COMMITTEE ON THE BUDGET
Chairman John Yarmuth

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The Steep Costs of Climate Change Call for Congressional Action

The House Budget Committee held two hearings in June and July 2019 on the costs of climate change: "Risks to the U.S. Economy and the Federal Budget" and "From Coasts to Heartland, Health to Security." The committee heard testimony from expert witnesses on the current and projected costs of climate change; the fiscal risks to the federal government; risks to national security; and the challenges that individuals, businesses, and communities face from severe coastal flooding and storms, decreased agricultural productivity, and increased health threats. "Every day that we wait to combat climate change," Chairman John Yarmuth said, "the potential impacts on our budget, our economy, our security, and our communities compound. We know that the economic costs of climate change will be significant and far-reaching."

Climate change is real and increasingly harming people across the country

The fundamental science of climate change is clear, compelling, and supported by a large body of research and real-world observations. The consequences are intensifying and without substantial global mitigation and regional adaptation efforts, climate change is projected to impose substantial damages on the U.S. economy, human health, and the environment.

"We care about a changing climate because it affects us personally, in the places where we live, in ways that matter to us." — Dr. Katharine Hayhoe, Professor and Director of the Climate Science Center at Texas Tech University, testified on the message of the Fourth National Climate Assessment: the climate is changing, humans are responsible, and the impacts become more severe as greenhouse gas emissions increase. Climate change already affects every region of the United States and nearly every sector. Witnesses in both hearings agreed unanimously with these conclusions.

"The days of climate stability that we have experienced for most of human civilization are over." — According to Rear Admiral David Titley, USN (Ret), Ph.D., Affiliate Professor of Meteorology and of International Affairs at Penn State, multiple independent sources of data show a rise in temperatures; an increase in the intensity of precipitation events; the continued collapse in the area and amount of sea ice in the Arctic Ocean; an acceleration of sea level rise; acidifying oceans; and ecosystems moving poleward and up in elevation. As Dr. Hayhoe said, these changes are "loading the natural weather dice against us."

The economic costs of inaction will be large and span regions and industries

Two major national-scale assessments, from the Climate Impact Lab and EPA's Climate Change Impacts and Risk Analysis project, have projected significant climate damages across industries such as health, labor, coastal property, agriculture, and energy. They independently concluded that, if we continue business as usual with high emissions and limited resilience efforts, annual losses will likely grow to exceed $500 billion, or roughly three percent of national GDP, by the end of the century – and that is just in the examined sectors.

"Unmitigated climate change is likely to have substantial negative impact on the U.S. economy" — Dr. Solomon Hsiang, Chancellor's Professor of Public Policy at the University of California, Berkeley and a co-principal investigator of the Climate Impact Lab, warned: "Expected damages are on the scale of trillions of dollars." For example, increasing temperatures alone would likely reduce incomes nationwide over the next 80 years, a loss of roughly $5-10 trillion in net present value, primarily due to reduced crop yield and labor productivity; and losses from intensified hurricanes would approach $900 billion. Each 1°C increase in global average temperature costs the United States an additional 1.2 percent of GDP. Losing large fractions of GDP due to climate change, he said, is like paying a tax – except you get nothing in return.

"The nature and magnitude of projected costs differs between locations" — Dr. Hsiang testified that each region of the U.S. will experience climate change differently: "extreme heat will impose large health, energy, and labor costs on the South; sea level rise and hurricanes will damage coastal communities, particularly Florida; humidity levels similar to those of modern Louisiana will force a restructuring of infrastructure in New England; declining crop productivities will transform land markets throughout the Plains and Midwest; and more frequent fires and water shortages will harm the West."

"Each industry exhibits different responses to climate change" — Dr. Hsiang's research concludes that the economic impacts vary by sector but are almost always negative. The largest estimated climate impacts nationwide would be reduced labor productivity, damaged coastal property, and lost lives (more than 10,000 additional deaths per year by 2090), with further losses associated with energy use, agricultural productivity, air quality, and transportation infrastructure.

Low-income and marginalized populations are among the most vulnerable

The risks of climate change are highest for low-income communities, some communities of color, children, and the elderly. Communities that have fewer resources, are underrepresented in government, live in or near deteriorating infrastructure (such as damaged levees), or lack financial safety nets are more vulnerable to the impacts of climate change.

"Because low-income regions and individuals tend to be hurt more, climate change will widen existing economic inequality" — "In a national analysis of many sectors," Dr. Hsiang said, "the

poorest counties suffered median losses that were nine times larger than the richest." Low-income individuals tend to bear a greater cost than wealthier individuals when subjected to climatic stress because they lack sufficient resources to cope with the changes. Workers in agriculture or construction are more exposed to heat extremes that reduce work hours and productivity – by the end of the century almost two billion labor hours could be lost annually due to such extremes. Rear Admiral Ann Phillips, USN (Ret), Special Assistant to the Governor of Virginia for Coastal Adaptation and Protection, testified that "underserved communities often bear the most substantial brunt of flooding challenges, and yet have the least capacity… to fund and implement actions to keep their communities and their histories viable into the future."

"Vulnerable populations, such as communities of color, older adults, young children, the sick, and the poor, bear the greatest burden of disease and death risks related to climate change." — Dr. Georges C. Benjamin, Executive Director of the American Public Health Association, explained that climate vulnerabilities "differ by place, race, and income, as a result of inequities in the distribution of money and power, historical disinvestment in some communities, discriminatory practices and policies over time, structural racism, higher pollution burdens, and lesser access to resources for health." For example, the rate of heat-related deaths for African Americans is greater than that for non-Hispanic whites, and Latino children are twice as likely to die from asthma as non-Latino whites. These facts raise issues of equity and justice in how we consider climate impacts and our responses to them.

Weather-related disasters are costly, deadly, and getting worse

The country is already seeing increases in the intensity of hurricanes, heavy rainfall events, flooding, heat waves, and wildfires, and these changes will become more severe over the coming decades. From 2016 to 2018, the U.S. experienced major weather and climate disasters costing more than $150 billion per year and causing more than 3,600 deaths, compared with approximately $16 billion per year (adjusted for inflation) and less than 600 deaths over a similar period 30 years ago.

"The ever-increasing frequency and severity of extreme weather raises serious financial questions." — Adm. Titley noted that inland flooding events, severe storms, and wildfires are growing in number and extent. Hurricanes are not getting more frequent, Dr. Hayhoe testified, "but they are intensifying faster on average, and getting stronger, bigger, and slower. It is estimated that between 20 to nearly 40 percent of the rain that fell during Hurricane Harvey, and a significant share of the over $125 billion worth of damage it caused, was because of a warmer climate."

"Extreme weather events are short-lived, but their economic impact is long-lasting." — Dr. Hsiang described how hurricanes, floods, droughts, and fires destroy assets and businesses that took communities years to build, and rebuilding diverts resources away from new, productive investments that would have supported future growth. Extraordinarily, the long-term loss in

future productivity and earnings from hurricanes "is actually 10 times the cost of the number that you read in the newspaper as the damage, which is really just accounting for buildings and structures that have fallen down." Dr. Hayhoe also said that multiple stressors exacerbated by climate change can lead to a cascade of impacts, providing an example in which "drought dries the soil, creating conditions for wildfire to burn greater area, which clears vegetation such that when the rains come, there is little to hold the land in place, increasing the risk of landslides which can cut off critical services and carry their own economic costs."

Coastal communities are on the front lines of climate change, with millions of people at risk

In addition to hurricanes and storm surges, coastal areas are threatened by increased flooding from sea level rise, saltwater intrusion into freshwater supplies, and reduced fishery productivity. More than 300,000 residential and commercial coastal properties, valued at approximately $136 billion today, are projected to be at risk of chronic tidal flooding by 2045 – even absent heavy rains or storms. By 2100, that number rises to nearly 2.5 million properties, valued at more than $1 trillion today.

"The rate at which sea level is rising is now almost three times faster than the average rate over the last century." — Relative to the year 2000, sea level is very likely to rise 1 to 4 feet by the end of the century, and Dr. Hayhoe stated that "sunny-day" flooding due to sea level rise has already increased by a factor of five to ten since the 1960s in some cities. "If no action is taken to reduce carbon emissions," she said, "this type of flooding throughout the southern states could be a daily occurrence by the end of the century." Tidal flooding has already eroded $15.8 billion in relative property values between 2005 and 2017 for the Eastern Seaboard.

"Coastal Virginia deals with water where we did not plan for it to be, and that impedes the expected pattern of life, in some form, nearly every day." — For coastal communities in Virginia, Adm. Phillips said that the duration, severity, and impacts of flooding have increased substantially, and the impacts of coastal storms are magnified as a result. These changes put their water-based economy at risk, including the Naval Station Norfolk; the only shipyard where we build aircraft carriers; the Port of Virginia; beach and water-related tourism; aquaculture and fisheries; and waterfront property and housing stock – a key source of property tax income for both urban and rural localities. In the City of Virginia Beach alone, she said, the annualized losses today "result in residential damages of $26 million annually due to coastal flooding events." If no action is taken, that number increases to $77 million annually within 20 to 30 years.

Agricultural impacts are complex but will strain farmers and increase food prices

Farmers are experiencing the changing climate firsthand, with flooding, drought, and new weather patterns altering planting decisions and agricultural productivity. Increased heat stress in plants and livestock, reduced soil health and moisture, shifts in pollination, and greater

pressure from weeds, pests, and diseases will result in declining crop yields and livestock and poultry productivity, increased rates of crop failure, and reduced food nutrition. Total productivity of the U.S. agricultural economy could drop by more than 4 percent annually, falling to pre-1980 levels by 2050.

"Food companies like ours, the farmers who grow our ingredients, and consumers who buy our products sit at the cross section of communities most impacted by climate change, which poses an existential threat to all living things." — Stefani Millie Grant, Senior Manager for External Affairs and Sustainability at Unilever (a food and personal care products company), provided an indication of the complexity of the changing climate's impact on U.S. agriculture: "While increased temperatures may provide a longer growing season in some regions and higher CO_2 may help to increase yields in some crops," she testified, "it is very likely that any benefits will be offset by the negative effects of increased ozone, less water availability and increased salinity." While climate change already threatens agricultural production in the Midwest and Southwest, Dr. Hayhoe noted that further warming will lead to negative impacts in the northern Great Plains due to the increased risk of summer heat waves, extreme precipitation, and the northward migration of pests and invasive species.

"As extreme climate events are becoming more of a frequent occurrence, so too are more frequent crop failures." — Ms. Grant highlighted the risk that weather- and climate-related disasters pose for agriculture and price stability. Just this year, floods associated with heavy rainfall have created 10 million abandoned acres, which roughly equals about $6.5 billion in lost revenue. According to Dr. Hayhoe, heavy precipitation is increasing in the Northeast and Midwest, and when the fields are too wet, farmers are forced to delay their planting by weeks. In contrast, droughts in the Southwest and elsewhere are getting hotter and longer, increasing the risk to crops and livestock.

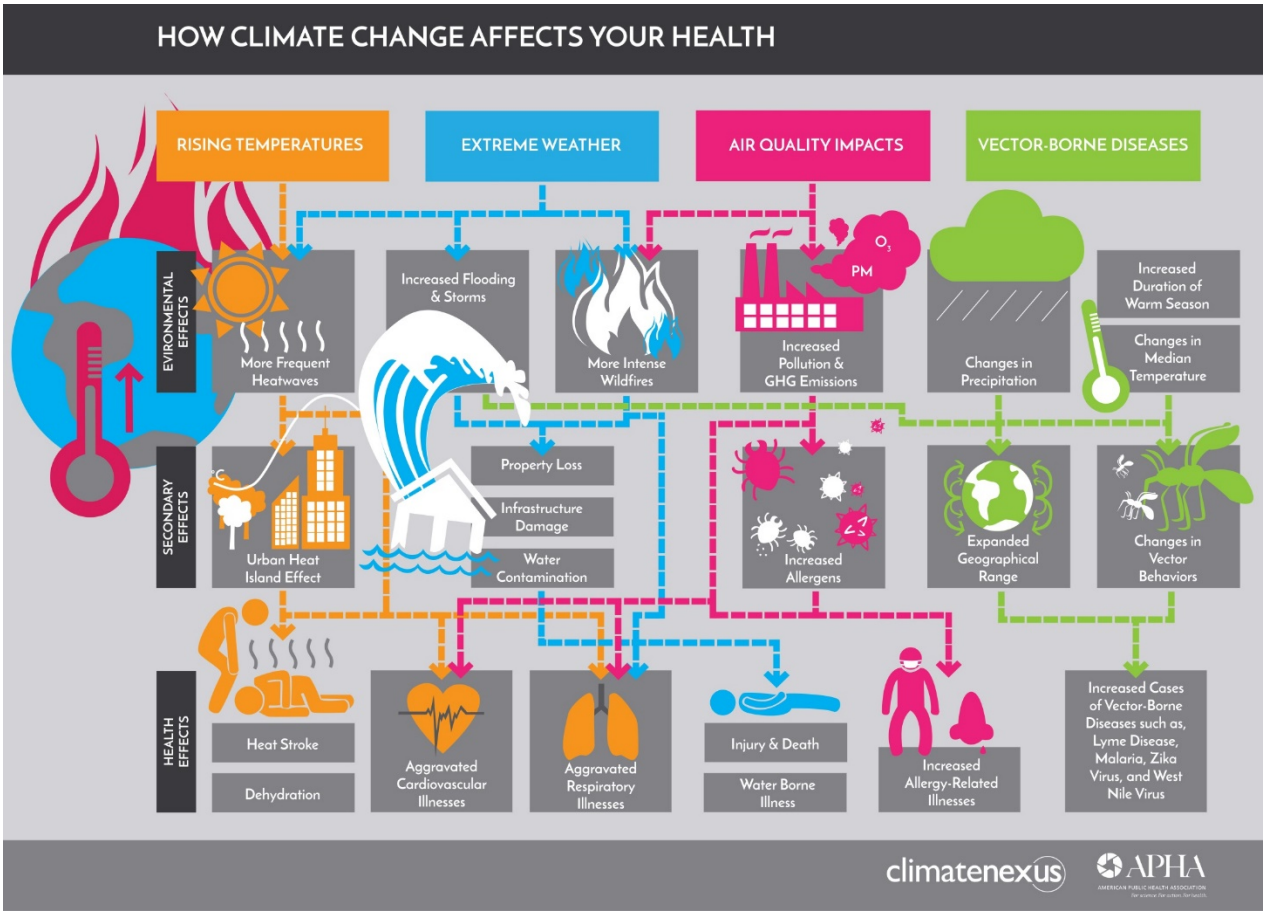
"Climate change could drive up commodity prices nearly 30 percent and disrupt global food chains." — Ms. Grant said that it is difficult to predict exactly how climate change will affect food prices. But she quoted Dr. Brian Gould, a professor at the University of Wisconsin–Madison, who said, "We will probably have to, down the road, change our lifestyles to have a more significant portion of our income spent on food. Maybe up to the level that current developing countries have," which can be as much as 60 percent of household income. She also noted that shortages in one part of the world affect prices in other parts of the world, leading to price spikes.

Climate change is the greatest public health challenge of the 21st century

Americans' health and well-being are increasingly threatened by extreme weather and temperatures, reduced air quality from ground-level ozone (smog) and wildfires, increases in airborne allergens, and greater disease transmission through insects and pests, water, and food. Severe storms can directly result in loss of life, as well as cause disruptions to critical health care

systems and infrastructure for months. More than 90 health organizations – including the American Medical Association, American Academy of Pediatrics, and the American Public Health Association – have jointly identified climate change as a public health emergency.

"Climate change is here today, is threatening our health now, and, if left unchecked, will lead to increases in both illnesses and deaths." — Dr. Benjamin gave an overview of the diverse pathways through which climate change causes increased illness, as summarized in the graphic below. Extreme heat events – which are on the rise – trigger severe dehydration and heat stroke, exacerbate cardiovascular and respiratory disorders, and elevate rates of violent crime. By midcentury, more than 90 million people in the United States – a 100-fold increase – will experience 30 or more days with a heat index above 105°F in an average year, with approximately 3,400 more premature deaths each year in the U.S. due to extreme heat. Greater rainfall and warmer temperatures expand the scope of diseases borne by vectors, such as pathogen-spreading ticks and mosquitoes, causing the further spread of dengue, malaria, yellow fever, West Nile, Zika virus, and Lyme disease. Climate change increases ground-level ozone and particulate matter air pollution, reducing lung function and exacerbating cardiovascular disease and respiratory conditions, and it leads to longer and more intense allergy seasons from rising pollen potency.



Climate change threatens defense readiness and stability around the world

The intelligence community, senior defense officials, former national security leaders, and previous Department of Defense (DoD) strategies and plans present a strong consensus that climate change is a threat multiplier that creates significant risks to national security and military readiness. Climate change will exacerbate food and water insecurity, infectious disease outbreaks, natural resource scarcity, commodity price shocks, economic distress and inequality, natural disaster severity, and population displacement and migration. These in turn will increase the risk of social unrest, political instability, and conflict abroad – and increase the frequency, scale, complexity, and cost of future DoD missions. In addition, U.S. military facilities, operations, and equipment are vulnerable to storms, sea level rise, flooding, wildfires, and drought.

"Climate change can be a powerful link in a chain of events that, if not broken, can lead to runaway instability." — Adm. Titley testified that climate change can make already unstable situations worse – sometimes catastrophically so – and its risks "affect, and are affected by, other large-scale 21st century trends: population growth, urbanization, expanding demand for food, energy and water resources, and globalization." Water challenges will likely increase the risk of instability and state failure, exacerbate regional tensions, and divert attention from working with the United States and other key allies on important policy objectives. U.S. military forces are frequently directed to impacted areas, putting our troops at risk.

"The challenge for readiness and resilience is to ensure our military bases and infrastructure are designed for and can withstand the extremes tomorrow." — To ensure the required levels of readiness, Adm. Titley said, DoD needs to manage the increasing risks posed by climate change to its installations and operations. DoD has suffered an estimated $8.5 billion in damage in just the past eight months at Camp Lejeune (Hurricane Florence), Tyndall Air Force Base (Hurricane Michael) and Offutt Air Force Base (Nebraska flooding). Adm. Phillips highlighted that a projected 3 foot increase in sea level rise would threaten 128 coastal DoD installations in the United States, 43 percent of which are Navy facilities valued at roughly $100 billion, and DoD has more recently assessed that approximately two-thirds of 79 mission assurance priority installations are at risk from climate-related impacts. Forces deployed around the world will need to be equipped to train and operate in areas with increasingly extreme weather.

States, local governments, and the private sector increasingly see the threat

State and municipal governments are facing the reality of climate change, since its direct impacts are inevitably local. And businesses and investors are also awakening to the financial risks posed by climate change, although significant blind spots remain. BlackRock, a global investment management company, estimates that the median risk of commercial properties being hit by a category 4 or 5 hurricane has increased by 137 percent since 1980 – and that this increase could further rise to 275 percent by 2050, with major implications for commercial mortgage-backed securities. BlackRock also assesses that "Extreme weather events pose

growing risks for the credit worthiness of state and local issuers in the $3.8 trillion U.S. municipal bond market." Financial regulators, central banks, and the insurance and reinsurance industries are beginning to see climate change as a systemic risk, including to financial stability.

"City-level plans absolutely make a difference, both in preparing and building resilience to the impacts of a changing climate, as well as weaning ourselves off the fossil fuels that are the primary cause of this issue." — Dr. Hayhoe identified the importance of local efforts, and Adm. Phillips expanded on this theme in her testimony. Local governments in Virginia, she said, "lead in planning, in policy, in research, in funding or funding strategy preparation, in implementation, and most importantly, in analyzing and understanding the scope, scale and cost of the sea level rise and recurrent flooding challenge today and in the future." Yet local communities face challenges. Credit rating agencies, for example, are asking for detailed plans about localities' strategies to address climate risk as a criterion for retaining their credit and bond rating – but to invest in risk-reduction measures often requires further borrowing that also negatively impacts their rating. Adm. Phillips emphasized that state and localities cannot do it alone; a coordinated nationwide federal response is needed, including adequate funding for the federal agencies that support resilience and pre-disaster mitigation.

"As a global company, any extreme weather event affects our business. The more events there are, the more it costs companies." — Ms. Grant discussed Unilever's business case for action on climate change. "The effects of climate change," she testified, "damage the crops and water systems we rely on for our products, and our business and consumers are affected by increases in energy and food prices caused by changes in weather patterns." In response, Unilever began its own internal carbon tax, internally pricing the emissions from manufacturing operations and reallocating those amounts from capital budgets toward installing clean technology at its facilities.

The long-term fiscal health of the federal government is at risk

Climate change is projected to increase federal expenditures for disaster relief and recovery, flood insurance, crop insurance, wildland fire suppression, and federal facility preservation and repairs, especially for the Department of Defense.

"The federal government faces fiscal exposure from climate change risks in a number of areas, and this exposure will likely increase over time" — The Government Accountability Office (GAO) includes the federal government's fiscal exposure to climate change on its high-risk list, and J. Alfredo Gómez, Director for Natural Resources and Environment at GAO outlined the areas in which the government has climate-related fiscal risks, including:

- Disaster assistance. Since 2005, federal funding for disaster assistance has totaled at least $450 billion, including approximately $19.1 billion in supplemental appropriations signed into law on June 6, 2019. Federal spending on hurricane relief and recovery alone is projected to increase 33 percent faster than the growth in the economy by 2075. Adm.

Titley also noted that fiscal risk arising from dozens and even hundreds of coastal communities needing to adapt to rising seas simultaneously.

- Federal insurance for property and crops: From 2013 to 2017, losses paid under National Flood Insurance Program and Federal Crop Insurance Corporation totaled $51.3 billion. Flood insurance claims are already increasing, with the six costliest years all occurring since 2005. Ms. Grant referenced a recent USDA Economic Research Service report that predicts climate change will cause crop insurance costs for the three major commodities of corn, soy and winter wheat to increase 22 percent by 2080 under a higher emissions scenario.
- Federal property and lands: The federal government owns and operates hundreds of thousands of facilities and manages millions of acres of land that could be affected by a changing climate and represent a significant federal fiscal exposure. DoD alone owns and operates domestic and overseas infrastructure with an estimated replacement value of about $1 trillion. "In addition to impacting readiness," Adm. Titley testified, "the continual destruction and reconstruction of critical infrastructure is a significant drain on precious taxpayer resources that could be funding a variety of other, high-priority programs."

"Addressing climate change risks requires advanced planning and investment to reduce the need for far more costly steps in the decades to come." — Mr. Gómez also described a set of previous GAO recommendations for reducing the federal governments exposure to climate change. These include:

- Undertaking strategic government-wide planning to manage climate risks and focus and coordinate federal efforts, including investments in disaster resilience.
- Adopting budgetary and forecasting procedures to account for disasters and other fiscal exposures, as part of the federal budget process, including comprehensive information on economic effects.
- Developing authoritative climate observations and projections for use by federal, state, local, and private sector decision makers.
- Enhancing federal investments in resilience and pre-disaster mitigation to reduce or eliminate long-term risk to people and property from natural hazards.

Of particular concern, GAO reported that the federal government had regressed in its progress to reduce fiscal exposure to climate change since 2017, under the Trump Administration.

Fiscal responsibility and good governance call for both climate mitigation and adaptation actions

Chairman Yarmuth said, "this future, as bleak as it is, does not have to come to fruition." To avoid significant and preventable costs to the economy and taxpayers, we must take action now. "We must rejoin our global partners in tackling the threat of climate change and commit to

substantial reductions in carbon pollution, meaningful investments in clean energy, and policies that strengthen our communities and prioritize the health and safety of current and future generations."

"We need engineers, we need business people, we need innovators, we need creators. We need all of us, really, on board to fix this thing and to make sure that we end up in a better place in the future, not worse." — Globally, Dr. Hayhoe testified, we have "between 16 to 21 years' worth of additional carbon emissions [at present-day rates] to have a 50 percent chance of remaining below 2°C," the level generally accepted as necessary to limit the risk of catastrophic disruptions. Dr. Hsiang said that the costs of climate change are substantially mitigated by reducing emissions, adding, "I think the entire field of economics uniformly agrees that what we need is to somehow find a way to put a price on carbon…. And I think the moment you put a price on carbon, markets will respond instantly. Markets are very efficient." Both Adm. Titley and Mr. Powell emphasized the importance of accelerating clean energy innovation, with Adm. Titley envisioning an Apollo-scale program to advance non-carbon-based power and energy storage technologies and to decarbonize the United States and the world by midcentury. Already, the rapidly declining costs of renewable energy and energy storage have put decarbonization within reach. The costs for solar energy, onshore wind, and lithium-ion battery storage have fallen by 84 percent, 49 percent, and 76 percent, respectively, in less than ten years. Based on the latest data, we could make all U.S. electric power generation carbon-free by 2050 for an estimated $23 billion per year.

"This Committee must recognize climate resilience and disaster preparedness as one of the country's greatest and most immediate needs." — Almost all the witnesses said it was critical to increase investments and coordinated efforts in climate resilience, adaptation capabilities, and pre-disaster hazard mitigation, especially for weather-related disasters. "Increased spending now," Adm. Phillips testified, "will better protect people, property and the fiscal strength of the United States for tomorrow, and save precious dollars over time." Both Adm. Phillips and Ms. Grant highlighted studies that found that every $1 spent on federally funded mitigation grants provided by the Federal Emergency Management Agency (FEMA) and other agencies can save $6 in future disaster costs.

In the interest of our nation's long-term fiscal health and the health of our communities, industries, local economies, and national security, Congress must prioritize making critical investments in clean energy and resilience. The testimony and expert insight from witnesses at these two hearings have helped illuminate how and why we must better prepare for the wide-ranging impacts of a changing climate.