint-v8.pdf>.

⁷ https://weatherization.ornl.gov/wp-content/uploads/pdf/WAPRetroEvalFinalReports/ORNLTM-2014_345.pdf.

⁸ <https://e4thefuture.org/occupant-health-benefits-of-residential-energy-efficiency/>.

⁹ https://www.energy.gov/sites/prod/files/2018/03/f49/WAP-fact-sheet_final.pdf.

¹⁰ Wilson, Eric, Craig Christensen, Scott Horowitz, Joseph Robertson, and Jeff Maguire. 2017. *Electric End-Use Energy Efficiency Potential in the U.S. Single-Family Housing Stock*. National Renewable Energy Laboratory.

successful model for public-private partnerships to improve energy efficiency of federal buildings. ESPCs allow federal agencies to procure energy savings and facility improvements with no up-front capital costs or special appropriations from Congress and provide savings guarantees, reducing government risk. Studies by the Oak Ridge National Laboratory show that actual cost savings exceed guaranteed savings for many ESPC projects allowing significant cost savings to accrue to the government, while also reducing emissions.¹¹ Congress should promote and support the expanded use of ESPCs to reduce emissions from federal buildings.

The Federal Energy Management Program (FEMP) is an important program that oversees and facilitates the implementation of ESPC activities, providing crucial assistance, guidance, and training to federal agencies to implement successful projects. FEMP staff help agencies use ESPCs in several ways: advising agencies on scoping, procurement, and performance requirements for energy conservation measures (ECMs); helping agencies select third-party ESCOs; finalizing contracting terms and project approval; and monitoring project implementation and performance.

FEMP is the program manager for the critical ESPC contracting tool used by federal agencies for the implementation of ESPCs—the U.S. Department of Energy (DOE) Indefinite Delivery Indefinite Quantity (IDIQ), Multiple Award, Energy Savings Performance Contract. This contract has historically been instrumental in achieving the aforementioned energy and cost savings as well as job creation outcomes for the nation. Since the inception of the DOE IDIQ ESPCs in 1998, 411 projects have been awarded and approximately \$6.6 billion has been invested in federal energy efficiency and renewable energy improvements. These improvements have resulted in approximately 573 trillion Btu in life cycle energy savings and over \$15 billion in cumulative energy cost savings for the federal government.¹²

Congress should enable more of these successful public-private partnerships through the following pieces of legislation:

Legislation

- **Federal Energy and Water Management Performance Act of 2019 (S. 1857, Sen. Murkowski, Sen. Manchin):** Would reauthorize the Federal Energy Management Program (FEMP) at \$36 million and improve federal energy and water requirements.
- **Energy Savings and Industrial Competitiveness Act of 2019 (S. 2137, Sen. Portman, Sen. Shaheen; H.R. 3962, Rep. Welch, Rep. McKinley):** Would reauthorize the Federal Energy Management Program (FEMP) at \$36 million and improve federal energy and water requirements. It extends energy use reduction goals and would expand the scope of existing energy standards for new federal buildings to include major renovations.
- **Energy Savings through Public-Private Partnerships Act of 2019, (S. 1706, Sen. Gardner, Sen. Coons; H.R. 3079, Rep. Welch):** Would encourage the increased use of ESPCs in federal facilities by addressing barriers and increasing the use of energy efficiency and distributed generation.

Federal Appropriations

Congress should also ensure adequate funding for the following programs to continue to improve the performance and cost savings for federal buildings:

- **Federal Energy Management Program (FEMP).** In addition to reauthorizing this important program (S. 1857), Congress should ensure continued adequate funding for FEMP including carveouts for the Assisting Federal Facilities with Energy Conservation Technologies (AFPECT) program which provides grants to federal agencies to support the use of ESPCs, to achieve energy savings and implement other important climate-related measures like resiliency that might not generate utility bill savings.
- **U.S. General Services Administration (GSA) Office of Federal High-Performance Buildings.** Through ESPCs, construction and leasing policies, and other public private partnership models GSA has saved millions of dollars. GSA has reported, for example, that sustainable building standards helped GSA avoid more than \$250 million in energy and water costs from 2008 to 2014.¹³ These programs save taxpayers money while reducing energy-related carbon emissions and should continue to be funded by Congress to ensure continued progress.

¹¹ <https://info.ornl.gov/sites/publications/Files/Pub41816.pdf>.

¹² <https://www.energy.gov/eere/femp/awarded-doe-idiq-energy-savings-performance-contract-projects>.

¹³ https://app_gsagov_prod_rdcgwaajp7wr.s3.amazonaws.com/GSA_FY_2015_SSPP_Final.docx.

4. How can we ensure that the advancement of residential energy efficiency helps all Americans, especially low-income households?

Access to Efficiency Improvements for All Income Levels

Policies aimed at retrofitting the over 115 million homes across the country will not only help reduce carbon emissions from the nation's residential building stock, but will also help homeowners save money on their monthly utility bills and improve the comfort, health, safety, and resiliency of their homes. Reducing monthly energy costs of homes is something that will benefit every American, as energy costs often represent the second or third largest recurring cost of homeownership, depending on location (behind mortgage and in some markets property tax). However, upfront costs remain a significant barrier preventing low and moderate-income households from completing energy efficiency upgrades. Meanwhile, nearly one-third of U.S. households reported facing a challenge in paying energy bills or sustaining adequate heating and cooling in their homes in 2015, with even higher rates among low-income and racial minority households.¹⁴ Low-income households also face the highest energy burdens, paying 7.2% of their household income on energy, more than three times the percentage that higher income households pay.¹⁵ Energy efficiency is an underutilized strategy that can help reduce these high energy burdens. Congress should advance policies to ensure Americans of all income levels, especially low-income households, have access to residential energy efficiency measures.

To ensure equity, we need to provide robust funding for low-income energy efficiency programs. It is critical that Congress continue to support and expand the Weatherization Assistance Program (WAP).¹⁶ I was the lead author of a 2017 report,¹⁷ published by the Home Performance Coalition (now the Building Performance Association), that offered recommendations for improvements to WAP, opportunities for streamlining, and ways to encourage the use of private sector contractors. Some of these ideas are included in the ***Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act (HR 2041)*** which would reauthorize and make updates to the program. This bill has passed out of Committee this year and awaits a floor vote. The Building Performance Association urges Congress to act on this important legislation. We also encourage consideration of the full list of recommendations from the 2017 report (Appendix A).

Congress should also create incentives to support low- to moderate-income families who don't qualify for low-income weatherization programs. The ***HOMES Act (HR 2043)***¹⁸ would help middle-income Americans make efficiency upgrades to their homes and incentivize investments that can achieve substantial energy savings. Furthermore, incentives are often targeted to "owner-occupied" buildings. To encourage landlords to upgrade their properties, I recommended removing this requirement from incentive programs as the tenants will benefit from the energy savings.

Job Opportunities for Communities Across America

Advancing residential energy efficiency will also create quality local jobs in communities across the country. According to this year's "Energy Efficiency Jobs in America"¹⁹ report from E4TheFuture, the energy efficiency sector employs 2.3 million Americans, twice as many workers as the entire U.S. fossil fuel industry, and energy efficiency is leading the nation's energy economy in new job creation. A significant portion of energy efficiency jobs in the U.S. are in the residential sector, and approximately 56 percent of energy efficiency jobs involve construction and repairs. These are the contractors—the "boots on the ground"—installing energy efficiency products and technologies and working to reduce energy waste in homes and buildings across the country. These jobs are, by their very nature, inherently local and cannot be exported. Energy efficiency workers work in their own communities and earn a livable wage while helping homes and businesses reduce energy waste and save money. Policies that encourage investment in energy efficiency can further advance growth in this industry, creating even more well-paying jobs all across the

¹⁴ <https://www.eia.gov/todayinenergy/detail.php?id=37072>.

¹⁵ <https://aceee.org/research-report/u1602>.

¹⁶ Since 1976, WAP has helped make more than 7 million homes more efficient, saving the average recipient about \$4,200 over the lifetime of their home.

¹⁷ <https://www.building-performance.org/sites/default/files/Weatherization%20%26%20HP%20Recommendations%20Report2.pdf>.

¹⁸ Updated version pending introduction from Rep. Welch.

¹⁹ <https://e4thefuture.org/wp-content/uploads/2019/09/Energy-Efficiency-Jobs-in-America-2019.pdf>.

country and generating economic opportunity for Americans through the decarbonization transition.

Congress should promote greater access to job opportunities in the growing energy efficiency industry and provide resources to communities for workforce development. A comprehensive, nationwide program is needed to improve education and training for workers in the energy efficiency industry, including manufacturing, engineering, construction, and building retrofitting jobs. This is exactly what the ***Blue Collar and Green Collar Jobs Development Act of 2019 (HR 4061)*** would create. One of the main pillars of HR 1315 is an energy workforce grant program, which would provide assistance to businesses in the energy efficiency and renewable energy industries that are seeking to educate and train new hires and existing employees. Importantly, the legislation would give priority to eligible businesses that recruit employees from local communities, minorities, women, foster children, persons who are transitioning from fossil energy sector jobs, and veterans; and would support critical on-the-job training and reskilling for workers. Congress should pass HR 1315 to prepare more American workers—especially transitioning workers, minorities, and members of low-income communities—for quality jobs in energy efficiency.

5. How can energy-efficiency in buildings make a transition to building electrification more successful?

Energy efficiency is critical to achieving electrification goals, particularly in cold weather climates where a poorly insulated, inefficient building would not be able to maintain its temperature with a traditional electric heat pump. Importantly, building electrification only leads to decarbonization if the electricity used is carbon-free, renewable energy. Coordinated delivery of energy efficiency and electrification improves outcomes in many ways:

1. Technology advancement. Energy efficiency programs have been instrumental in advancing high-efficiency technologies, including air and ground-source heat pumps and heat pump water heaters. Northeast Energy Efficiency Partnerships, with support from many efficiency program administrators, maintains a cold-climate specification and list of air-source heat pumps that perform well in cold climates, even in the coldest states.²⁰ These high-efficiency heat pumps, coupled with energy efficiency improvements in the building envelope, make it possible for buildings to switch to electric heat.

2. Workforce development. The contractors who install energy-efficient equipment are now adding heat pumps to their businesses, and the trade ally networks currently supported by efficiency programs are expanding to support building electrification. Efficiency programs are key partners for recruitment, training, and quality assurance of building electrification contractors, making whole-building energy efficient a part of the business model.

3. Customer experience. Efficiency programs have strong skills in customer engagement, and know-how to design programs that overcome barriers to customer adoption of new technologies. They are well-positioned to help customers navigate an increasingly complicated set of energy options, including electrification of buildings and transportation.

4. Reduced electric system costs as the building and transportation sectors electrify. To effectively reduce emissions, building electrification will need to be coupled with a transition to clean, decarbonized electricity generation. By lowering demand, energy efficiency will ease the speed and scale of investment in renewable and low-carbon energy resources needed to support this transition. Efficiency lowers overall energy demand and demand flexibility (dynamic efficiency, demand response, and smart technology) allows for the shifting of load. Together, these strategies both curb the increase in electricity demand as more end uses are powered with electricity and shift load to allow for grid stability. This will lower requirements for new electricity generation and transmission through the transition, saving money on power plant construction and grid buildout.

5. Grid stability and reliability. Building electrification will affect the timing and seasonality of peak demand. For example, in cold climates, as heating

²⁰There is widespread availability of cold-climate heat pumps, which ensure that the equipment performs well in cold climates and doesn't, for example, kick into electric resistance mode. NEEP maintains a cold-climate spec and associated product list: <https://neep.org/ASHP-Specification>. There are 4,775 products listed from more than 24 manufacturers in all configurations: single-zone, multi-zone, ducted, ductless. Cold states like Vermont and Maine have high rates of adoption of ductless mini-split heat pumps because the customer economics are really compelling for customers using expensive unregulated fuels (oil, propane). In Vermont, there are examples of high-performing efficient homes built to Passive House standards that are 100% heat pump heated.

load is electrified, power systems may become winter peaking with significantly higher demand during the coldest times of the year). Energy efficiency is needed to help effectively manage the peak load impacts of new electricity demand; lowering baseload demand and supporting load shifting through energy efficiency ensures that peaks are not as high, improving reliability. Mitigating grid stress and supporting stability through energy efficiency can reduce the risk of brownouts and rolling blackouts. That grid reliability is increasingly important as more buildings electrify (and depend on electric power for heating and cooling).

6. Better performance of electrified buildings. Creating a tight building envelope lowers heating and cooling loads and allows highly efficient electric heat pumps to meet the full heating and cooling needs for more homes and businesses. Super-insulated homes can be heated entirely with heat pumps, and it is becoming increasingly possible for heat pumps to fully replace fossil fuels, even in cold climates, through emerging whole-house heat pump systems and air-to-water systems.²¹ In the case of a power outage that would cut off electrified heating and cooling systems, building envelope improvements like high-performance insulation, air sealing, and strong leak-resistant windows also help to ensure that homes remain safe and comfortable, allowing people to shelter in place. Finally, an efficient, well-sealed home also enables demand flexibility allowing timing of space heating or cooling to be shifted in order to maximize the use of renewable energy while still maintaining comfortable conditions.

Appendix A

Weatherization and Home Performance: Recommendations for Mutual Success and Collaboration

1. The U.S. Department of Energy (DOE) Residential Building Integration Program, working together with the Office of Weatherization and Intergovernmental Programs, should support the adoption and use of the Building Performance Institute's (BPI)—2101 *Standard Requirements for a Certificate of Completion for Residential Energy Efficiency Upgrades* ("Home Performance Certificate") as a strategy for documenting upgrades (and resulting energy savings) funded by WAP. A BPI-2101-compliant certificate that is issued to homeowners that receive weatherization assistance can be used as reference document by real estate agents, appraisers, and other professionals during the home sale process.

2. The DOE Residential Building Integration Program, working together with the Office of Weatherization and Intergovernmental Programs should promote the use of smart home technologies in weatherization as a way of reducing program costs, streamlining EM&V, and providing real-time feedback on performance to weatherization contractors and program participants. Data from smart home devices can be used to support traditional EM&V, reducing the costs of evaluation and providing real-time or near real-time feedback to contractors, programs, and program participants on performance. Programs can then use this information to target resources to high energy users. Contractors can use this information to better understand the results of their work and communicate to customers the value of weatherization.

The DOE Residential Building Integration Program, working together with the Office of Weatherization and Intergovernmental Programs and the Office of Electricity Delivery and Energy Reliability, should consider establishing a pilot program in FY 2018 and FY2019 in multiple states to test new models for streamlining and maximizing resources. The pilot would aim to test auto-M&V41 and utilize home energy management devices, such as smart thermostats and smart meters that are enabled to provide near real-time data to programs to demonstrate if a project was successfully completed. By utilizing an auto-M&V system, the pilot would test the current 100% quality control currently used by WAP in an effort to reduce both costs to the program and burden on the contractors and homeowners.

3. The DOE Office of Weatherization and Intergovernmental Programs should work to ensure that training and technical assistance is offered to all contractors that make a commitment to work in the WAP program. The training should be consistent with industry best practices. In addition, the WAP provider should consider a stipend for private sector contractors to equalize the time-cost of participation in training.

4. The DOE Residential Building Integration Program, working with Department of Commerce's Small Business Administration, should work to advance small business loans to states that are focused on energy efficiency contracting and training to complement the WAP programs.

²¹This is possible even in the coldest states.

5. In FY2017 and FY2018, there should be a series of national dialogues among private contractors and members of the Weatherization network for the purpose of developing a better understanding of WAP programs by contractors, and identifying best practices and shared interests between the two groups that can become the foundation to improve the alignment of residential energy efficiency programs. This dialogue should take place in connection with existing national or regional conferences where contractors and members of the WAP network will be in attendance (to avoid unnecessary costs).

6. The DOE Office of Weatherization and Intergovernmental programs should be authorized to streamline the process for approving energy efficiency measures for inclusion in the Weatherization Assistance Program to advance innovative pilot programs and quickly approve adoption of new technologies for the benefit of low-income clients.

Questions for the Record

James Rutland
President

Lowder New Homes

On behalf of National Association of Home Builders

THE HONORABLE GARRET GRAVES

1. Considering capital stock rollover rate, if the U.S. adopted net-zero building codes today, how long would it take for all homes in the U.S. to be built to today's standards?

There are roughly 137 million homes in the United States. While some are built to achieve net zero, the overwhelming majority currently are not. To get all the homes in the U.S. to net zero would be a daunting task given the need to not only accommodate and rehouse existing families, but to also provide new housing to newly-formed households. This challenge would be further exacerbated by the current low rate of production and slow replacement rate. Finally, the funding needed to finance the increased up-front costs associated with zero net energy would make such an undertaking effectively prohibitive.

While there are no statistics that indicate how long it would take to replace the existing housing stock, inferences can be made. According to NAHB's forecast, 250,000 single-family starts per year are currently built to replace older homes. According to the latest American Community Survey tables from the Census Bureau (for calendar year 2017), there are slightly under 93 million single-family homes in the U.S. If all single-family homes were built to a net-zero standard going forward, and if the rate of 250,000 per year remains constant (which is unlikely; for one thing, building to a net-zero standard would likely increase costs and slow down housing production & replacement), it would take just over 370 years to achieve a 100 percent net-zero stock of single-family homes in the U.S. The attached article provides additional detail about actual replacement statistics.

2. How does residents' behavior act as a barrier to the builder's taking the opportunity to make improvements in the structural envelope of a building to enhance its energy efficiency?

Builders can implement a host of techniques and install numerous products to improve the energy efficiency of the homes they build. Just because a home is built well, does not mean it will perform well. Predicted energy savings are based on idealized occupant behavior. The habits of real people and families can vary dramatically from these hypothetical conditions. The best of intentions to save energy can quickly be negated when occupants are not conforming to the anticipated behavior. For example, seemingly trivial things such as opening windows, setting thermostats significantly above/below set points, operating humidifiers, using a large number of electric devices (plug loads), etc. can significantly impact overall energy savings. In addition, not only can energy efficient designs be more sensitive to occupant behavior, but the impacts of that behavior can also impact other performance attributes of the home.

Regarding building envelopes, the focus should be on much needed innovation in cost-effective window technologies. Further, increases in requirements for opaque assemblies (i.e., structural envelope) will come at substantial costs with little benefit in energy savings. The levels of insulation and air sealing for opaque assemblies required in the latest model energy codes have already past the inflection point where the upfront cost outweighs the long-term benefit.

3. Mr. Rutland, in your testimony you noted that new building codes often reflect national averages that aren't always true for local conditions. Can you give some examples of how attempts to use building standards that are good for California or Massachusetts can do more harm than good for a home built in, say, Alabama?

The model building codes are meant to be a starting point for the state and local governments to use when developing their building codes and are intended to be amended to fit state and local conditions. But because they are created to be generally applicable, they can over or understate risks and, hence, include provisions that may be inapplicable, unrealistic or unnecessary for certain areas. For example, the hazard maps for wind, snow, and earthquakes in model building codes and national standards incorporate a variety of modeling assumptions and simplifications that enable the maps to be generated on a national scale. As such, they can overstate hazards in certain areas of the country.

A good example is the risk of earthquakes in the Central and Eastern US, where the defining events in Memphis (1811-1812) and Charleston (1886) happened before seismographs and other accurate methods of measuring earthquake magnitudes existed. Absent real data, the magnitude of these events that is assumed in the modeling that generates the modern seismic hazard maps is conservatively estimated. Because the modeling process itself adds more conservatism since the mapped ground motions are intended to represent an event with a low probability of being exceeded, more structures are drawn into the risk area and, hence, must comply with additional code requirements. This raises the cost of construction and harms housing affordability by forcing homes to be over-designed for events that are extremely unlikely to occur over the life of a home in those areas. Similar challenges can be faced when addressing risks for flooding and other hazards, as well as for certain water and energy efficiency features, among others.

4. What are some of the biggest hurdles states face in adopting and implementing newer building codes?

There are four major hurdles that states may encounter when adopting new building codes, and especially when attempting to update to every new edition of the model codes:

- **Lengthy and Varied Code Adoption Processes.** For states and local jurisdictions, adopting building codes and standards typically requires following a legislative or rulemaking process, including posting of notices, holding a legislative hearing, or hosting building code council meetings. In some states, the codes process is legislatively scheduled to only happen every other year and in many instances, the code adoption and amendment process can take 12 to 18 months or more. Not only are these processes time-consuming, they also come with a cost. Further, personnel are needed to examine and suggest revisions, data is needed to support proposals, and the public must be invited to participate.
- **Code Official and Builder Training and Education.** Every time a code is adopted, building officials and inspectors need training and education on the changes from the previous edition(s) so they can understand those changes and consistently enforce them. Builders and designers need training too. There can be significant costs for building departments to set up this training or for their staff to attend such training, let alone the cost for the design and construction community.
- **Impact of New Codes on New Home Construction.** Adopting updated codes can significantly increase cost of construction due to more stringent requirements. Especially in the realm of energy efficiency and mechanical/plumbing/electrical, changes, recent editions of the code have had the effect of requiring the use of specific insulation products, window types, ventilation systems or electrical systems in such a way that both raises the cost of construction and provides a financial boon to the manufacturers who angled to get their products into the code. Amidst the current housing affordability crisis, most State and local governments are seeking ways to reduce, not increase, the cost of housing for their constituents.
- **Consistency within the Codes and with Other State/Local Requirements.** Code provisions have a way of changing back and forth from cycle to cycle as new data on hazards, new research, or field experience is brought to the process. Also, because codes are developed in silos (i.e. structural design, energy efficiency, and fire prevention are all covered in different codes and debated by different committees), there are often conflicts between and even within the codes and standards when significant new requirements are introduced. Sometimes it takes a cycle or two to resolve the conflicts such that one aspect of building performance is not negatively impacted by changes in another aspect of construc-

tion. For example, the upcoming 2021 *International Residential Code* has finally incorporated changes to address moisture and durability issues created by significant increases in insulation levels and building air tightness required by the 2012 energy codes.

Similarly, given the number of statutes, standards, codes, ordinances and other requirements imposed at the state and local levels, there is a need to ensure that any new code or code provision is consistent or at least compatible with the regulations that are already on the books. Because many of the codes overlap with zoning, stormwater, and other mandates, completing such a review can be significant.

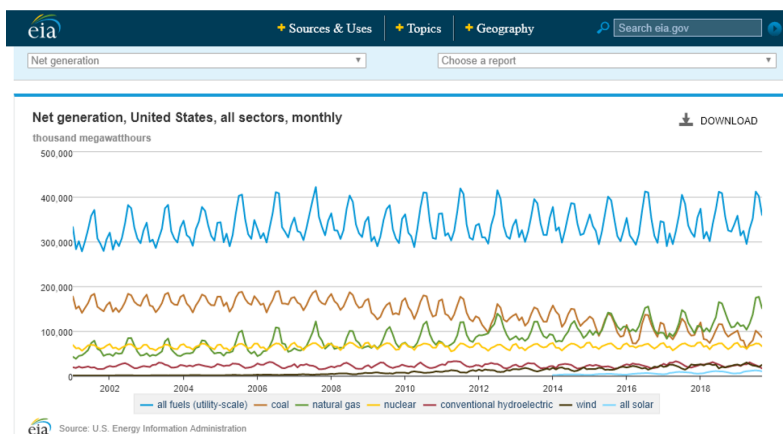
5. Could you explain the change in cost to construct a fossil-free building? In your opinion, would most homeowners be able to afford those upgrades?

A building that uses near-zero or zero fossil fuel resources to operate would involve a combination of multiple modifications requiring detailed coordination at the design and construction phases. Many of these technologies have not been adopted by the market and require further development and evaluation before mainstream implementation is possible. Unless the market is given time to absorb these innovations at a reasonable pace, the outcomes could be counter-productive, leading to substandard performance and potentially public's rejection of these technologies. Moreover, the industry and the market have not yet determined the optimum balance of technologies that would achieve fossil-free or near-free solutions. Although various combinations of future technologies can be envisioned, they would vary greatly by climate and market.

Unlike LED lights that have become ubiquitous, most building innovations that would enable fossil-free living are not one-for-one substitutes where the older version gets simply replaced with a next-generation gadget. Instead, this type of change would impact the entire building system, which would require a "ground-up" re-envisioning of the design and building process and the operation/occupancy. Any such modification would come at a significant premium that would include both the price of the products/systems/material and the added costs of installation. The increased costs will lead to significant impact on the price of the home that many home buyers will not be able to afford. This price increase will particularly impact the home buyers in the affordable and move-up segments of the market.

The other side of the fossil-free living equation is where the building's power comes from. Even for buildings with some on-site generation, the grid-supplied power will remain an integral element of the building's function. Fossil fuels remain a large source of electricity generation in the country. As long as the electricity mix produced at the utility level includes a portion of fossil fuel generation, the building will not be a fossil-fuel-free building.

Electricity generation by source is shown below.



For more information on NAHB's economic report on older homes: <http://eyehousing.org/2019/01/more-homes-needed-to-replace-older-stock/>.

Questions for the Record

Khalil Shahyd
Senior Policy Advocate
Healthy People/Thriving Communities Program
Natural Resources Defense Council

THE HONORABLE KATHY CASTOR

- 1. In your testimony, you mentioned that low-income households and communities of color often have higher energy burdens than average families, frequently caused by poor maintenance of older, less efficient buildings. What are the main challenges preventing energy efficiency investments in these communities? How can the Federal government help address these challenges?**

Of the more than **25 million households that earn \$25,000** or less, roughly two-thirds are renters (including 1.2 million families in public housing) and one-third are owners. Over 30% of the U.S. population and over 25% of U.S. households live in multifamily buildings. Yet when we talk about possible energy efficiency improvements in the residential sector, these households are rarely considered with resources and program capacity devoted to middle- and upper-income single-family homes.

However, there is an enormous opportunity in making energy efficiency accessible to low income families. A Federal investment of \$5 billion a year over 10 years could achieve 25 percent to 40 percent energy savings in up to **25 million residential units**, cut up to 50 million tons of CO₂ emissions and create hundreds of thousands of green jobs annually when fully implemented.

These households still face multiple barriers to accessing efficiency services, which can be grouped into four (4) primary categories; Economic, Social, Health and Safety, and Policy barriers.

I. Economic barriers include:

- High upfront costs, creditworthiness requirements. the largest barrier to retrofitting multifamily arises from the absence of capital for the upfront cost of an energy retrofit. Federal policy arbitrarily separates energy improvements from capital improvements in both public and assisted housing, missing an opportunity to integrate energy use into capital reinvestment planning and analysis HUD buildings undergo for refinancing.
- Split incentives: Renters face a unique barrier by fact that they don't own the dwelling or unit they reside in. In typical, unsubsidized multifamily housing with individual meters, resident interest in lower utility costs is often thwarted by owner disinterest in making energy efficiency investments that can't be directly recouped through savings. Split incentives exacerbate the upfront capital problem by placing the burden on the tenant, or relying on the owner who receives little of the savings benefit for making the energy investments.
- Small and medium sized owners need special assistance: Many retrofit programs that target rental housing aren't suitable to small and medium sized owners who don't own a great deal or large scale of properties. These owners tend to be individual or private owners with very limited capital to meet upfront cost.

II. Social barriers:

- Communication and trust: Implementing a successful energy efficiency program in rental housing requires a great deal of information sharing between tenants, building owners and program administrators. Lack of trust between tenants and building owners or managers can reduce the likelihood of participation.
- Scheduling difficulties: completing an energy efficiency retrofit can cause a disruption to the lives of the tenants even a disruption of their occupancy in the unit until repairs are completed. Trust is required so they know they will be allowed to stay and return, to their home without a subsequent increase in cost to them, straining already stretched household budgets.
- Language and literacy barriers: Increasingly language and literacy issues are becoming factors making the deployment of services difficult, in addition to immigration status which may keep some households from applying for any formal services or supports.

III. Health and safety barriers:

- Age of housing and deferred maintenance: 64% of all U.S. housing was built before 1980, and many of the homes relied upon by low income households for

housing have not received regular maintenance or repair. The combination of age and deferred maintenance of the housing stock increases the cost of providing basic energy efficiency retrofits when those cost are expected to be recouped through savings. This is especially true if a home or building is in need of roof repair. A compromised roof would nullify many of the benefits of the energy retrofit, and when the cost are measured against the potential savings of a project, a leaky roof makes the home or apartment ineligible for energy efficiency financing.

- Local climate and building materials: Deferred maintenance combined with local climatic and building material quality can add additional burdens to affordable housing. Many low-income homes in humid climates face issues such as mold that create health hazards that would be exacerbated by energy retrofits that “lock-in” mold causing material in a highly sealed building envelope. Similarly, older homes built with asbestos, lead paint and pipes can also create health hazards that would increase unless addressed in conjunction with an energy retrofit. However, most efficiency programs offer very little support if any for incorporating these areas into the retrofit portfolio. Nationwide, up to 15 percent of homes may be unable to access weatherization services due to these and other health and safety issues.

IV. Policy barriers:

- HUD Capital restrictions: Federal policy arbitrarily separates energy improvements from capital improvements in both public and assisted housing, missing an opportunity to integrate energy use into capital reinvestment planning and analysis HUD buildings undergo for refinancing.

- Energy benchmarking: is a critical requirement for understanding energy usage and knowing where potential savings can be gained. However, without a national benchmarking strategy, service providers are reliant on local governments to implement benchmarking ordinances that vary in quality and scope of data collected.

- Cost/Benefit testing: Utilities are increasingly relied upon to provide financing for energy efficiency services as a customer benefit to rate payers for utility services. Low income families pay into the utility rate system often at a higher rate per square foot than their higher income counterparts. However, they rarely receive an adequate share of utility rate-payer financed efficiency investments in return. This is often due to cost/benefit testing requirements, regulated at the state level, requiring utility programs to meet a cost/benefit threshold set by the regulator. Due to the deferred maintenance of many affordable housing units and other cost issues, low income housing often has difficulty meeting that threshold making those properties effectively ineligible for services.

- Fragmentation: At the federal level, energy efficiency dollars and programs are administered by HUD, DOE, HHS, Treasury who must then coordinate with a myriad of state and local housing and energy financing agencies. These disparate public agencies are charged with governing affordable housing operations and capital improvements on the one hand, and energy efficiency, tax, and utility policy on the other. Fragmentation, influences program delivery for example by requiring “door-to-door” income verification of DOE weatherization assistance program eligibility. This cumbersome step, can often discourage program services to be applied to multifamily properties where many low-income families live. Fragmentation also exacerbates shortages and bottlenecks in workforce training and employment.

The primary federal programs to increase energy efficiency in homes for very low-income people are a patchwork of small, poorly funded and in some cases, poorly designed initiatives. Within each, however, are elements that could be improved and expanded with potential for greater impact.

The primary programs that fund or administer energy efficiency at the federal level are the DOE Weatherization Assistance Program; EPA Energy Star Programs, HUD Energy Performance Contracting, and LIHEAP Emergency Energy Assistance program which states can apply a portion of its allotted annual LIHEAP budget (up to 15%) to address high energy burdens through increased efficiency.

The Federal government can improve energy efficiency services by:

- Increasing funding levels of Federal energy efficiency programs to meet certain efficiency benchmarks and goals over time.
- Create more coordination among various Federal programs, in particular in the areas of program eligibility, benchmarking and savings verification.
- Create a national standard for utility cost/benefit testing that properly values societal and non-energy benefits of energy retrofits for low income households.

- Mandate the inclusion of energy improvements as an aspect of capital refinancing plans under HUD
- Create national benchmarking database and require rental units to make available energy usage data that can be utilized by potential tenants to determine housing options. This would create an incentive for building owners to investment in improving energy efficiency.

2. In addition to reducing carbon emissions, what are some of the public health benefits of energy-efficiency upgrades of multifamily housing?

Achieving the health benefits of energy efficiency updates requires attention to the various social determinants of health and how housing quality drives many of those outcomes. There is an overall decline in life expectancies in the 21st century despite the increased spending on medical care and it is likely that the inability of the nation to address physical and social determinants of health have contributed to this problem. Efficiency provides a unique opportunity to improve those outcomes for individual families and for the population at large.

Social determinants of health (SDOH) are defined by World Health Organization (WHO) and by Healthy People 2020 as the conditions in the environments in which people are born, live, learn, work, play, worship, and age that affect a wide range of health, functioning, and quality-of-life outcomes and risks.

Social and economic factors, such as affordability, restrict housing and neighborhood options for low-income households often giving them few options but to reside near or in proximity to hazardous sites as these locations are often the housing of last resort. In addition, energy insecurity that leads to utility shutoffs leaving families (particularly the elderly and young) vulnerable to weather conditions while forces tradeoffs in meeting basic needs such as housing, food and health care.

Energy efficiency can also reduce exposure to indoor and outdoor pollutants and particulate matter that lead to respiratory illnesses, absences from school or work and longer term health conditions that accumulate over time.

Better Indoor Air Quality: leads to reduced concentration of poly-cyclical aromatic hydrocarbons (PAH), hydrocarbons, aldehydes, carbon monoxide (CO), sulfur dioxide (SO₂), nitrogen oxides (NO_x), and particulate matter (PM) in the home

Weatherization and Efficiency Can: Lower Incidence of CVD related Emergency Room visits, Reverse adverse respiratory symptoms such as COPD, Eliminate CO poisoning hospitalization and death, Reduce coronary heart disease deaths

3. In your testimony, you describe some of the unique challenges faced by residents of rural areas. Many of these communities depend on non-profit electric cooperatives for their power. How can Congress make sure that rural communities are able to access energy-efficiency upgrades?

Rural communities face unique challenges for maintaining and upgrading homes and residential buildings. Particularly those areas serviced by smaller utility coops who may not be able to finance efficiency programs internally.

Federal policies that can help rural communities include expanding the USDA Rural Energy Savings Program. This program “provides rural electric cooperatives and other rural utilities with zero-percent loans to launch or expand energy efficiency financing programs for their members. Beneficial electrification and renewable energy projects are also eligible.”

In addition to ensuring financing for existing federal programs, the Federal government can support efforts that increase partnerships with local community based and regional organizations that support enhanced efficiency programs. These organizations can reduced cost of program implementation through outreach, program marketing, workforce training and needs assessments at the community level.

Couple financial resources with technical assistance to make efficiency improvements. Help customers conduct energy audits, identify energy efficiency measures, and work with qualified contractors to conduct selected improvements.

Particular emphasis in rural communities needs to be to scale up resources devoted to retrofitting or replacing manufactured homes, as these housing types are overly represented in rural communities.

Require and support better program evaluation of small electric coop programs and services to optimize resources and results. Many rural co-ops have worked with partners to evaluate their programs. For example, EETility’s EM&V of the PAYS on-bill tariff programs offered by Ouachita Electric and Roanoke Electric provides data on the effectiveness of these programs. Similarly, Delta Montrose Electric Association (DMEA), Midwest Energy, and the city of Springfield, Missouri, all hired evaluators to review their programs. Additionally, in 2016, Cooperative Energy, a G&T co-op in Mississippi, collaborated with Advanced Energy (AE) to develop a two-year

Residential Retrofit Pilot Study examining the impact of three types of retrofit measures.

4. In your testimony, you outlined several policies that could reduce emissions in the building sector. In your opinion, which policies would be most impactful and should be prioritized?

To avert the worst impacts of climate change, our policy must ensure both the reduction of emissions that cause climate change and also support people's capacity to adapt and thrive in a post carbon world. In order to act on climate change while also addressing the threat of rising inequality, we must accelerate action on all fronts and in particular create a more supportive policy environment for affordable housing and accelerate residential energy efficiency. We need Congressional action to lead our nation in its response to climate change and to realize the enormous benefits of these investments. Through decisive action, Congressional leaders can address the dual crisis of affordable housing and climate change, while producing hundreds of thousands of clean jobs and alleviating the negative health impacts of indoor and outdoor air pollution.

Addressing these core policy areas will enable affordable housing and low-income families to be engaged as partners in actions that contribute to meaningful emissions reductions by reducing household energy use and demand.

The Federal government should endorse and establish a national Energy Efficiency Resource Standard that would create a wider incentive for reducing energy use in buildings and homes.

Key policies congress should support toward these outcomes that will influence the affordable housing sector most are;

Preserving Affordable Housing

- Expand the National Housing Trust Fund from \$367m now to \$3.5 billion/year. Affordable housing is in short supply across the country, and this is one of the newer sources of funding to improve it. Ensure that energy use assessments and benchmarking are incorporated into refinance requirements. The support can be used to reduce energy use and increase resiliency of housing, depending on state allocation plan requirements. But the need vastly outstrips the funding currently available.

- Support and utilize S. 1703 the Affordable Housing Credit Improvement Act (AHCIA) and S. 1288 the Clean Energy for America Act to enable Low Income Housing Tax Credit (LIHTC) properties to take advantage of tax incentives available for energy efficiency investments. The LIHTC is the largest and most successful tool for creating and preserving affordable housing. The Clean Energy for America Act amends the Internal Revenue Code of 1986 to provide tax incentives for increased efficiency investments in retrofitting existing and new residential and commercial buildings.

- Support H.R. 4307, the Build More Housing Near Transit Act. The legislation would require major transit projects using Federal Transit Administration (FTA) New Starts capital investment grant funding to incorporate an evaluation of housing development near transit station areas as a part of the application process.

Lowering Household Energy Cost

- Support reauthorization of S. 983, the Weatherization Enhancement and Local Energy Efficiency Investment and Accountability Act. This bill reauthorizes the DOE WAP, creates a new innovation fund for special projects.

- Support S. 185 the Investing in State Energy Act. This bill would require that the Department of Energy (DOE) distribute funding appropriated for WAP and SEP by Congress to implementing agencies within 60 days.

- Support the Green New Deal for Public Housing Act. The bill would create seven new grant programs that public housing agencies (PHAs), tribes or tribally designated housing entities, and Native Hawaiian housing entities can apply for under a single application. Some grants focus on workforce development while others address building and unit upgrades such as energy-efficient windows, improved insulation, pipe replacement to improve water quality, and new appliances. Grant programs would also facilitate community energy generation in public housing to make public housing energy self-sufficient and empower residents to vote to determine how to utilize any profits.

Improving Indoor Air Quality and Health

- Support H.R. 3590, the Environmental Justice and Civil Rights Restoration and Enforcement Act. This bill reinforces that Federal agencies are to comply and be held accountable to the Title VI Civil Rights Act and that disparities and outcomes shown to have disparate impact must be addressed through Environmental Justice actions. This bill gives communities the legal tools to hold

Federal agencies including the Environmental Protection Agency (EPA) accountable to unequal burdens.

- Support H.R. 3923, the Environmental Justice Act. Requires Federal agencies to address environmental justice, to require consideration of cumulative impacts in certain permitting decisions, and for other purposes.

Creation Jobs with Career Opportunities for Workers

- Support H.R. 4061, the Blue Collar and Green Collar Jobs Development Act. Directs the Secretary of Energy to establish and carry out a comprehensive, nationwide, energy-related industries jobs program.

- Support H.R. 4148, the Green Jobs and Opportunity Act. Requires the Secretary of Labor, in consultation with the Secretary of Energy and Secretary of Education, to submit a report on current and future trends and shortages in the clean energy technology industry to achieve a clean energy economy, and to provide grants to establish and enhance training programs for any occupation or field of work for which a shortage is identified.

Questions for the Record

Roy Wright
President

Insurance Institute for Business and Home Safety

THE HONORABLE KATHY CASTOR

- 1. IBHS researches and tests building standards, installation practices, and the quality of material found across the country and determines how variations affect the ability of a structure to withstand a variety of hazards. Building codes play an important role in how this type of research is translated in meaningful ways across our communities. Can you help the Committee better understand the role of building codes related to resilient construction practices and how your research can lead to stronger, sustainable, and resilient homes and businesses?**

IBHS strongly supports the statewide adoption of building codes and standards, strong local enforcement of the codes, and training and licensing of building officials, builders and contractors. It is important to understand that building codes were developed first and foremost for the purpose of life safety—that is, to ensure safe electrical wiring and gas lines, basic structural integrity, and to reduce internal fire hazards. However, damage reduction that results from the adoption and enforcement of building codes helps to keep people in their homes and businesses following a natural or man-made disaster, reduces the need for public and private disaster aid, and preserves natural resources and the built environment.

The importance of strong, well-enforced building codes was clearly demonstrated in 2017. Over a two-month period from August through late September, three devastating hurricanes (Harvey, Irma, and Maria) each caused more than \$1 billion in damages, and collectively affected 25 million Americans, or almost 8 percent of the U.S. population, according to the Federal Emergency Management Agency (FEMA). Hurricane Irma, in particular, provided a real-world test of the strong statewide building code now in Florida, with homes built to modern Florida building codes faring much better than those built before major code changes were implemented. In other areas of the country, like California, building codes focus on the threat of earthquakes and wildfires. Unfortunately, many states have not prioritized adopting modern codes or allow local jurisdictions to “opt-out” of certain sections of the code. This piecemeal approach among states and jurisdictions can lead to compromised building safety standards, varying enforcement regimes, and unpredictable permitting processes. When entire communities utilize a common set of base rules for construction, it leads to safer buildings and more predictable construction practices. Critical to ensuring building codes function properly is proper enforcement as a building code is only effective if there is enforcement and inspection to verify that construction is completed according to the code requirements.

Building codes provide benefits beyond keeping people and property safe. Studies have found that investing in stronger building can save the homeowner and taxpayer significantly during a hazard. Recent research shows that improvements to the Florida building code have reduced windstorm losses by up to 72% and that for every \$1 of additional construction costs \$6 in losses were saved.

While much of IBHS’ work focuses on preventing avoidable damage before it occurs, it is equally important to build back better. Congress should demand that communities receiving grant or programmatic assistance for pre-disaster mitigation or those in the recovery process rebuild in smarter, stronger, and sustainable ways. At

a minimum, this means states should have a up to date, statewide, and strongly enforced building codes. In areas of the state where known vulnerabilities exist, congressional funds should demand even more advanced building standards.

2. Can you comment on how energy-efficient and resilient building practices work hand-in-hand?

Energy efficiency and resilient construction practices can work together to build clean, efficient, and strong homes. One of the most visible examples of the nexus between energy efficiency and resilience is use of an impact resistant window, which can provide protection from flying debris in areas that are vulnerable to winds while simultaneously providing excellent thermal insulation, reducing energy costs and consumption. Similar insulation benefits can be realized with a spray foam sealed roof deck, which have high R-values and can provide an extra water barrier when the roof cover fails.

Perhaps the greatest return on energy efficiency value realized when building strong homes is their long-lasting durability. The vast energy consumed by the manufacturing and transportation of building new homes—and disposal of debris following a storm—can be greatly reduced by taking small steps to prevent avoidable damage.

3. In your testimony, you discuss two pieces of tax legislation: one for state-run grant programs and the other for home and business owners that undertake mitigation activities. Could you tell us more about these bills and how they would help adaptation?

First of all, I would like to congratulate Congress for taking bold action last year by advancing two of the most significant pieces of disaster mitigation legislation in decades: The Bipartisan Budget Act of 2018 and the Disaster Recovery Reform Act of 2018. While these laws represent a new era in disaster mitigation policy at the federal level, there are additional steps Congress can take to assist homeowners and small businessowners with disaster preparedness. One idea is to remove the tax penalty for individuals and businesses that benefit from state-based catastrophe-loss mitigation programs.

H.R. 2053 the “Catastrophe-Loss-Mitigation Incentive and Tax Parity Act of 2019” would eliminate tax liability for amounts received as part of certain state-funded grant programs. Several states sponsor these types of successful mitigation programs, including the California Bolt + Brace program for strengthening buildings located in earthquake prone areas, and the Strengthen Alabama Homes program, which provides grants funds to upgrade to a FORTIFIED Roof. We know it is unsustainable for the federal government to be the sole leaders on mitigation.

Where states are contributing their own funds, it is important for the federal government to recognize and reward those actions, not penalize them. Similarly, on the on the individual side, bipartisan legislation pending in both the House and Senate, known as the SHELTER Act, would provide up to a 25% tax credit for eligible expenses paid by individuals and businesses for purchases that help reduce potential damage from hurricanes, flooding, and other forms of natural disaster. These types of proposals empower and reward states and individuals who take action into their own hands—ultimately contributing to overall community resilience.

4. Congress has allocated a lot of money to disaster recovery through HUD CDBG-DR. Recently another \$6.8 billion was made available for mitigation in several states, including Florida, Texas, California, Georgia, and Louisiana. How can the Federal government ensure that states are using disaster recovery funds to rebuild in ways that reduce risks from future disasters?

Congress should require communities receiving grant or programmatic assistance for pre-disaster mitigation to rebuild in smarter, stronger, and sustainable ways. At a minimum, this means states should have up-to-date, statewide, and strongly enforced building codes. In areas of the state where known vulnerabilities exist, congressional funds should demand even more advanced building standards. Specifically, Congress should urge the use of the FORTIFIED Home standard when appropriating CDBG-DR or MIT funds for new homes.

Habitat for Humanity created the Habitat Strong program, which mirrors the FORTIFIED Home standards and provides low-to-moderate income families with resilient and affordable housing. Recently, five Habitat Strong homes in Panama City, Florida stood strong against the fierce winds of Hurricane Michael in 2018—the only reported damage to any of the homes being a single piece of loose siding.

As mentioned above, the IBHS FORTIFIED program has shown its effectiveness with the five Habitat Strong homes in Panama City, Florida. We also saw success of the FORTIFIED building standard in North Carolina following Hurricane Dorian.

Hurricane Dorian threatened close to 1,000 FORTIFIED homes in coastal North Carolina in August 2019. Many of these homes were FORTIFIED by grants made available from the North Carolina Insurance Underwriters Association (NCIUA). Dorian had sustained winds that were as high as 90 mph along the barrier islands, including the Outer Banks, where most of North Carolina FORTIFIED designations are located. NCIUA has received just five roof-related claims from their 400+ insureds with FORTIFIED roofs, only two of which reported water intrusion. FORTIFIED Roof kept the water out for 99.5% of homeowners who have invested in a stronger, sealed roof. Federal programs that fund housing should take a cue from this example and ensure taxpayer investments are protected.

We urge Congress to incentivize the adoption and use of higher building standards, such as FORTIFIED Home, when federal funds are at stake.

Wildfire

Recently, IBHS joined ICC to urge FEMA to require the use of the International Wildland Urban Interface Code as a Minimum Standard for disaster loans and grants. Wildfires have destroyed more than 35,000 structures within the past decade. Our comments state, in part, “The wildland urban interface (WUI) is an area of particular wildfire risk, and one-third of all U.S. homes are now located there. One study found that the WUI has increased from 1990 to 2010, now affecting 43.4 million homes (a 41% increase), and covering 770,000 km (a 33% increase), making it the fastest growing land use type in the conterminous U.S. Yet despite the seriousness of this hazard, FEMA’s Policy does not address wildfire resilience.” Congress should continue its oversight role of FEMA to ensure these types of policy changes are made at FEMA.

5. In your testimony, you mentioned Habitat for Humanity and said several of their strong homes did a great job holding up during Hurricane Michael. It’s great to hear that programs like this are protecting vulnerable populations—the ones who can least afford to be displaced from their home or job after a disaster. Could you tell us more about the Habitat Strong program? How can the Federal government incentivize more innovative solutions to help vulnerable populations become more resilient?

The Habitat Strong program was developed by Habitat for Humanity International (HFHI) to provide resources and recommendations for weather-resilient construction to Habitat affiliates across the country, with the goal of reducing damage to homes owned by the families served by Habitat being able to return to their normal lives as quickly as possible after a disaster. One of the primary recommendations to affiliates nationally has been the IBHS FORTIFIED standards. Working with funding partners, including many IBHS member companies, HFHI has been able to provide a number of grants to affiliates for resilience improvements, specifically for FORTIFIED Roof, Silver or Gold designations. There are some affiliates that have not pursued a designation, but have begun implementing the standards, as was the case in the homes that fared so well in Hurricane Michael.

IBHS would recommend that all homes built and all roofs replaced with federal dollars meet the standards set forth in FEMA’s Wind Retrofit Guide. At a minimum, we would suggest that HUD encourage its grantees to do this, in the same manner it encourages grantees to build and retrofit to Energy Star standards.

THE HONORABLE GARRET GRAVES

1. You mention in your testimony the successes seen from programs instituted in Alabama. Was this program directed by any mandate at the federal level?

There was no federal mandate or federal dollars for the programs instituted in Alabama. The successes here were realized from a multifaceted approach, including a suite of state legislation providing incentives and setting FORTIFIED as the resilience standards for the state, the establishment of a grant program to retrofit existing homes, robust coastal codes and a grassroots education effort that helped to create a culture of resilience and facilitated the widespread adoption of the FORTIFIED program for both new construction and reroofing.

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III. In your testimony, you describe some of the unique challenges faced by residents of rural areas. Many of these communities depend on non-profit electric cooperatives for their power. How can Congress make sure that rural communities are able to access energy-efficiency upgrades?

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<https://www.energyefficiencyforall.org/resources/the-high-cost-of-energy-in-rural-america-household-energy-burdens-and/>

Ms. CASTOR. Thank you very much.
And the hearing is adjourned.

[Whereupon, at 10:43 a.m., the committee was adjourned.]

